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ČASOPIS ZA EKONOMSKU TEORIJU I PRAKSU**

**PROCEEDINGS OF RIJEKA
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O ČASOPISU

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The Journal is open for cooperation with scientists from Croatia and abroad all year round. Your contribution to economic theory and practice is welcomed.

A special section in the Journal is reserved for Letters to the Editor. Readers and authors are invited to give their comments and suggestions. The most interesting letters, comments, and discussions will be published.

Publisher does not charge “submission fee”. However, if the paper is accepted for publication, the author receives notification on paying publishing fee (285 EUR) and should pay it prior to the publication of the paper. Publisher made a decision to charge publishing fee commencing with the Vol. 33, No. 2, 2015. In addition, starting with the same volume the Publisher uses CrossRef and CrossCheck Services.

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Editor's note

Dear authors, reviewers, readers and colleagues,

Although most of us would like to forget all misfortunes brought upon us by the pandemic circumstances, in terms of our publication contributions, we are very happy to say that we have been fortunate to witness increasing number of papers and increased quality of papers submitted. We are also glad to observe that all of the relevant indicators monitoring Journal's quality, from total number of citations, citations per document, citable documents and percentage of international collaboration have upward trend. Thus, we believe that the papers published in this issue will significantly add to such successful continuation and confirmation of our efforts. Thus, as always, on behalf of the Editorial Board, we are deeply grateful to our authors, reviewers and readers who have contributed to our scientific activities during the 2020.

Besides the regular papers submitted to the Journal during the year, we have published four best papers from the Conference *Digitomics – Economics of digital transformation* which was held online in the period June 24 – 26, 2020. The central topic of the Conference was “**Fiscal and monetary policy at the crossroads**”. We had a privilege to host stellar keynotes who presented their latest research in the field, professor Eric Leeper, Paul Goodloe McIntire, professor in economics at the Department of Economics, University of Virginia, as well as, Dr. Corrado Machiarelli, a Principal Economist at the National Institute of Economic and Social Research (NIESR) Macroeconomic Modelling and Forecasting team.

The main Conference topic for the forthcoming year 2021 is “**Economics and business of the post COVID-19 world**”. The conference will be held in hybrid organization both in designated venue, as well as under virtual platform framework. The Conference will take place from 23rd to 25th of June, 2021 in Opatija, Croatia. We are looking forward to submissions related to the developments and contemporary changes related to the impact of COVID-19 pandemics to wide fields of economics and business theory and practice. Of course, the best papers will apply for the process of publication within our Journal.

Finally, we would like to invite our future authors, reviewers and partners to contribute to our efforts and cooperate with us. We are truly open to your comments, suggestions, invitations and cooperation proposals. We hope that the next year will be far less stressful than 2020, but , at least, as challenging and productive in terms of publication activity. The Editorial board and International Advisory board wish all the best to our readers, authors, reviewers and supporters in 2021!

Sincerely,

Professor Saša Drezgić
Editor-in-Chief

ARTICLES – ČLANKI

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Real interest rate convergence and monetary policy independence in CEE countries*

Milan Deskar-Škrbić¹, Antonija Buljan², Mirna Dumičić³

Abstract

In this paper we provide new empirical evidence relevant for discussions on monetary policy independence in the context of euro adoption in three Central and Eastern European (CEE) countries: Czechia, Hungary and Poland. Unlike many other authors, in this paper we focus on real and not nominal interest rates as real interest rates are at the hearth of modern macroeconomic and monetary policy theory. In the paper we employ several methodologies to test the convergence of real interest rates between these countries and the euro area and to determine the main drivers of real interest rates. Based on the unit root analysis we find evidence of convergence of real interest rates in these countries, thus confirming the real interest rate parity (RIRP) hypothesis. Next, using principle component analysis (PCA) we show that common factor extracted from the sample of CEE countries and individual euro area countries can explain high proportion of real interest rate developments in these countries. Finally, results of our newly proposed analytical framework for the analysis of determinants of real interest rates in small open economies, based on a Bayesian VAR model with block exogeneity, show that external shocks have non-negligible effect on real interest rate developments in selected CEE countries. Thus, our results indicate that real interest rates in CEE depend on factors that are beyond the scope of domestic monetary policy makers. In this sense we can conclude that (conventional) monetary policy independence in these countries is limited. Thus, we see the loss of monetary policy independence as overly emphasized argument in discussions on the euro adoption in these countries. However, we are aware that national central banks in CEE started to

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rely more on non-conventional measures recently, which gives them a higher degree of flexibility (and autonomy).

Key words: *euro adoption, real interest rate parity (RIRP), real interest rates, BVAR – Bayesian VAR model, CEE, optimal currency area (OCA)*

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1. Introduction

Theoretical and empirical literature in the field of international macroeconomics indicates that the loss of monetary policy independence⁴ represents the most pronounced cost of joining the common currency area (e.g. Eudey, 1998; Alesina et al., 2002; Angelloni et al., 2007; Edwards, 2015).

Discussions on the monetary policy independence are especially interesting in Europe as the Economic and Monetary Union (EMU) is founded with the goal and ambition that all member states of the European Union (EU) will gradually adopt the common currency and complete the decades-old idea of full economic integration in the EU. Out of twenty-seven EU member states, nineteen adopted the euro since its introduction in 1999. Most of remaining eight non-euro area member states are legally bound to adopt the euro eventually by the provisions of the EU Accession Treaties. The group of the non-euro area EU members includes two old member states, Denmark and Sweden, and six new member states, Bulgaria, Croatia, Czechia, Hungary, Poland and Romania. All countries are formally obliged to introduce the euro, except Denmark, as this country negotiated a so-called opt out option in 1992.

New member states that have not adopted the euro yet are all located in the Central and Eastern European (CEE) region. Three of them, Bulgaria, Croatia and Romania are on the path towards the monetary union and euro adoption (Deskar-Škrbić et al., 2020), while other three countries, Czechia, Hungary and Poland, decided to postpone the discussion on euro adoption indefinitely (Deskar-Škrbić and Kunovac, 2020). The latter three countries, which are in the focus of our analysis, operate in the inflation targeting monetary policy regime, with flexible exchange rates, and use the policy rate as the key monetary policy instrument. Thus, policy makers in these three countries see euro adoption as a threat to the monetary policy independence.

However, theoretical and empirical literature show that monetary policy independence in small open economies⁵ can be fairly constrained, especially in

⁴ Aizenman et al. (2013) define the monetary policy independence as the ability of the national central bank to set interest rates independently from international interest rates.

⁵ A small open economy is an economy that participates in international trade, but is small enough compared to its trading partners that its policies do not alter world prices, interest rates, or incomes. All countries in the CEE region can be described as small open economies.

small open economies that are strongly integrated with major markets.⁶ On the one hand, there are several *exogenous* factors that motivate small open economies to adjust their monetary policy rules towards an open economy version of Taylor rule and implicitly or explicitly include major market interest rates in their monetary policy reaction function (Edwards, 2015).⁷ First is the so-called *fear of float* argument (Calvo and Reinhart, 2002). In this case, monetary policy measures are directed on limiting exchange rate volatility by avoiding wide interest rate differentials that could lead to large capital flows. Second, monetary policy makers in small open economies should carefully monitor monetary policy moves in major markets because there are strong spillovers of major markets monetary policy directly to macroeconomic variables in small open economies, mostly through the *trade channel* (Rodseth, 2004; Ca'Zorzi et al., 2020). Third, due to high level of trade integration among countries, especially in economic unions such as the EU, inflation rates tend to move in a similar manner. Thus, inflationary or deflationary monetary policies by major markets will eventually spill over to small open economies, triggering their monetary policy reaction (Macchiaelli, 2013). These factors can be seen as exogenous restraints to monetary policy independence in small open economies. On the other hand, correlation of interest rates in small open economies and major markets can also be *endogenously* driven by the synchronization of business cycles and coherence of economic shocks (Goczek and Mycielska, 2019; Deskar-Škrbić et al., 2020).⁸ More precisely, if economic developments in small open economies and major markets are driven by some common shocks, reactions of monetary policies in these countries will be fairly similar, without small open economies taking into account monetary policy decisions in major markets.

All these factors suggest that there should be not only high level of correlation and/or convergence in nominal interest rates between small open economies and major markets but also real interest rates. And real interest rates are at the hearth of modern macroeconomics and monetary policy analysis (Woodford, 2003; Gali,

⁶ Capital mobility is one of the corner stones of the EU which led to strong integration of financial markets and triggered capital flows from the euro area to the CEE region. Euro area-based bank groups dominate local banking sectors in the CEE, most of FDI inflows in the CEE region originates in the euro area, euro area-based institutional investors hold the largest share of the CEE sovereign debt etc. Thus, even countries with flexible exchange rates in CEE region can find it hard to pursue independent monetary policy so the Mundellian trilemma boils down to the "dilemma" (Rey, 2015).

⁷ Unlike closed economy Taylor rule that is based on domestic inflation and output gap, open economy version includes exchange rate and/or foreign interest rates.

⁸ Beside these mechanisms that primarily work through conventional monetary policy tools, there are other channels of international transmission of monetary policy, which are mostly related to the effects of unconventional monetary policy. Papers investigating these channels for the CEE are, for example, Prettnner and Prettnner (2014) and Feldkircher (2015). Generally, empirical literature shows that unconventional monetary policy spillovers from the euro area to CEE countries are fairly pronounced (for literature review see Benecka et al., 2018).

2008; Walsh, 2010; Carlin and Soskice, 2014). In modern macroeconomic models decisions of households and investors depend on real interest rates, while the role of monetary policy authority is to steer the real interest rate towards the natural level in order to close the output gap and stabilize inflationary or deflationary pressures.⁹ To put it in the context of macro and monetary theory, real interest rates determine the relationship between IS-curve, Phillips curve and monetary policy rule in dominant New Keynesian macroeconomic models. Thus, when we discuss monetary policy independence in CEE region, unlike many other authors, in this paper we do not focus on *nominal* interest rates but *real* interest rates.¹⁰

More precisely, in this paper we analyze *de facto*¹¹ monetary policy independence in three CEE countries, Czechia, Hungary and Poland, by analyzing the convergence of real interest rates in the context of real interest rate parity (RIRP) and investigating the main drivers of real interest rates in these countries and the euro area. The focus of our analysis is on these countries as all of them pursue inflation targeting strategy with (mostly) flexible exchange rates and they are all reluctant to join the euro area in the near future with the loss of monetary policy independence as the key economic argument against euro adoption (Deskar-Škrbić and Kunovac, 2020).

Our empirical approach is based on several methods. First, in order to test the validity of RIRP we use standard unit root tests and unit root test with endogenous structural break. Second, to analyze whether real interest rates in the euro area and CEE are driven by some common shocks we use principle component analysis (PCA) and simple OLS models. Finally, to determine the nature of shocks that drive real interest rates in selected CEE countries and the euro area we rely on a small open economy Bayesian VAR (BVAR) model with block exogeneity assumption. Structural shocks in this model are identified using sing and zero restrictions, based on economic theory. In the interpretation of our results we focus on historical decomposition that allows us to trace the effects of various shocks to real interest rates over time and to determine the relevance of external shocks to development of real interest rates in selected small open economies.

Our contributions to the literature is twofold. First, to our knowledge, there is no similar analysis that explicitly investigates the contribution of common factors

⁹ As Carlin and Soskice (2014) point out, in modern macro models central bank must adjust the nominal interest rate in order to achieve a particular real interest rate according to the so-called Taylor principle.

¹⁰ In addition, as Cuaresma and Wojcik (2006) explain, strong disinflation process in CEE countries introduced a considerable trend in nominal interest rates that inhibits making proper econometric inferences from estimations using nominal interest rates.

¹¹ *De jure* monetary policy independence reflects formal, legal institutional framework, while *de facto* monetary policy independence reflects the actual degree of monetary policy independence in practice.

to developments of real interest rates in selected countries over time. Second, we offer a novel approach suitable for the analysis of real interest rate developments in small open economies, based on BVAR with block exogeneity assumption. Our hypothesis is that there is a real interest rate convergence between selected CEE countries and the euro area and that the convergence is a result of the fact that real interest rates are determined not only by domestic but also by external (common) shocks.

Next section provides a brief review of the literature on real interest rate convergence and monetary policy independence in CEE region. Section 3 describes the methodology used in the empirical part of the paper, while in Section 4 we present the data and provide relevant descriptive statistics that motivate our analysis. In Section 5 we discuss the results and then draw the main conclusions in the last section.

2. Literature review

Our paper builds on three major strands of literature. The first strand of literature deals with the so-called real interest rate parity and convergence of real interest rates among countries, with the focus on relations between small open economies and major economies. The second strand is focused on international spillovers of economic shocks between major economies and small open economies. Finally, third strand of literature is focused on monetary policy independence in small open economies. However, the literature is fairly extensive in this review we mostly focus on papers that are concentrated on the euro area and CEE region.

2.1. Real interest rate parity (RIRP)

There are three fundamental relations in international macroeconomics: uncovered interest parity (UIP), purchasing power parity (PPP) and Fisher's equation (Obstfeld and Rogoff, 1996). If the first two parities hold, combined with the Fisher's equation, they lead to a notion that real interest rates should be equal across countries.¹² Equalization of real interest rates across countries became popular as the "real interest rate parity" (RIRP).¹³

¹² For mathematical derivation of this condition see, for example, Chin and Frenkel (1995).

¹³ The RIRP was popularized in empirical works by prominent economists during the last two decades of the twentieth century (e.g. Mishkin, 1984; Mark, 1985; Cumby and Mishkin, 1986; Meese and Rogoff, 1988; Dutton, 1993; Goodwin and Grennes, 1994; Wu and Fountas, 2000; Obstfeld and Taylor, 2002).

This parity represents an important measure of international financial markets integration and has notable repercussions for monetary policy. As Mark (1985) states, if the RIRP holds, the ability of domestic monetary authority to affect domestic real interest rates and other variables that depend upon them will be severely limited to the extent to which the monetary authority can affect the global real interest rate.¹⁴ Although the validity of the RIRP is important on the global level, special interest for this topic was triggered by the euro introduction in 1999. The third stage of the EMU brought together countries with different structural characteristics and united them under the “umbrella” of the common central bank, the ECB (e.g. Holmes, 2002; Holmes, 2005; Ferreira and Leon-Ledesma, 2007). Effectiveness of the monetary transmission mechanism in European monetary union heavily depends on the validity of the RIRP (Aksoy et al., 2002). Arghyrou and Gregoriou (2007) point out that for transmission to be uniform, national real interest rates against the EMU average must be mean-reverting and display similar persistence patterns. If the opposite is true, shifts in the eurozone average-oriented ECB policy would result in intra-EMU asymmetric monetary shocks. The RIRP is also an important indicator of the level of integration of the non-euro area countries with the euro area and can be used as one of the optimum currency area (OCA) indicators. If non-euro area member states fulfill nominal convergence criteria, which suppose convergence of interest rates, inflation rates and stability of exchange rates, the RIRP should hold. Thus, in discussions on the future of the euro area enlargement it is important to analyze the RIRP validity in the non-euro area CEE countries.

The literature dealing with the validity of RIRP in CEE is relatively abundant. In order for the RIRP to hold in the CEE, real-interest rate differentials should be stationary, i.e. there should be a convergence of real interest rates between the CEE countries and the euro. That is why most papers in this strand of literature are based on different unit root tests. For example, Aghrizm et al. (2009) use various unit root tests with and without structural breaks and find evidence of real interest rate convergence between EU new member states (mostly from CEE region) and the euro area. Cuestas and Harrison (2010) use Ng and Perron (2001) unit root test and find evidence in favor of the empirical fulfilment of the RIRP. Su et al. (2012) employ Enders and Lee (2012) unit root test and indicate that the RIRP holds true for CEE countries. Su, Jiang and Chiang (2014) confirmed the RIRP for CEE countries, using the Narayan and Popp's (2010) unit-root test with structural breaks. Overall, papers in this strand of literature point to convergence of real interest rates between CEE countries and the euro area, especially after the Great Recession.

¹⁴ Term “global” refers to interest rates on major markets, such as the US or the euro area.

2.2. International transmission of economic shocks

As previously explained, convergence in real interest rates will occur more easily if real interest rates in these two regions are driven by some common factors and if their business cycles are synchronized. In this context there is a lot of empirical evidence showing that there is a high level of correlation of business (and price) cycles between CEE and the euro area (e.g. Arčabić, 2011; Stanišić, 2013; Jiménez-Rodríguez et al., 2013; Macchiaelli, 2013; Kotarac et al., 2017; Campos et al., 2019; Botrić et al., 2020). These findings have great importance in the context of the euro area enlargement as they indicate that CEE countries could satisfy important conditions of the optimal currency area (OCA).

However, business cycle synchronization only reflects some deeper relations between CEE countries and the euro area. To put it differently, business cycle synchronization is the result of some fundamental relations. According to Mongelli's (2002) endogenous theory on OCA these deep relations should be sought in the coherence of economic shocks between countries. More precisely, Mongelli (2002) claims that coherence of economic shocks is a "meta property" of OCA because if the same shocks drive economic developments in countries inside and outside the common currency area it means that there is a high level of financial and trade integration between these countries and that there are strong flows of good, capital and even labor. That is why later stages of OCA literature mostly focus on coherence of economic shocks, starting with Bayoumi and Eichengreen (1992).¹⁵

Literature on the role of euro area shocks in CEE and coherence of shocks between CEE and the euro area mostly¹⁶ points to notable effects of euro area shocks and a high level of coherence. For example, Mackowiak (2006) uses structural small open economy vector autoregressive (VAR) model with block exogeneity and shows that euro area shocks have economically significant oh Hungary, Poland and Czechia. Horvath and Rusnak (2009) and Hanclova (2012) use similar methodology and find similar evidence in case of Slovakia and Czechia. Iossifov and Podpiera (2014) use panel model and show that there is a strong transmission of euro area prices to domestic prices in CEE region. Felkircher (2015) relies on Global VAR (GVAR) model and shows that euro area shocks have notable effect on macroeconomic developments in CEE countries. Kotarac et al. (2017) follow Bayoumi and Eichengreen (1992) methodology and show that there is a high level of correlation

¹⁵ For extensive literature review on OCA see Broz (2005).

¹⁶ Papers with older date are more skeptical in this context. For example, meta-analysis presented in Fidrmuc and Korhonen (2006) indicates that the correlation of economic shocks in CEE and the euro area is low and that euro adoption would be costly. Broz (2010) uses Bayoumi and Eichengreen (1992) approach and concludes that the level of coherence of economic shocks in most CEE countries with the euro area was not on satisfactory level in the context of OCA conditions up to 2006.

of economic shocks between CEE countries and the euro area. Additionally, authors estimate structural BVAR model with block exogeneity and show that economic developments in CEE countries are mostly determined by symmetric and not asymmetric shocks. Finally, Deskar-Škrbić et al. (2020) use Bayesian structural VAR model with block exogeneity to identify various domestic and common shocks (that are relevant for both CEE countries and the euro area) and show that common shocks are dominant determinant of GDP and inflation developments in most CEE countries.

2.3. Monetary policy independence in CEE

Finally, our paper is related to the literature that analyzes the degree of *de facto* monetary policy independence in small open economies from CEE region. This strand of literature indicates that monetary policy independence in most inflation-targeting CEE floaters is constrained by various factors.

Cuaresma and Wojcik (2006) employ dynamic conditional correlation multivariate GARCH (DCC-MGARCH) model and show that none of the three CEE countries enjoy full monetary independence. Benkovskis et al. (2011) analyze the transmission of monetary policy shocks from the euro area to Poland, Hungary and Czechia. They employ a factor augmented VAR (FAVAR) model and show that there are substantial effects of euro area monetary policy on interest rates and economic activity in CEE countries. Kadow et al. (2013) coin a so-called “euro dominance hypothesis” (EDH) and find empirical evidence to prove it in case of CEE countries, using GVAR model. EDH hypothesis states that euro area interest rates dominate money market interest rates in CEE countries, which constrains the monetary policy independence of local central banks. Goszczek and Mycielska (2016) use vector error correction (VEC) model and also find the empirical proof for EDH in case of Czechia. Keppel and Prettnner (2015) use structural VECM with sign restrictions and show that increases in euro area interest rates translate into rising CEE interest rates. Dabrowski et al. (2019) use autoregressive distributed lag (ARDL) model and show that there is convergence in nominal interest rates between euro area and CEE countries.

This brief literature review indicates that CEE countries are strongly integrated in euro area trade and financial flows and that there are notable spillovers from the euro area to CEE small open economies. In addition, there is a robust empirical evidence that economic developments in CEE and the euro area are driven by common shocks. This is reflected in a high level of business cycle synchronization, convergence in prices and convergence and synchronization of nominal interest rates on money markets. Thus, we can expect that similar patterns should be reflected also in developments of real interest rates. We turn to this important question in the empirical part of the paper.

3. Methodology

We start our analysis by testing the validity of RIRP hypothesis in Czechia, Hungary and Poland. As previously explained, for the RIRP to hold real interest rate differentials should be stationary.¹⁷ Thus, we test the stationarity of real interest rate differentials in Czechia, Hungary and Poland vis-a-vis euro area interest rates through standard unit root tests such as Augmented Dickey and Fuller (1979) (ADF), Phillips and Perron (1988) (PP) and Kwiatkowski et al. (1992) (KPSS) test. However, these tests do not allow for the possibility of a structural break and thus can provide misleading results. In our sample, structural breaks can occur due to the effects of various factors, such as global financial crisis, European sovereign debt crisis, launch of quantitative easing program by the ECB etc. Thus we additionally employ Zivot and Andrews (2012) test with endogenous structural break.

As RIRP suggests that there is a convergence in real interest rates among countries, in the second step of the analysis we want to determine whether real interest rates in selected CEE countries and the euro area converge because they are driven by some common factors. To assess the contribution of common factors to developments of real money market interest rates in CEE and the euro area, we follow approach proposed in Kunovac (2013). We employ the principal component analysis to extract common factors from the sample of all countries and then regress real interest rate in respective country to principal component(s) and a constant. By multiplying the estimated coefficients with principal component(s) we get the contribution of common factors, while residual represents the contribution of domestic (idiosyncratic) factors.

We can define the factor model as:

$$RIR_{it} = \lambda_i F_j + \epsilon_{it} \quad (1)$$

where RIR_{it} is an N-dimensional vector of multiple time series in countries i and time periods t . RIR_{it} includes (standardized) real interest rates in the three CEE countries and individual euro area countries.¹⁸ RIR_t can be expressed as a linear combination of common factors F_t , while $N \times 1$ is a vector of idiosyncratic disturbances. Factors are estimated by method of principle components (PCA).

In the second step, we regress real interest rates of each country on principle components:

¹⁷ Bernard and Durlauf (1996) and Estrin and Uruga (1997) indicate that convergence occurs if the long-run differences between time series tend to move to some steady state level.

¹⁸ Besides Czechia, Hungary and Poland in this part of the analysis we additionally include individual euro area countries because PCA on the small sample could produce misleading results. We did not include new member states as the focus of our paper is on the relationship between CEE countries and the euro area.

$$RIR_t = \beta_0 + \sum_{j=1}^k \beta_j F_{jt} + e_t \tag{2}$$

We decompose RIR developments on the part explained by common factors $\sum_{j=1}^k \beta_j F_{jt}$ and the residual e_t , which can be interpreted as the domestic (idiosyncratic) factor.

Although this approach gives some interesting insights into the relevance of common shocks for real interest rate developments in selected CEE countries, it is purely empirical. Thus, in the third part of our analysis we give some more theoretical rigor to our analysis by estimating small open economy BVAR model with block exogeneity identified by sign restrictions, based on economic theory.

Structural form of the VAR model for *each* CEE country of interest can be defined as:¹⁹

$$\sum_{s=0}^p A_j y_s = \varepsilon_t \tag{3}$$

Vector y contains all variables in the model that can be divided in two blocks: $y = [y_1, y_2]'$. External block y_1 includes external (euro area) GDP (GDP_t^{EA}) and inflation (π_t^{EA}), while domestic block y_2 includes real money market interest rates (r_t^d), share of investments in GDP (i_t), domestic GDP (GDP_t^D) and domestic inflation (π_t^D).

$$\begin{aligned} y_1 &= [GDP_t^{EA}, \pi_t^{EA}]' \\ y_2 &= [r_t^d, i_t, GDP_t^D, \pi_t^D]' \end{aligned} \tag{4}$$

As we explain below, selection of variables is based on economic theory that should help us to identify structural shocks in the model. We are aware that this is not a full set of relevant variables but due to relatively short sample we wanted to keep our model parsimonious. Matrices A_j are matrices of structural parameters that determine the relationship between all variables in the model up to period p . Vector ε_t is a vector of structural shocks with distribution $MVN(0, I)$. As we have two blocks of variables in our model each matrix A_j can be expressed as:

$$A_j = \begin{bmatrix} A_{11}^j & A_{12}^j \\ A_{21}^j & A_{22}^j \end{bmatrix}, j = 0, \dots, p \tag{5}$$

¹⁹ The exposition of the model mostly relies on Krznar and Kunovac (2010) and Deskar-Škrbić, Kotarac and Kunovac (2020). Model also includes constant.

As we assume that small open economies in our sample cannot affect economic developments in the euro area we impose block exogeneity assumption $A_{12}^j = 0$. However, structural VAR model cannot be estimated directly without imposing additional restrictions on A_j , i.e. without identifying the model (Killian and Lütkepohl, 2017).

However, we can derive reduced form of VAR model by multiplying (3) with matrix A_0^{-1} (this matrix contains contemporaneous relations between variables):

$$y = \sum_{s=1}^p B_j y_{t-s} + \eta_t \tag{6}$$

where $A_0^{-1} \varepsilon_t = \eta_t$ (MVN $(0, \Sigma_\eta)$) and $B_j = A_0^{-1} A_j$, for $j = 0, \dots, p$. Matrices B_j inherit the block exogeneity assumption:

$$A_j = \begin{bmatrix} B_{11}^j & 0 \\ B_{21}^j & B_{22}^j \end{bmatrix}, j = 1, \dots, p \tag{7}$$

Although (5) implies (6), the opposite does not hold. Thus, to get (5) from (6) we need to impose additional restrictions on A_0 (parameters that define impulse response functions on impact) and on VAR parameters. First we impose restriction on A_0 that small open economies cannot affect euro area at impact $j = 0$. Next, the second part of block exogeneity implementation is to shut down the impact of small open economy shocks on external variables beyond the impact ($j = 1, \dots, p$). We do this within the Bayesian framework that is explained in details in Deskar-Škrbić et al. (2020).²⁰

Structural shocks in (3) are identified using sign and zero restrictions.²¹ We base our identification strategy in the domestic block on Alexius (2017). However, we extend this model with the external block that is identified similar to Deskar-Škrbić et al. (2020). Our identification strategy is presented in Table 1.

²⁰ To implement (6) authors assume zero mean priors with extremely small variance for all the small open economy parameters in every equation of the euro area block. A sample from the posterior of the reduced form parameters and residual covariance matrix is drawn using a Gibbs sampler, with the total number of 3000 iterations and 500 burns. Authors use loose priors in spirit of Minnesota priors: $\lambda_1 = 100, \lambda_2 = 100, \lambda_3 = 2, \lambda_4 = 10^4$. Estimation is based on toolbox developed by Kunovac and Kotarac (2017).

²¹ At each step of Gibbs sampler, given a draw of reduced form parameters, we recover a set of structural models satisfying the imposed sign and zero restrictions. The sign and zero restrictions are imposed directly onto the impulse response function, using the procedure proposed by Arias et al. (2014).

Table 1: Identification strategy

Shock \ Variable	Domestic savings rate shock	Domestic productivity shock	Domestic cost push shock	Domestic business cycle shock	External business cycle shock	External productivity shock
Real interest rate	<0	>0	>0	>0	?	?
Investments	>0	>0	<0	>0	?	?
Domestic GDP	>0	>0	<0	>0	?	?
Domestic inflation	>0	<0	>0	>0	?	?
Euro area GDP	0	0	0	0	>0	>0
Euro area inflation	0	0	0	0	>0	<0

Note: “>0” indicates that shock leads to increase of corresponding variable at impact; “<0” indicates that shock leads to fall of corresponding variable at impact; “0” indicates that shock does not affect corresponding variable at impact; “?” indicates that there we did not impose restrictions at impact

Source: Authors

Firstly, we identify four domestic shocks that are relevant for developments of real interest rates. *Domestic savings shock* leads to decrease in real interest rate, according to standard macroeconomic models. Falling real interest rate stimulates investments, investment growth leads to stronger aggregate demand which leads to rise in inflation rate. *Domestic productivity shock* leads to increase in GDP and investments (accelerator effect) and fall in inflation.²² Falling prices lead to increase in real interest rate. *Domestic cost push shock*²³ increases marginal costs of firms, thus leading to fall in investments and GDP, while at the same time it leads to increase in prices (as producers try to shift part of the cost increase to consumers). Monetary policy reacts to cost push factors by increasing nominal interest rate above the increase in inflation (aforementioned Taylor principle), thus increasing the real interest rate. *Domestic business cycle shock*²⁴ leads to accelerating economic activity and investments (accelerator effect), which put pressures on prices. Monetary policy again reacts counter-cyclically by increasing real interest rate. Zeros in in last two rows indicate that domestic shocks cannot affect euro area economic developments at impact.²⁵

²² We can also label this shock as an *aggregate supply shock* in line with the classification proposed by Bayoumi and Eichengreen (1992).

²³ According to Gali and Gertler (2007) cost push factors come from the labor market in fashion of a staggered nominal wage setting.

²⁴ We can also label this shock as an *aggregate demand shock* in line with the classification proposed by Bayoumi and Eichengreen (1992).

²⁵ Block exogeneity assumption additionally ensures that domestic shocks cannot affect euro area in all other periods as well.

We additionally define two external shocks. As in the case of domestic shocks, *external business cycle shock* leads to increase in the euro area GDP and prices, while *external productivity shock* leads to increase in euro area GDP and fall of prices. Question marks in the last two columns indicate that we impose no restrictions on the effects of external shocks on domestic variables as we want to get information on the role of external shocks for domestic economic developments from data. In this way our main results, i.e. relevance of external shocks for domestic real interest rate developments, seem more reliable. Finally, we want to emphasize that the label *external shock* implies that these shocks can originate in the euro area (e.g. European debt crisis) but also outside the euro area (e.g. Global financial crisis, GFC). More precisely, these shocks capture the effects of both euro area and global shocks.

4. Empirical data and analysis

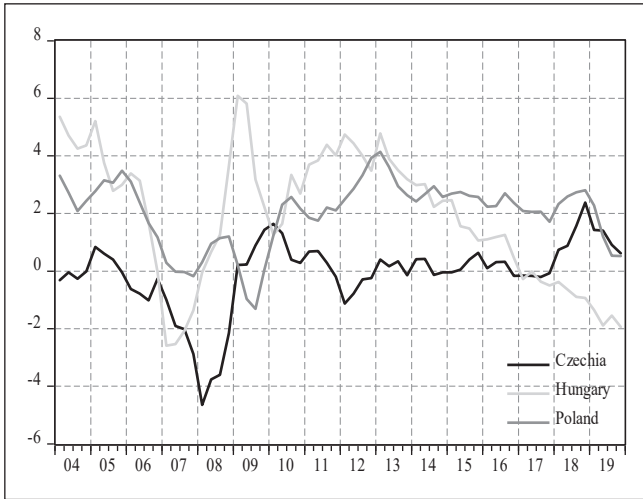
The first part (unit root tests) and the second part (PCA and decomposition of real interest rates in OLS regressions) of our analysis are based on monthly data on 3-month money market interest rates obtained from the Eurostat website. Nominal interest rates are deflated by inflation rates calculated from the monthly HICP data, also obtained from the Eurostat website. The period of the analysis ranges from 2004m1 to 2019m12. Although data is available before 2004, we exclude this period from the analysis as Czechia, Hungary and Poland became members of the EU in 2004.

BVAR models in the third part of the analysis are based on quarterly data in the same period. 3-month real money market interest rates defined above are averaged into quarterly figures. Macroeconomic data for the euro area and Czechia, Hungary and Poland are obtained from Eurostat: real GDP (seasonally adjusted data in constant prices, 2015=100), prices (harmonized index of consumer prices, HICP, 2015=100)²⁶ and share of gross capital formation in GDP (seasonally adjusted data). Real interest rates and investment ratios are included in models in levels, while real GDP and HICP in log-differences. Before we move to the empirical analysis we provide some stylized facts to motivate our analysis.

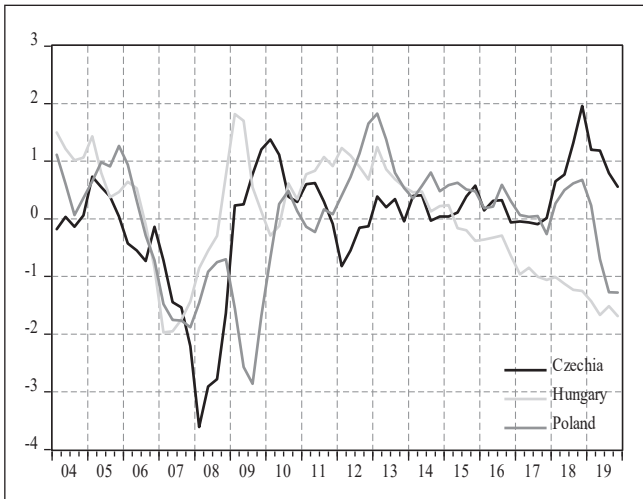
Figure 1 shows real interest rate differentials in Czechia, Hungary and Poland vis-a-vis the euro area. Overall, we can conclude that real interest rate differentials in these CEE countries are relatively stable if we analyze the whole period and that they are lower compared to the pre-crisis period. Also, we can see that interest rate differential was in Czechia was the most stable one.

²⁶ For seasonal adjustment of HICP series we used ARIMA X-13 method.

Figure 1: Real interest rate differentials in Czechia, Hungary, Poland and the euro area



(a) original data

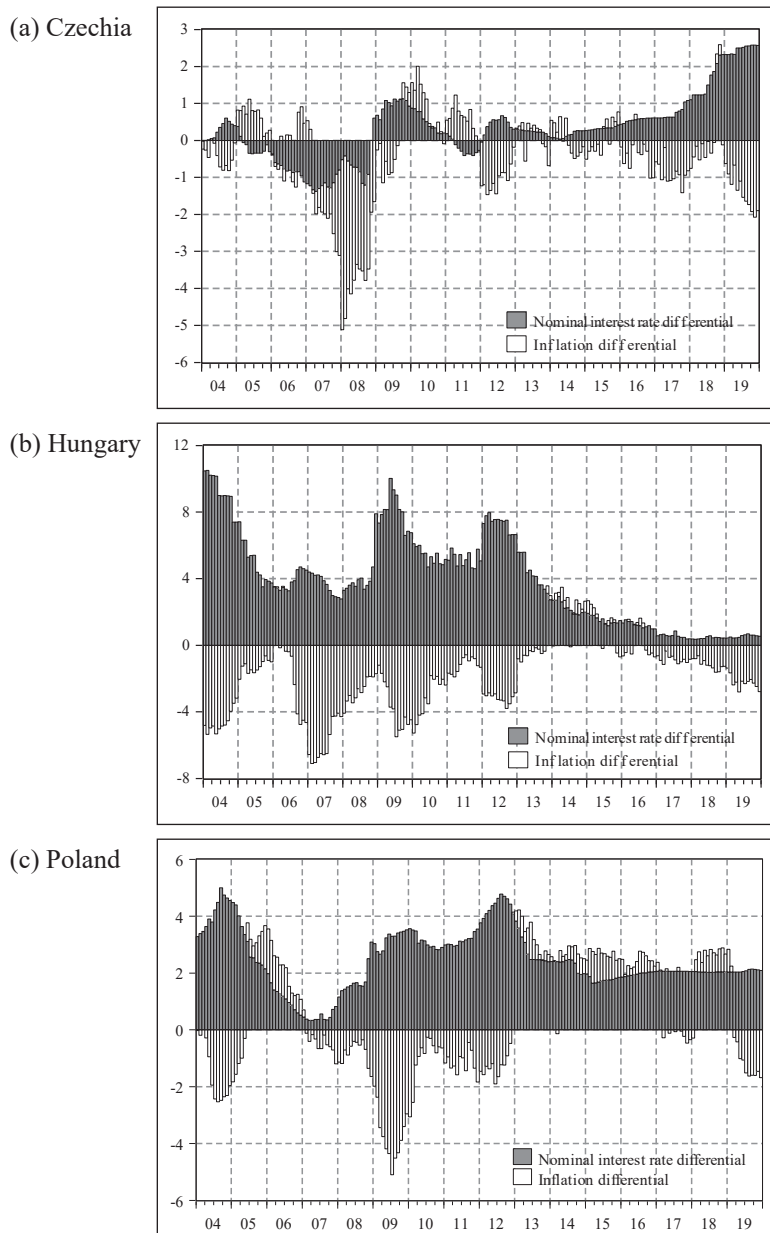


(b) normalized data

Source: Eurostat; authors' calculations

However, if we focus on sub-periods we can identify episodes of greater and lower volatility. For Czechia and Poland we can identify volatile periods before the GFC, during the European debt crisis and after 2017. In Hungary we can also observe period of high volatility up to 2009 and during the European debt crisis. After 2013 we can see a secular decline in real interest rate differential in this country.

Figure 2: Decomposition of real interest rate differentials



Note: As stated in the Related literature section, RIHP is based on Fishers equation, UIP and PPP. Combining these relations we can decompose real interest rate differential as: $rid_t = (i_t - i_t^* - \Delta s_t^e) - (\pi_t - \pi_t^* - \Delta s_t^e)$. This is equal to: $rid_t = (i_t - i_t^*) - (\pi_t - \pi_t^*)$, where superscript * stands for foreign variables. Inflation differential is presented with the opposite sign (negative inflation differential indicates that inflation is higher in CEE than in the euro area)

Source: Authors' calculations

To get a clearer picture on determinants of interest rate differentials and to better understand sources of volatility during some periods, on Figure 2 we decompose real interest rate differentials in nominal interest rate differentials and inflation differentials.²⁷ Figure shows that inflation differentials played a dominant role in the period before the GFC in Czechia, while in Poland and Hungary both differentials had significant effect on real interest rate differential. During the European debt crisis nominal interest rate differential vanished in Czechia so inflation differential had decisive role, while in Hungary and Poland both differentials had notable contribution. Interestingly figure also shows that in the period from 2013 to approximately 2017 inflation rate differential disappeared in all countries, during the period of the so-called “missing inflation” in Europe (Bobeica and Jarocinski, 2017). After 2017 inflation differentials started to play important role again as inflation rates in CEE countries picked up. It is also important to notice that in this period nominal interest rate differential started to increase in Czechia as Czech National Bank started with rate hikes after exchange rate targeting policy fueled inflation (Bruha and Tonner, 2018), while it became negligible in Hungary, as Hungarian National Bank pursued expansionary monetary policy. Polish National Bank kept key policy rate unchanged since 2015 so most changes in real interest rate differential in this country can be attributed to inflation differentials.

Although this descriptive analysis gives some important insights it can't give some reliable evidence regarding the real interest rate parity (RIRP), which is the starting point of our empirical analysis. Thus, Table 2 presents results of various unit root tests. As we explained earlier, in order for RIRP to hold, real interest rate differentials have to be stationary.

Table 2: Unit root tests

	ADF	PP	KPSS	ZA
Czechia	0.16	0.18	0.45*	0.00***
Hungary	0.38	0.31	0.51*	0.00***
Poland	0.31	0.13	0.47*	0.00***

Note: Numbers in the table present p-value for ADF, PP and ZA test and LM-stat for KPSS test;
 * indicates that variable is stationary at the level of statistical significance of 10%; ***
 indicates that variable is stationary at the level of statistical significance of 1%

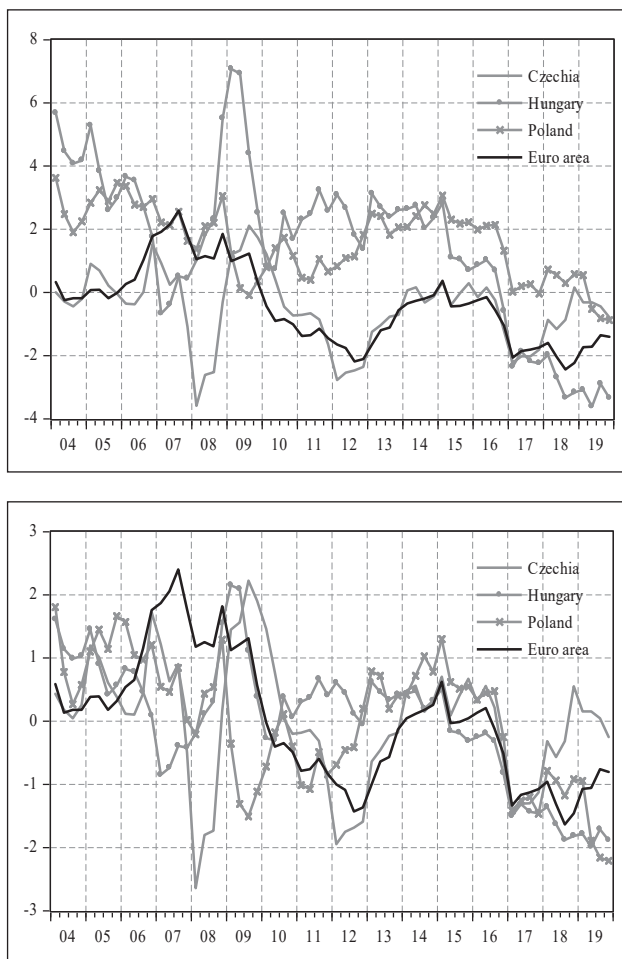
Source: Authors' calculations

Results presented in the table show that according to ADF and PP tests we cannot reject the null hypothesis that series contain unit root (non-stationarity). On the other hand, KPSS test indicates that series are stationary at the level of significance

²⁷ See Appendix for detailed variance decomposition of real interest rate differentials.

of 10%. As we discussed earlier, one of the main weaknesses of standard unit root tests is that they are sensitive to potential structural breaks. Hence, we also employed ZA test which indicates that series are stationary at 1% level of significance (with structural break in all series in 2008). These tests indicate that RIRP holds for the countries in the sample, which is in line with conclusions of the papers presented in the literature review.

Figure 3: Real interest rates (original and normalized data)



Source: Eurostat; authors' calculations

Stationarity of real interest rate differentials implies that real interest rates in CEE countries and the euro area are driven by some common factors. Thus, on Figure 3 we show developments of real interest rates. The figure leads to several conclusions,

(expectedly) in line with the discussion on real interest rate differentials. First, there is a visible correlation between real interest rate in the euro area and real interest rates in CEE countries. Second, the sample can be clearly split on two sub-samples: volatile pre-crisis period up to the end of 2009 and more stable post-crisis period after 2009. After 2009, and especially after 2014, real interest rates in CEE countries stabilized and correlation with the euro are increased.

These conclusions are supported by the correlation coefficients presented in Table 3. In the pre-crisis period, correlations of real interest rates between CEE countries and the euro area were low or even negative. In the crisis period (GFC in 2009 and European debt crisis 2011/12) correlations coefficients turned positive and increased substantially. In the period from 2014, correlation coefficients remained on the relatively high levels in all countries.

Table 3: Correlation of real interest rates in the CEE and the euro area

	2004-2008	2009-2013	2014-2019	2004-2019
Czechia	0.02	0.90	0.64	0.45
Hungary	-0.65	0.67	0.92	0.46
Poland	-0.11	-0.40	0.85	0.51

Source: Authors' calculations

Strong correlation and convergence of real interest rates (implied by analysis of stationarity) implies that these economic could be driven by some common factors. Thus, as explained in the previous section, we employ principal component analysis (PCA) to extract common factors and test whether common factors can explain notable part of the variance of real interest rates in these countries. Table 4 shows the cumulative proportion of variance of real interest rates explained by common factors.

Table 4: Cumulative proportion of variance of real interest rates explained by common factors

	2004-2008	2009-2013	2014-2019	2004-2019
PC 1	0.59	0.70	0.81	0.60
PC 2	0.71	0.83	0.87	0.71
PC 3	0.79	0.88	0.93	0.78
PC 4	0.85	0.92	0.95	0.85
PC 5	0.89	0.95	0.99	0.92

Source: Authors' calculations

Numbers presented in Table 4 are in line with the conclusions based on correlation analysis. In the pre-crisis period, 90% of the variance of real interest rates was explained by more than five factors, in the period of GFC and European debt crisis by four common factors and after 2014 by three common factors, indicating that synchronization of real interest rates increased notably over time.

Results of unit root tests and principle component analysis presented in this section indicate that real interest rates in the euro area and selected CEE countries show convergence patterns and that they are partially driven by some common factors. In the next section we analyze this finding in more details in a more rigorous analytical framework.

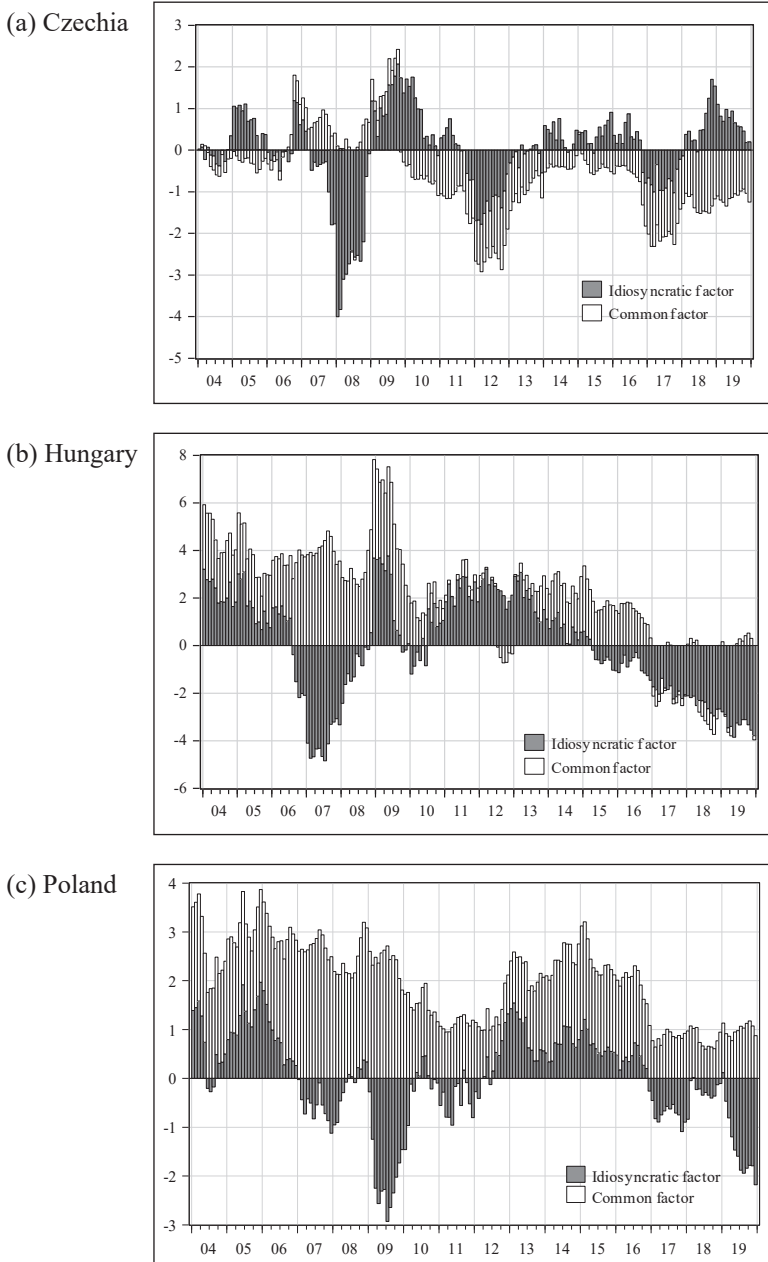
5. Results and discussion

In this section we present the results of two main methodological approaches described in Section 3. First, we analyze the contribution of common factor obtained by the principal component analysis to developments of real interest rates in selected CEE countries, using simple regression analysis. Then we move to more detailed analysis through the lenses of structural BVAR model.

5.1. Contribution of common factor to developments of real interest rates in CEE

Figure 4 graphically presents estimation results of (2), with the first principle component. It shows that contribution of common factor is fairly pronounced in all countries, especially in Czechia and Poland.

Figure 4: Contribution of common factor to developments of real interest rates (%)



Source: Authors' calculations

However, figure also points to some interesting findings. Firstly, although GFC was a common global shock, our results indicate that idiosyncratic factors played

very important role for developments of real interest rates.²⁸ This can be explained by the fact that GFC primarily hit large euro area economies, which then spilled-over to CEE with some lag. Also, ECB reacted to GFC shock somewhat earlier compared to national banks in CEE (especially in Poland), while inflation in more developed countries recorded stronger decline compared to CEE. Second, during the European debt crisis we can see increase of idiosyncratic component in all CEE countries, which is not surprising as this was primarily euro area crisis, with relatively limited spillovers to CEE. In the period of “missing inflation” we can detect rise of a common component, as this low inflationary environment was a kind of “new normal” across Europe. Finally, in the last few years of the sample we can observe increase of the idiosyncratic component, which is in line with the discussion presented in the previous section.

Although PCA is a very useful tool in this kind of analysis, it is purely empirical. It cannot provide a framework for understanding of the nature of idiosyncratic and common shocks that drive variables of interest. Thus, to give our analysis more theoretical rigor in the next section we analyze the contribution of theoretically-founded structural shocks identified in the structural BVAR model.

5.2. Contributions of external shocks to developments of real interest rates in CEE

VAR analysis provides three main types of results: impulse response functions (IRF), forecast error variance decomposition (FEVD) and historical decomposition (HD) (Killian and Lutkepohl, 2017).

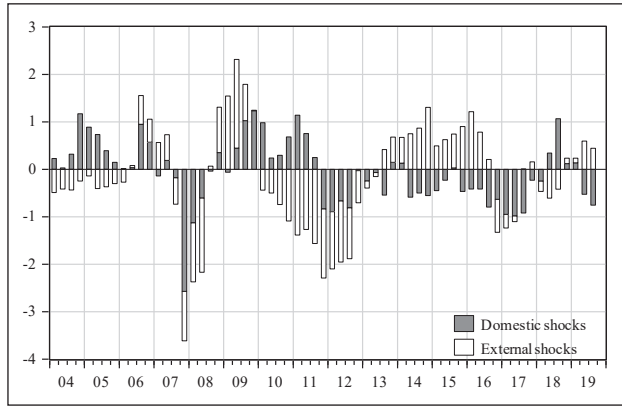
In this paper we are mostly interested in historical decompositions of real interest rates in selected CEE countries. By definition, historical decomposition decomposes each endogenous variable in the model into contribution of each identified shock by multiplying impulse response function by structural shock in every period. Thus, unlike purely empirical approaches such as PCA, historical decompositions provide a richer analytical framework for the analysis of the nature of shocks that drive real interest rates in our sample.

Figure 5 presents historical decompositions of real interest rates for countries in our CEE sample. To make our result more comprehensive we cumulated shocks presented in Table 1 into two groups: domestic and external. Contributions of individual shocks are presented in Appendix.

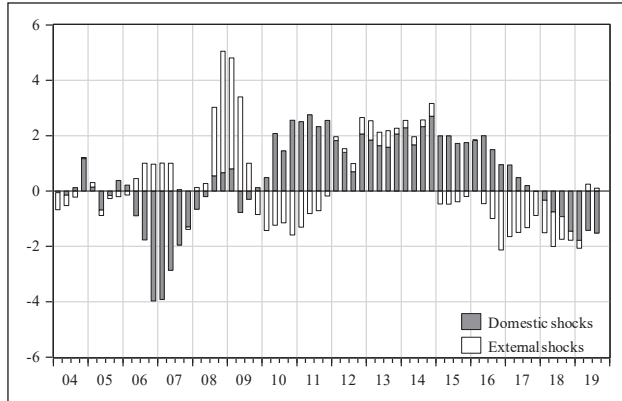
²⁸ We base this discussion on figures provided in Appendix.

Figure 5: Historical decompositions of real interest rates (deviations from the baseline)

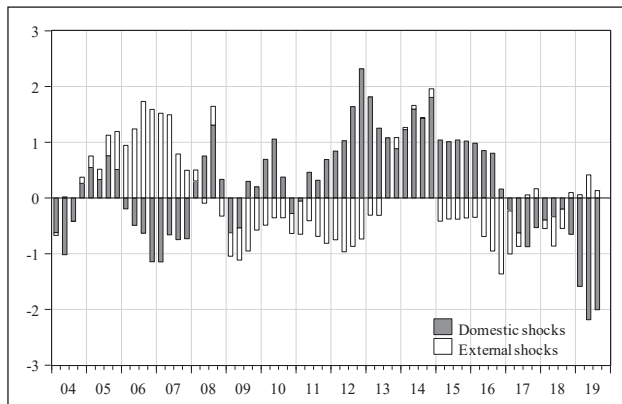
(a) Czechia



(b) Hungary



(c) Poland



Source: Authors' calculations

Figure shows that in the observed period external shocks played dominant role for developments of real interest rate in Czechia, which is in line with previous conclusions based on other methodological approaches in this paper. Contribution of external shocks to developments of real interest rates in other two countries is not so pronounced but still it is far from negligible.²⁹ External shocks played important role in Czechia in Hungary during the GFC and during the missing inflation period. During the sovereign debt crisis contribution of external shocks was pronounced only in case of Czechia (see for example Deskar-Škrbić et al., 2020), while for other two countries this period was marked by dominance of idiosyncratic shocks.

6. Conclusions

Empirical results presented in this paper show that real money market interest rates in Czechia, Hungary and Poland show patterns of convergence with the euro area. Thus, we found empirical evidence for the validity of RIRP, in line with previous research presented in the literature review. However, unlike many other authors in this field of research we took a step forward and tried to shed some new light on the reasons why RIRP holds for these countries.

We analyzed whether there are some common factors that prevent real interest rates in CEE countries to diverge from real interest rates in the euro area. Our results show that historical developments of real interest rates can be adequately described by the common factor extracted from real interest rates in these countries and individual euro area countries. In addition, we showed that external shocks have notable effects on real interest rates in these countries. However, our results also showed that there are differences between countries in our sample. Real interest rates in Czechia are mostly determined by external shocks, while the contribution of external shocks in Hungary and, especially, Poland is less pronounced. These findings are not surprising as previous research shows that the relevance of external shocks in these countries is lower compared to Czechia. However, the relevance of external shocks in the other two countries is still far from negligible.

Bottom line, our results indicate that real interest rates in CEE depend on factors that are beyond the scope of domestic monetary policy makers. In this sense we can conclude that (conventional) monetary policy independence in these countries is limited. In this context we see the loss of monetary policy independence overly pronounced argument in discussion on euro adoption in these countries. Our

²⁹ Effects of external shocks on real interest rate developments on CEE countries are mostly transmitted through the effects of these shocks on domestic GDP and inflation. Thus, our results are in line with conclusions of Deskar-Škrbić et al. (2020) and Deskar-Škrbić and Kunovac (2020) who show that contribution of external shocks to GDP and HICP developments in Czechia is more pronounced compared to Hungary and Poland.

findings are mostly in line with conclusions of previous research. However, this is the first paper that provides evidence for the hypothesis of limited monetary policy independence in these countries based on decompositions of real interest rates.

We are well aware of some shortcomings of our analysis. First, in this paper we focus solely on the conventional monetary policy tools both in CEE and the euro area, while unconventional monetary policy is the new game in town. Our choice of this approach was motivated by the desire for our results to be comparable to previous research in this field, which was mostly based on conventional monetary policy. Second, due to relatively short sample we could not provide robustness check by splitting the sample, which is common in VAR literature. Third, as for the same reason we wanted to keep our BVAR model parsimonious, we identified relatively low number of structural shocks, especially in the external block. It would be very interesting to analyze the contribution of the euro area monetary policy shock in this context. Thus, our results should be interpreted with the grain of salt.

However, we hope that our findings can motivate other authors to additionally explore relevance of common and external shocks for real interest rate developments in these countries in the context of monetary policy independence. This is especially important topic in the current environment shaped by the global exogenous COVID-19-related shock that affected both euro area and CEE economies and led to strong synchronized reaction of policy makers in all countries. With similar GDP and inflation developments and similar reactions of policy makers, current events suggest that we could see even stronger convergence of real interest rates in the future.

References

- Aizenman, J., Chinn, M.D., Ito, H. (2013) “The “impossible trinity” hypothesis in an era of global imbalances: measurement and testing,” *Review of International Economics*, Vol. 21, No. 3, pp. 447–458, <https://doi.org/10.1111/roie.12047>.
- Aksoy, Y., De Grauwe, P., Dewachter, H. (2002) “Do asymmetries matter for European monetary policy?”, *European Economic Review*, Vol. 46, No. 3, pp. 443-469, [https://doi.org/10.1016/S0014-2921\(01\)00160-X](https://doi.org/10.1016/S0014-2921(01)00160-X).
- Alesina, A., Barro, R., Tenreyro, S. (2002) “Optimal Currency Areas,” *NBER Macroeconomic Annual 2002*. Cambridge, MA: MIT Press: pp. 301–355, <https://www.journals.uchicago.edu/doi/abs/10.1086/ma.17.3585292>.
- Alexius, A. (2017) “Why are real interest rates so low? Evidence from a structural VAR with sign restrictions”, *Research Papers in Economics*, No. 6, Stockholm University, Department of Economics, <https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1279929&dswid=5308>.

- Angeloni, I., Flad, M., Mongelli, F. P. (2007) "Monetary integration of the new EU Member States: What sets the pace of euro adoption?", *JCMS: Journal of Common Market Studies*, Vol. 45, No. 2, pp. 367–409, <https://doi.org/10.1111/j.1468-5965.2007.00715.x>.
- Arčabić, V. (2011) "Usklađenost poslovnih ciklusa Republike Hrvatske sa zemljama Europske unije", *Zbornik Ekonomskog fakulteta u Zagrebu*, Vol. 9, No. 1, pp. 127–144, <https://hrcak.srce.hr/70799>.
- Arghyrou, M.G., Gregoriou, A. (2007) "Testing for Purchasing Power Parity correcting for non-normality using the wild bootstrap", *Economics Letters*, Vol. 95, No. 2, pp. 285–290, <https://doi.org/10.1016/j.econlet.2006.10.022>.
- Arghyrou, M.G., Gregoriou, A., Kontonikas, A. (2009) "Do real interest rate converge? Evidence from the European Union", *Journal of International Financial Markets, Institutions and Money*, Vol. 19, No. 3, pp. 447–460, <https://doi.org/10.1016/j.intfin.2008.05.004>.
- Arias, J., Rubio-Ramírez, J. F., and Waggoner, D. F. (2014) "Inference Based on SVAR Identified with Sign and Zero Restrictions: Theory and Applications", *International Finance Discussion Papers*, No. 1100, <https://doi.org/10.3982/ECTA14468>.
- Bayoumi, T., Eichengreen, B. (1992) "Shocking aspects of European monetary unification", *National Bureau of Economic Research*, No. w3949, <https://www.nber.org/papers/w3949>.
- Benecka, S., Fadejeva, L., Feldkircher, M. (2018) "Spillovers from Euro Area Monetary Policy: A Focus on Emerging Europe", *Working Papers*, No. 2018/2, Czech National Bank, https://www.macro-economics.lv/sites/default/files/2018-10/spillovers%20from%20euro%20area%20monetary%20policy%20wp_4-2018_en.pdf.
- Benkovskis K., Bessonovs A., Feldkircher M., Worz, J. (2011) "The transmission of euro area monetary shocks to the Czech Republic, Poland and Hungary: evidence from a FAVAR model", *Focus on Euro Econ Integration*, No. 3, pp. 8–36, <https://ideas.repec.org/a/onb/oenbfi/y2011i3b1.html>.
- Bernard, A., Durlauf, S. (1996) "Interpreting tests of the convergence hypothesis", *Journal of Econometrics*, Vol. 71, No. 1-2, pp. 161–173, [https://doi.org/10.1016/0304-4076\(94\)01699-2](https://doi.org/10.1016/0304-4076(94)01699-2).
- Bobea, E., Jarocinski, M. (2017) "Missing disinflation and missing inflation: the puzzles that aren't", *ECB Working Paper*, No. 2000, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2910914.
- Botrić, V., Broz, T., Jakšić, S. (2020) "Business cycle synchronisation with the euro area countries at times of crisis: differences between SEE and CEE countries", *South-Eastern Europe Journal of Economics*, Vol. 17, No. 2, <https://ojs.lib.uom.gr/index.php/seeje/article/view/9640>.

- Broz, T. (2005) "The Theory of Optimum Currency Areas: A Literature Review". *Privredna kretanja i ekonomska politika*, No. 15, https://scholar.google.hr/scholar?hl=hr&as_sdt=0%2C5&q=Broz%2C+T.+%282005%29+%E2%80%9F+The+Theory+of+Optimum+Currency+Areas%3A+A+Literature+Review%E2%80%9F.+Privredna+kretanja+i+ekonomska+&btnG=.
- Broz, T. (2010) "Introduction of the euro in CEE countries—is it economically justifiable? The Croatian case", *Post-Communist Economies*, Vol. 22, No. 4, pp. 427–447, <https://doi.org/10.1080/14631377.2010.518449>.
- Brůha, J., Tonner, J. (2017) "An exchange rate floor as an instrument of monetary policy: An ex-post assessment of the Czech experience", *Czech National Bank, Working paper series*, No. 4, https://www.cnb.cz/export/sites/cnb/en/economic-research/.galleries/seminars_workshops/2018/rod_2018_10_tonner.pdf.
- Calvo, G.A., Reinhart, C.M. (2002) "Fear of Floating," *Quarterly Journal of Economics*, Vol. 107, No. 2, pp. 379–408, <https://doi.org/10.1162/003355302753650274>.
- Campos, N. F., Fidrmuc, J., Korhonen, I. (2019) "Business cycle synchronisation and currency unions: A review of the econometric evidence using meta-analysis", *International Review of Financial Analysis*, Vol. 61, pp. 274–283, <https://doi.org/10.1016/j.irfa.2018.11.012>.
- Carlin, W., Soskice, D.W. (2014) *Macroeconomics: Institutions, instability, and the financial system*, Oxford University Press, USA.
- Carrion-i-Silvestre, J.L., Del Barrio-Castro, T., Lopez-Bazo, E. (2005) "Breaking the panels: an application to the GDP per capita", *The Econometrics Journal*, Vol. 8, No. 2, pp. 159–175, <https://doi.org/10.1111/j.1368-423X.2005.00158.x>.
- Ca'Zorzi, M. et al. (2020). "Monetary policy and its transmission in a globalised world", *ECB Working Paper*, No. 2405, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3599928.
- Chinn, M., Frankel, J. (1995) "Who drives real interest rates around the Pacific Rim: the USA or Japan?", *Journal of International Money and Finance*, Vol. 14, No. 6, pp. 801–821, [https://doi.org/10.1016/0261-5606\(95\)00038-0](https://doi.org/10.1016/0261-5606(95)00038-0).
- Cuaresma, J.C., Wójcik, C. (2006) "Measuring monetary independence: Evidence from a group of new EU member countries", *Journal of Comparative Economics*, Vol. 34, No.1, pp. 24–43, <https://doi.org/10.1016/j.jce.2005.12.003>.
- Cuestas, J.C., Harrison, B. (2010) "Further evidence on the real interest rate parity hypothesis in Central and East European countries: unit roots and nonlinearities", *Emerging Markets Finance and Trade*, Vol. 46, No. 6, pp. 22–39, <https://doi.org/10.2753/REE1540-496X460602>.
- Cumby, R., Mishkin, F. (1986) "The international linkage of real interest rates: The European-U.S. connection", *Journal of international Money and Finance*, Vol. 5, No. 1, pp. 5–23.
- Dąbrowski, M. A., Papież, M. and Śmiech, S. (2019) „Monetary Independence of Central and Eastern European Economies with Flexible Exchange Rate

- Regimes“, *Eastern European Economics*, Vol. 57, No. 4, pp. 295–316, <https://doi.org/10.1080/00128775.2019.1610897>.
- Deskar-Škrbić, M., Kotarac, K., Kunovac, D. (2020) “The third round of euro area enlargement: Are the candidates ready?”, *Journal of International Money and Finance*, Vol. 107, No. 102205, [https://doi.org/10.1016/0261-5606\(86\)90047-1](https://doi.org/10.1016/0261-5606(86)90047-1).
- Deskar-Škrbić, M., Kunovac, D. (2020) “Twentieth Anniversary of the Euro: Why are Some Countries Still Not Willing to Join? Economists’ View”, *Comparative Economic Studies*, pp. 1–21.
- Dickey, D.A., Fuller, W.A. (1979) “Distribution of the Estimators for Autoregressive Time Series with a Unit Root”, *Journal of the American Statistical Association*, Vol. 74, No. 366, pp. 427–431, <https://doi.org/10.1080/01621459.1979.10482531>.
- Dutton, M. M. (1993) “Real interest rate parity: new measures and tests”, *Journal of International Money and Finance*, Vol. 14, No. 1, pp. 801–825, [https://doi.org/10.1016/0261-5606\(93\)90010-9](https://doi.org/10.1016/0261-5606(93)90010-9).
- Edwards, S. (2015) “Monetary policy independence under flexible exchange rates: an illusion?”, *The World Economy*, Vol. 38, No. 5, pp. 773–787, <https://doi.org/10.1111/twec.12262>.
- Enders, W., Lee, J. (2012) “A Unit Root Test Using a Fourier Series to Approximate Smooth Breaks”, *Oxford Bulletin of Economics and Statistics*, Vol. 74, No. 4, pp. 574–599, <https://doi.org/10.1111/j.1468-0084.2011.00662.x>.
- Estrin, S., Uraga, G. (1997) “Testing for Ongoing Convergence in Central and Eastern Europe”, *CEPR Discussion Paper*, No. 1615.
- Eudey, G. (1998) “Why is Europe Forming a Monetary Union?”, *Federal Bank of Philadelphia, Business Review*, Nov/Dec, pp. 13–21, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.196.1036&rep=rep1&type=pdf>.
- Feldkircher, M. (2015) “A global macro model for emerging Europe,” *Journal of Comparative Economics*, Vol. 43, No. 3, pp. 706–726, <https://doi.org/10.1016/j.jce.2014.09.002>.
- Ferreira, A.L., Leon-Ledesma, M. A. (2007) “Does the real interest parity hypothesis hold? Evidence for developed and emerging markets”, *Journal of International Money and Finance*, Vol. 26, No. 3, pp. 364–382, <https://doi.org/10.1016/j.jimonfin.2006.11.003>.
- Fidrmuc, J., Korhonen, I. (2006) “Meta-analysis of the business cycle correlation between the euro area and the CEECs”, *Journal of Comparative Economics*, Vol. 34, No. 3, pp. 518–537, <https://doi.org/10.1016/j.jce.2006.06.007>.
- Frankel, J.A., Rose, A.K. (1998) “The Endogeneity of the Optimum Currency Area Criteria”, *The Economic Journal*, Vol. 108, No. 449, pp. 1009–1025, <https://doi.org/10.1111/1468-0297.00327>
- Galí, J. (2008) *Monetary Policy, Inflation, and the Business Cycle: An Introduction to the New Keynesian Framework*, Princeton, N.J: Princeton University Press.

- Gallí, J., Gertler, M. (2007) "Macroeconomic Modeling for Monetary Policy Evaluation", *The Journal of Economic Perspectives*, Vol. 21, No. 4, pp. 25–45, <https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.21.4.25>.
- Goczek, L., D. Mycielska (2019) "Actual monetary policy independence in a small open economy: The Polish perspective," *Empirical Economics*, Vol. 56, No. 2, pp. 499–522, <https://doi.org/10.1007/s00181-017-1370-y>.
- Goczek, Ł., Mycielska, D. (2016) "Euro Dominance Hypothesis and Monetary Policy Independence-the Czech Perspective", *Prague Economic Papers*, Vol. 2016, No. 6, pp. 655–670, doi: 10.18267/j.pep.584.
- Goodwin, B.K., T.J. Grennes (1994) "Real interest rate equalisation and the integration of international financial markets", *Journal of International Money and Finance*, Vol. 13, No. 1, pp. 107–124, [https://doi.org/10.1016/0261-5606\(94\)90027-2](https://doi.org/10.1016/0261-5606(94)90027-2).
- Hanclova, J. (2012) "The effects of domestic and external shocks on a small open country: The evidence from the Czech Economy", *International Journal of Mathematical Models and Methods in Applied Sciences*, Vol. 6, No. 2, pp. 366–375, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.352.5855&rep=rep1&type=pdf>.
- Holmes, M.J. (2002) "Does long-run real interest parity hold among EU countries? Some new panel data evidence", *The Quarterly Review of Economics and Finance*, Vol. 42, No. 4, pp. 733–746, [https://doi.org/10.1016/S1062-9769\(01\)00116-8](https://doi.org/10.1016/S1062-9769(01)00116-8).
- Holmes, M.J. (2005) "Integration or independence? An alternative assessment of real interest rate linkages in the European Union", *Economic Notes*, Vol. 34, No. 3, pp. 407–427, <https://doi.org/10.1111/j.0391-5026.2005.00156.x>.
- Horvath, R., Rusnak, M. (2009) "How important are foreign shocks in a small open economy? The case of Slovakia", *Global Economy Journal*, Vol. 9, No. 1, <https://doi.org/10.2202/1524-5861.1420>.
- Iossifov, P., Podpiera, J. (2014) "Are Non-Euro Area EU Countries Importing Low Inflation from the Euro Area?", *IMF Working Papers*, No.14/191.
- Jiménez-Rodríguez, R., Morales-Zumaquero, A., Égert, B. (2013) "Business Cycle Synchronization between Euro Area and Central and Eastern European Countries", *Review of Development Economics*, Vol. 17, No. 2, pp. 379–395, <https://doi.org/10.1111/rode.12038>.
- Kadow, A., Cerrato, M., MacDonald, R., Straetmans, S. (2013) „Does the euro dominate Central and Eastern European money markets?“, *Journal of International Money and Finance*, Vol. 32, pp. 700–718.
- Keppel, C., Prettner, K. (2015) "How interdependent are Eastern European economies and the Euro area?", *The Quarterly Review of Economics and Finance*, Vol. 58, pp. 18–31, <https://doi.org/10.1016/j.qref.2015.02.012>.

- Kilian, L., Lütkepohl, H. (2017) *Structural vector autoregressive analysis*, Cambridge University Press.
- Kotarac, K., Kunovac, D., Ravnik, R. (2017) “Coherence of business cycles and economic shocks between Croatia and Euro Area Member States”, *CNB Working Papers*, No. 53.
- Krznar, I., Kunovac, D. (2010) “Utjecaj vanjskih šokova na domaću inflaciju i BDP”, *Istraživanja*, No. 1-28.
- Kunovac, D. (2013) “Trošak zaduživanja odabranih zemalja Europske unije i Hrvatske – uloga prelijevanja vanjskih šokova”, *HNB Istraživanja*, No. 1-41.
- Kunovac, D., Kotarac, K. (2017) *BVAR under block exogeneity and sign restrictions: Matlab toolbox*, Croatian National Bank.
- Kwiatkowski, D., Phillips, P. C. B., Schmidt, P., Shin, Y. (1992) “Testing the null hypothesis of stationarity against the alternative of a unit root”, *Journal of Econometrics*, Vol. 54, No. 1-3, pp. 159–178.
- Macchiarelli, C. (2013) “GDP-Inflation cyclical similarities in the CEE countries and the euro area”, *ECB Working Paper*, No. 5024, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2268505.
- Mackowiak, B. (2006) “How much of the macroeconomic variation in Eastern Europe is attributable to external shocks?”, *Comparative Economic Studies*, Vol. 48, No. 3, pp. 523–544, <https://doi.org/10.1057/palgrave.ces.8100143>.
- Mark, N.C. (1985) “Some evidence on the international equality of real interest rates”, *Journal of International Money and Finance*, Vol. 4, No. 2, pp. 189–208, [https://doi.org/10.1016/0261-5606\(85\)90043-9](https://doi.org/10.1016/0261-5606(85)90043-9).
- Meese, R., Rogoff, K. (1988) “Was it real? The exchange rate-interest differential relation over the modern floating rate period”, *Journal of Finance*, Vol. 43, No. 4, pp. 933–948, <https://doi.org/10.1111/j.1540-6261.1988.tb02613.x>.
- Mishkin, F.S. (1984) “Are real interest rates equal across countries? An empirical investigation of international parity conditions”, *Journal of Finance*, Vol. 39, No. 3, pp. 1345–1357, <https://doi.org/10.1111/j.1540-6261.1984.tb04911.x>.
- Mongelli, F. (2002) ““New” views on the optimum currency area theory: What is EMU telling us?”, *ECB Working Paper*, No. 138.
- Narayan, P.K., Popp, S. (2010) “A New Unit Root Test with Two Structural Breaks in Level and Slope at Unknown Time”, *Journal of Applied Statistics*, Vol. 37, No. 9, pp. 1425–1438, <https://doi.org/10.1080/02664760903039883>.
- Ng, S., Perron, P. (2001) “Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power”, *Econometrica*, Vol. 69, No. 6, pp. 1519–1554, <https://doi.org/10.1111/1468-0262.00256>.
- Obstfeld, M., Rogoff, K. (1996) *Foundations of International Macroeconomics*, MIT Press.
- Obstfeld, M., Taylor, A.M. (2002) “Globalization and capital markets”, *NBER working paper*, No. 8846, <https://www.nber.org/system/files/chapters/c9587/c9587.pdf>.

- Phillips, P., Perron, P. (1988) "Testing for a Unit Root in Time Series Regression", *Biometrika*, Vol. 75, No. 2, pp. 335–346, <https://doi.org/10.1093/biomet/75.2.335>.
- Prettner, K., Prettner, C. (2014) "How Interdependent Are Eastern European Economies and the Euro Area?", *SSRN Electronic Journal*, No. 58, <http://dx.doi.org/10.2139/ssrn.2393906>.
- Rey, H. (2015) "Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence," *CEPR Discussion Papers* 10591, C.E.P.R. Discussion Papers, <https://www.nber.org/papers/w21162>.
- Rødseth, A. (2000) *Open economy macroeconomics*, Cambridge University Press.
- Stanišić, N. (2013) "Convergence between the business cycles of Central and Eastern European countries and the Euro area", *Baltic Journal of Economics*, Vol. 13, No. 1, pp. 63–74.
- Stock, J. H., Watson, M.W. (2002) "Macroeconomic Forecasting Using Diffusion Indexes", *Journal of Business and Economic Statistics*, Vol. 20, No. 2, pp. 147–162, <https://doi.org/10.1198/073500102317351921>.
- Su, C. W., Chang, H. L., Liu, L. (2012) "Real interest rate parity with flexible Fourier stationary test for Central and Eastern European countries", *Economic Modelling*, Vol. 29, No. 6, pp. 2719–2723, <https://doi.org/10.1016/j.econmod.2012.06.017>.
- Su, C.W., Jiang, X., Chang, H.L. (2014) "Real interest rate parity for Central and Eastern European countries: a new unit root test with two structural breaks", *Ekonomicky Casopis*, Vol. 62, No.1, pp. 3–18, <https://www.ceeol.com/search/article-detail?id=163902>.
- Ter Ellen, S., Jansen, E., Midthjell, N.L., (2020) "ECB Spillovers and domestic monetary policy effectiveness in small open economies", *European Economic Review*, Vol. 121, <https://doi.org/10.1016/j.euroecorev.2019.103338>.
- Walsh, C. E. (2010) *Monetary Theory and Policy*, Third Edition, Volume 1 of MIT Press Books, The MIT Press.
- Woodford, M. (2003) *Interest and Prices: Foundations of a Theory of Monetary Policy*, Princeton, N.J., Woodstock, Oxfordshire England: Princeton University Press.
- Wu, J.L., Fountas, S. (2000) "Real interest parity under regime shifts and implications for monetary policy", *The Manchester School*, Vol. 68, No. 6, pp. 685–700, <https://doi.org/10.1111/1467-9957.00225>.
- Zivot, E., Andrews, D. (2012) "Further evidence of great crash, the oil price shock and unit root hypothesis", *Journal of Business and Economic Statistics*, Vol. 10, pp. 251–270, <https://doi.org/10.1198/073500102753410372>.

Konvergencija realnih kamatnih stopa i neovisnost monetarne politike u zemljama Srednje i Istočne Europe

Milan Deskar-Škrbić¹, Antonija Buljan², Mirna Dumičić³

Sažetak

U ovom radu daju se novi empirijski dokazi relevantni za rasprave o neovisnosti monetarne politike u kontekstu uvođenja eura u tri zemlje Srednje i Istočne Europe (CEE): Češkoj, Mađarskoj i Poljskoj. Za razliku od mnogih drugih autora, u ovom se radu težište stavlja na realne, a ne na nominalne kamatne stope, jer su realne kamatne stope u središtu moderne makroekonomske teorije i monetarne politike. U istraživanju se primjenjuje nekoliko metodologija za ispitivanje konvergencije realnih kamatnih stopa između ovih zemalja i euro-područja kako bi se utvrdili glavne odrednice realnih kamatnih stopa. Na temelju testova jediničnog korijenja nalazimo dokaze o konvergenciji realnih kamatnih stopa u tim zemljama, čime se potvrđuje hipoteza o realnom kamatnom paritetu (RIRP). Nadalje, primijenjena analiza glavnih komponenata (PCA) ukazuje na činjenicu da se zajedničkim faktorom izdvojenim iz uzorka zemalja Srednje i Istočne Europe i pojedinih zemalja euro-područja može objasniti visok udio kretanja realnih kamatnih stopa u tim zemljama. Konačno, rezultati našeg predloženog novog analitičkog okvira za analizu odrednica realnih kamatnih stopa u malim otvorenim gospodarstvima, temeljenog na Bayesovskom VAR modelu s pretpostavkom blok-egzogenosti (eng. block exogeneity), pokazuju da vanjski šokovi imaju nezanemariv učinak na kretanje realnih kamatnih stopa u odabranim zemljama srednje i istočne Europe. Dakle, naši rezultati pokazuju da realne kamatne stope u SIE ovise o čimbenicima koji su izvan dosega domaćih kreatora monetarne politike. U tom smislu može se zaključiti da je (konvencionalna) neovisnost monetarne politike u tim zemljama ograničena. Stoga gubitak neovisnosti monetarne politike vidimo kao pretjerano naglašeni argument u raspravama o uvođenju eura u tim zemljama. Međutim, svjesni smo da su se nacionalne središnje banke u Srednjoj i Istočnoj Europi nedavno počele više oslanjati na nekonvencionalne mjere, što im daje veći stupanj fleksibilnosti (i autonomije).

Cljučne riječi: uvođenje eura, realni kamatni paritet (RIRP), realne kamatne stope, Bayesovski VAR model, Srednja i Istočna Europa (SIE), Optimalno valutno područje (OCA)

JEL klasifikacija: E32, E52, F45

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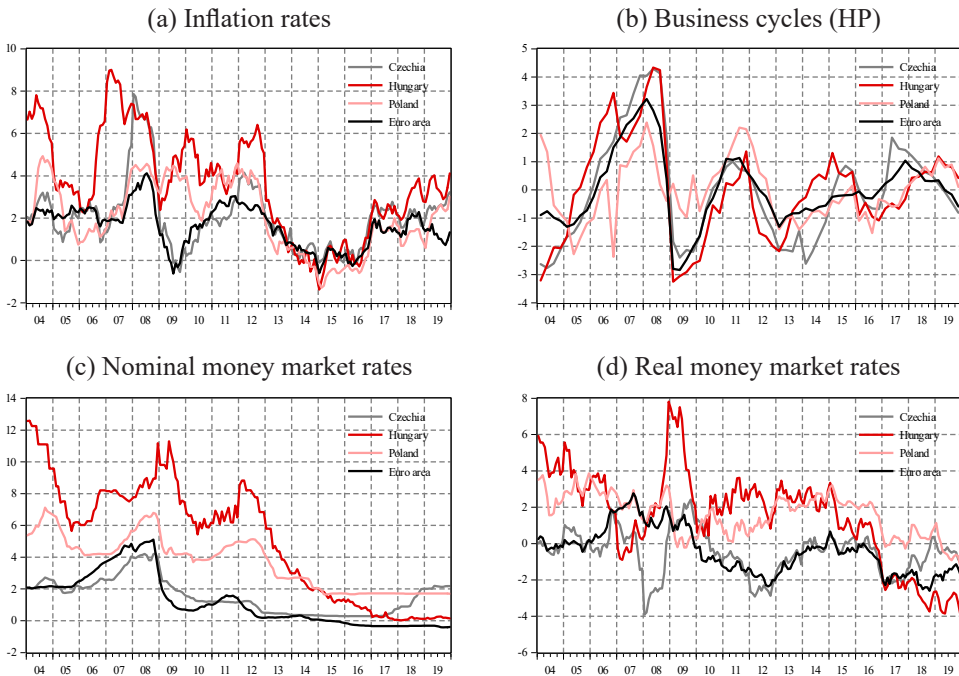
Appendices

Appendix 1: Variance decomposition of real interest rate differentials

	$Var(i_t - i_t^*)$	$Var(\pi_t - \pi_t^*)$	$2 * Cov(i_t - i_t^*)$	$Var(r_t - r_t^*)$
Czechia				
2004-2008	0.32	1.85	0.23	2.41
2009-2012	0.22	0.56	-0.19	0.59
2013-2017	0.03	0.13	-0.06	0.10
2018-2019	0.58	0.37	-0.27	0.68
Hungary				
2004-2008	5.34	4.18	-2.66	6.85
2009-2012	1.90	1.79	-1.95	1.74
2013-2019	1.71	0.80	6.98	0.48
Poland				
2004-2008	2.04	1.19	-1.67	1.56
2009-2012	0.34	1.70	0.14	2.18
2013-2017	0.22	0.11	-0.09	0.24
2018-2019	0.00	0.64	-0.04	0.60

Source: Authors' calculations

Appendix 2: Some stylized facts on CEE economies



Source: Eurostat; authors' calculations

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Threshold effect of public debt on economic growth: An empirical analysis in the European transition countries*

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Abstract

The paper empirically examines and assess the relationship between public debt and economic growth in the European transition countries from 1995 to 2017 (both years inclusive). The study attempts to identify and determine the threshold values or the extent to which public debt-to-GDP ratio has a positive effect on economic growth, and beyond which point debt-to-GDP ratio has a negative effect on the economic growth in European transition countries. For this purpose, we employ different econometric models and techniques such as pooled OLS, fixed and random effects models, GMM (Generalized Method of Moments), and bootstrap method in order to determine threshold values of public debt-to-GDP ratio. The findings prove the general theoretical assumption that at low level of public debt- to-GDP ratio has a positive effect on economic growth, whereas

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beyond a certain turning point a negative effect on growth prevails in the European transition countries. In addition, the results show different levels of threshold values of public debt-to-GDP ratio among European transition countries. So far, it is confirmed that for less developed European transition countries the threshold values of the debt-to-GDP is lower than for more developed ones in the sample. Therefore, the findings provide additional information for European transition countries, which have debt levels above the threshold values, as to reduce their public debt and to support long-term economic growth prospects.

Key words: *Economic growth, public debt, turning point, panel data, European transition countries*

JEL classification: *E60, E69, E011, H63*

1. Introduction

There is a mountain of empirical studies that have investigated the relationship between public debt and economic growth. However, the empirical evidence is still inconclusive and debatable regarding the threshold of the public debt. Most of the studies show that lower public debt or debt below a certain threshold value has positive effect on economic growth (Reinhart and Rogoff, 2010; Baum et al., 2013; Woo and Kumar, 2015; Taylor et al., 2012; Irons and Bivens, 2010; Pescatori et al., 2014; Rankin and Roffia, 2003; Mencinger et al., 2015; Bexheti et al., 2020). Surprisingly, only a few studies have examined the issue of public debt, and how the threshold value of public debt affects economic growth in transition countries, particularly in European transition countries (Mencinger et al., 2015; Checherita and Rother, 2010; Bexheti et al., 2020). European Transition countries have been faced with several problems including war, political instability, hyperinflation, high public debt and the collapse of their financial sector. In the process of transitioning; these countries now offer an interesting case study, particularly with regard to relationships between public debt and economic growth. Therefore, the research question of this paper is to examine the public debt threshold value and its effect on economic growth in the European transition countries. To examine the relationships between public debt-to GDP ratio and economic growth we propose two following research hypotheses:

H1: The hypothesis of this paper is that debt-to-GDP ratio below certain point of threshold value has a positive impact on economic growth, whereas debt-to-GDP ratio beyond certain point of threshold value has a negative impact on economic growth in the European transition countries.

H2: The threshold value of debt-to-GDP ratio is lower for less developed European transition countries than developed ones in our sample.

To search for threshold values to public debt-to GDP ratio, we employ different econometric models and techniques such as pooled OLS, fixed and random effects model, GMM (Generalized Method of Moments), and bootstrap approach. The

data, for this paper have been collected from World Bank, International Monetary Fund, and Eurostat. The main argument for this study is that only a few studies have examined the threshold value of public debt and its effect on economic growth in European transition countries (Mencinger et al., 2015; Checherita and Rother, 2010; Bexheti et al., 2020), hence, a gap exists in the literature that this study seeks to fill. However, they have not showed clear methodology regarding identification of the threshold value of public debt. Our study differs from them, as we employ panel threshold model proposed by Hansen (1999) in order to identify threshold value of public debt in the European transition countries.

To summarize, the findings of this study show that the debt-to-GDP ratio turning point are 81.60% of GDP in Central Europe countries, 71.90% of GDP in Eastern Europe countries, and 58.20% of GDP in Western Balkans countries. That is any increase of public debt-to-GDP ratio up to this interval has positive impact on economic growth, and beyond this interval, the positive affect inverts to have a negative effect on economic growth in the European transition countries. Another interesting issue is that, squaring debt will also negatively affect economic growth in the European transition countries.

The reminder of this paper is organized as a follow: Section 2 reviews of literature; Section 3 presents research methodology and data; Section 4 provides the results and discussion, and Section 5 provides the findings and conclusion.

2. Literature review

There are several authors who have examined the effect of public debt threshold value on economic growth, both developed, and countries in transition (Checherita and Rother, 2010; Baldacci and Kumar, 2010; Egert, 2013; Wigger, 2009; Baum et al., 2013; Schclarek, 2004; Adam and Bevan, 2005). However, there are only few studies that have examined the public debt threshold value and its effect on economic growth in countries in transition, particularly the European countries. Noted is the fact that the empirical evidence does show consensus relating to the public debt threshold value and its effect on economic growth. The study by Mencinger et.al. (2015) found that the public debt threshold in developed countries is ranged from 90% to 94%, which means that above this public debt threshold, it will have a negative effect on economic growth. However, the public debt threshold below 90% will have a positive effect on economic growth. In addition, the findings show that public debt threshold limit in developing countries is ranged from 44% to 45%, below this limit the public debt will have positive effects on economic growth, while above this limit it will have a negative impact on economic growth. These findings suggest that there is a difference between developed and developing countries with regard to the relationship between public debt and threshold value.

The study by Checherita and Rother (2010) examined the public debt threshold in the EU countries and found that the public debt threshold value ranged from 82% to 91%. If the public debt is above this threshold, it will have a negative effect on economic growth in EU countries. On the other hand, if the public debt remains below the threshold value of 82%, it will have a positive impact on economic growth, and will foster the economic growth on these countries. Reinhart and Rogoff (2010) investigated the impact of public debt on real long-term GDP growth rates, taking into account a sample of 24 developing countries, over a period of nearly 200 years (1790-2010). They have found that the public debt may have positive effect on economic growth in the short run, while in the long run the public debt has been rated as negative by systematically curbing the growth and economic development of these countries. In addition, Baldacci and Kumar (2010) examined the impact of fiscal deficits and public debt on long-term interest rates during 1980–2008, taking into account a wide range of country-specific factors for a panel of 31 advanced and emerging market economies. The authors found that higher deficits and public debt lead to a significant increase in long-term interest rates, which in turn lead to decrease of economic growth.

Research study by Panizza and Presbitero (2014) analyzed the linkages between growth, public debt and productivity in the 155 countries over the period 1970-2008. The authors found that there is a negative effect of debt ratio to GDP and financial crisis on economic growth. Afonso and Alves (2015) analyzed the effects of sovereign debt-to-GDP ratio on economic growth for 14 European countries over 43 years (1970-2012). The study concluded that government debt has a negative effect on economic growth, both, in the short and long-term. This contrast with Panizza and Presbitero (2013) who showed that there is no evidence that debt has an effect on economic growth and there are different ways through which a large public debt may harm the economy.

Research by Ghosh et al. (2013) examined empirically a sample of 23 advanced economies over 1970–2007 and found robust empirical support for the fiscal fatigue characteristic. They found that the marginal response of primary budget balance to lagged debt is nonlinear, remaining positive at moderate debt levels but starting to decline when debt reaches around 90-100 percent of GDP. Furthermore, they found that the estimated debt limits and corresponding fiscal space vary considerably across countries. For example, the debt limit obtained for countries in the sample ranges between 150 to 250 percent of GDP, while the fiscal space estimates indicate limited or no available fiscal space for Greece, Iceland, Italy, Japan and Portugal, and ample space for Australia, Korea and the Nordic countries. Gnegne and Jawadi (2013) analyzed public debt and its dynamics for the UK and the USA, and public debt proved to be asymmetric and nonlinear making the authors conclude that public debt seems to be based on several threshold effects, which helps to understand its dynamics with more accuracy. On the other hand, Schclarek

(2004) found that a significant relation between the government debt and economic growth could not be identified for the industrialized countries. For the developing countries, low levels of external debt are associated with higher growth rates. The reverse is not caused by private external debt, but rather by the incidence of public external debt.

Study by Bexheti et al. (2020), investigated the impact of public debt on economic growth, employing panel data, 2OLS and panel VAR, over the period 2003-2016, in the Western Balkans Countries. The result showed that the public debt has a weak negative effect on economic growth and the coefficient is statistically significant only in random approach and 2OLS. Moreover, they found that threshold value of public debt is 50,87%, however, there was not clear methodology by which they have identified threshold value in their study.

To summarize, it is clear that a considerable number of studies have analyzed the effect of the public debt on economic growth in developed countries. However, there are very few empirical studies addressing the relationship between public debt and economic growth in countries in transition, especially in European transition countries. This paper will attempt to contribute to the issue, by investigating how growth of public debt, will affect the economic growth in the European transition countries. This research will also attempt to determine the optimal threshold value, and to what level does the increase of public debt to GDP ratio affects positively the economic growth of the European transition countries.

3. Methodology

In order to explore relationships between debt-to-GDP ratio and economic growth we employ panel data model such as OLS, fixed and random effect models, Hausman-Taylor IV and GMM. In addition, we employ panel threshold model proposed by Hansen (1999) in order to identify the threshold values of debt-to-GDP ratio.

3.1. Research Methodology

(i) Panel Data Model

The empirical analysis contains panel data from 1995 to 2017 (approximately 22 years) for 20 European transition countries, specifically countries in Central Europe, Eastern Europe, and the Western Balkans. The dynamic panel model (GMM) are employed to test the relationships between debt to GDP and GDP per capita and other independent variables in the European transition countries. We apply Arellano and Bond (1991), Blundell and Bond (1998), Blundell et al. (2000) GMM estimator

as it is proper estimator. The GMM procedure also allows us to control for problem of endogeneity bias caused by reverse causality running from GDP per capita to debt to GDP and other explanatory variables. In order to deal with endogeneity problem, we employ instrumental variable (IV) or two steps GMM estimators instrumental (IV). It is relatively common practice with macroeconomics data to use the lagged debt to GDP ratio and the lagged debt to GDP ratio squared as instruments with two lags. This instrument has the advantage of not having a direct causation effect on the growth rate, if it is assumed that there are not spillover effects between debt levels in European transition countries. The endogeneity problem is also avoided in our specification because independent variables are all lagged 1 or 2 years compared to the dependent variable. Furthermore to determine the public debt threshold value, we used the “bootstrap” estimator, which is based on a very high number of simulations. For the comparison purpose, we apply and OLS, fixed effect model and random effect model.

The reliability of the GMM estimator depends on the validity of its instrument sets. To address this issue, we consider two specification tests suggested by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (2000). The first is the Sargan test that tests the null hypothesis of over-identification restrictions apply or instruments as group are exogenous.

This test proves or rejects the overall validity of instruments by analyzing the sample analog of moment conditions used in the estimation process. The second test examines the null hypothesis that autocorrelation does not exist, which means that the error terms are not serially correlated. In the difference regression, we test whether the differenced error term is in first order or in second order serially uncorrelated.

The specification of dynamic panel data model (GMM) is as follows:

$$\begin{aligned}
 GDP_{it} = & \mu + GDP_{(it-1)} + B_1 DEBT_{it} + B_2 DEBT_SQUARE_{it} + \\
 & + B_3 FINAL_CONSUM_{it} + B_4 EXPORT_{it} + B_5 GROSS_SAV_{it} + \\
 & + B_6 CURRENT_ACCOUN_{it} + B_7 FINAL_GOVERNMENT_EXPEND_{it} + \\
 & + \delta_i + \gamma_i + \varepsilon_i
 \end{aligned} \quad (1)$$

The dependent variable is GDP per capita growth rate for each country i and t represents years, μ is term of constant; explanatory variables include GDP_{it-1} is the first lag of dependent variable, $DEBT_{it}$ is debt and $DEBT_QUARE_{it}$ represents debt square assuming a non-linear relationship between government debt and economic growth. Based on the theoretical assumption that the relationships between public debt and economic growth is non-linear, we expect lower debt to have a positive effect and debt in square to have negative effect on economic growth. We also include and control variables in order to enhance the performance of model and to provide robust result. The control variables are selected based on the main

determinants of economic growth (see Sala-i-Martin et al., 2004; Kumar and Woo, 2010; Checherita and Rother, 2010). The control variables are final consumption, exports, gross savings, current account and final government expenditures. The term δ_i is the country fixed effect that enables us to control for time-invariant unobservable factors that may affect economic growth which otherwise may lead to bias coefficients. The term γ_i is the common time effect that covers business cycle effect which otherwise may lead to spurious regression between dependent variable and explanatory variables. The term ε_{it} represent standard error.

ii) Panel threshold model

The relationship between GDP per capita growth and public debt-to-GDP is examined, applying Panel threshold model proposed by Hansen (1999) and Wang (2015). This method allows us to estimate the endogenous threshold level. The specification of the single threshold is the following:

$$y_{it} = \mu_i + B_1 X_{it} + debt.I(q_{it} < \gamma) + B_2 X_{it} + debt.I(q_{it} \geq \gamma) + u_i + e_i \quad (2)$$

The dependant variable y_{it} is GDP per capita growth. The threshold variable q_{it} is the public debt-to-GDP ratio and γ is the threshold parameter that divides the equation into two regimes with coefficients β_1 and β_2 . μ_i represents the country-specific effect. $I(\cdot)$ is indicator of function. The parameter u_i is the individual effect, while e_{it} is the disturbance. X contains control variables. The equation may also be written

$$\begin{aligned} y_{it} &= \mu_i + B_1 X_{it} + debt.I(q_{it} \leq \gamma) + e_{it} \text{ if } q_{it} \leq \gamma \\ y_{it} &= \mu_i + B_2 X_{it} + debt.I(q_{it} > \gamma) + e_{it} \text{ if } q_{it} > \gamma \end{aligned} \quad (3)$$

According to Hansen (1999), there are several steps that should be undertaken in order to find threshold. In the first step, the equation is estimated, applying ordinary last-square to determine threshold. Then, we calculate the sum squares residuals (RSS) for all values of the threshold γ . The sum squared residuals is

$$S_1(\gamma) = [\hat{e}(\gamma)]' [\hat{e}(\gamma)] \quad (4)$$

Following Hansen (1999) in the second step the threshold parameter is calculated by minimizing the sum squared residuals $S_1(\gamma)$ as following:

$$\hat{\gamma} = \arg \min_{\gamma} S_1(\gamma) \quad (5)$$

In the third step we estimate the significance of threshold level, i.e., the null and alternative hypotheses. The null hypothesis and alternative hypothesis, i.e., the linear versus the single threshold model are

$$H_0 : B_1 = B_2, \tag{6}$$

$$H_a : B_1 \neq B_2$$

Following Hansen (1999) we apply the following likelihood ratio to test of H_0 :

$$F_1 = \frac{S_0 - S_1(\gamma)}{\delta^2} \tag{7}$$

where S_0 is the sum of squared residuals under H_0 i.e., the linear model $S_1(\hat{\gamma})$ represents the sum of squared residuals under H_a i.e., the threshold model. Hansen (1999) showed that the asymptotic distribution of F_1 is not standard, he however resolved the problem by applying bootstrap procedure to simulate the asymptotic distribution of statistics F_1 .

4. Empirical data and analysis

In this section we report descriptive statistics/empirical data and regression results analysis of panel data model and result of panel threshold model regarding the impact of debt-to-GDP ratio on economic growth in the European transition countries.

4.1. Descriptive statistics

In this paper we used annual data for a panel of 20 European transition countries, (Central, Eastern and Western Balkans) over the period from 1995 to 2017. In addition, we provide summary statistics for European, Central, Eastern and Western Balkans countries in appendix A, tables A1 to A3. The sources of the data sets are provided by World Bank, International Monetary Fund, and Eurostat. In appendix B are the tables B1 to B6 that contain information on list of countries and description of the variables. The dependent variable is GDP per capita growth rate whereas the independent variables are debt-to-GDP ratio, debt squared that represents debt square assuming a non-linear relationship between government debt and economic growth. We include control variables that are based on the main determinants of economic growth (see Sala-i-Martin, 2004; Kumar and Woo, 2010; Checherita and Rother, 2010). The control variables are final consumption as % of GDP, exports as % of GDP, gross savings as % of GDP, current account as % of GDP, and final government expenditures as % of GDP.

4.2. The result of panel data model and panel threshold model

We report the result of the panel data model and threshold value estimation in the transition countries in Central, Eastern and Western Balkans countries in tables 1, 2 and 3 from equations (1) and (2). The estimation results of the panel threshold model are reported in Appendix C, tables C1, C2 and C3. The results show that all calculated dynamic panel models are well modeled, as the coefficients of lagged real GDP per capita are statistically significant. Furthermore, the Sargan -test for identification restrictions in the presence of heteroscedasticity with the associated p-value which examines the validity of the instrumental variables is accepted (obtained in the second steps result) as healthy instruments for all estimated equations. Therefore, the results from GMM estimator proves the hypothesis that instrumental variables are not correlated with the set of residuals. As a result, Arellano – Bond test AR(1) and AR(2) tests with associated p-values are rejected in the first order while, it is accepted in the second order, which confirms that there is no autocorrelation in the second order between the error term (by construction, the differenced error term is first-order serially correlated even if the original error term is not). The confidence intervals (CI) of the debt turning point are generated through bootstrapping based on a normal distribution, i.e., asymptotically normally distributed. The bootstrap method is based on simulations used to derive the coefficients and calculate the turning points. Confidence intervals are subsequently calculated based on the resulting distribution of the turning points.

(i) Threshold effect of public debt on economic growth in the transition countries of Central Europe

Table 1 reports the results of the panel data model and threshold value estimation in the transition countries of Central Europe such as Estonia, Lithuania, Latvia, Slovenia, Czech Republic, Poland and Croatia. Employing various econometric techniques, the findings show that all the panel data models have almost same results regarding the effect of debt-to-GDP ratio on GDP per capita growth. However, the significant part of this research is to determine the turning point of the public debt-to GDP ratio. Applying bootstrap method (Hansen 1999), the panel threshold model is estimated, where threshold value is identified (see estimation in Appendix C, Table C1).

Table 1: Results from regression analysis

Variables	OLS	Fixed effects	Random effects	Hausman-Taylor	GMM
GDP_lag				0.1327*	-0.1799***
See				(0.091)	(0.0072)
Debt	0.0072	0.0889**	0.0072	0.0646*	0.1338**
see	(0.192)	(0.012)	(0.17)	(0.052)	(0.081)
Debt_Square	-0.0783	-2.73***	-0.07832	-1.7183**	-5.2434***
See	(0.14)	(0.003)	(0.14)	(0.9168)	(1.4561)
Export	0.033*	0.0968**	0.0332*	0.0834*	0.279***
Final_Consum	0.1116	-0.0898	0.1116	0.1228	0.5842**
Gross_Saving	0.0984	0.2827	0.0984	0.2456	0.714***
Current_Account	-0.45**	-0.385**	-0.470***	-0.360***	-0.5862***
Final_Government_Expenditure	-0.61**	-0.1449	-0.6901**	-0.3735*	-0.722**
Constant	3.22	15.75	3.22	-3.92	–
Observation	146	146	146	145	138
Arellano – Bond test for AR (1)	–	(1.97)	–		(1.97)
Arellano – Bond test for AR (2)	–	(-3.47)	–		(-3.47)
Sargan Test	–	–	–		(280.79)
$\chi^2(56)prob.$					
Turning Point 95% CI bootstrap – normal-based CI					81.60 (45;82)

Note: GDP Per capita (Economic Growth) is a dependent variable. In all GMM regression are used with robust standard error. Robust standard error in parenthesis, *, **, ***, denote significance at the 10%, 5% and 1% respectively. Sargan test shows the p-value for null hypothesis of the validity of instruments (obtained second steps result). The AR (1) and AR (2) are p-values for first and second order of auto correlated of errors term (obtained in the second order). The confidence intervals (CI) of the debt turning point are generated through bootstrapping based on a normal distribution.

Source: Authors' calculations

Findings show that the turning point of the effect of public debt to GDP ranged from 45% to 82%, more specifically, turning point is 81.60%. Table 1 report the results of the GMM estimator, one will argue that if the debt to GDP is lower than the turning point, it will have a positive effect on GDP per capita in the transition countries of Central Europe. The results show that, an increase of public debt-to-

GDP ratio for 1% will have a positive impact on GDP per capita growth by 0.13%. Furthermore, Debt Square (debt^2) to GDP provides a non-linear impact of debt-to-GDP on GDP per capita in the transition countries of Central Europe, this produces a concave (inverted U-shape) relationship between the public debt and the economic growth. The coefficient is statistically significant. The result is consistent with result of Checherita and Rother (2010).

Based on the results, it can be seen that the threshold value or limit of the growth of public debt to GDP ranged from 45% up to 82%. So, the turning point is 81.60%, which means that below of this level will have a positive impact on economic growth. On the other hand, an increase of public debt to GDP above to this level (turning point) will have a negative impact on economic growth in the transition countries of Central Europe. Each excessive increase of public debt may exacerbate the economic system as well as economic growth in general. The results, is consistent with Keynesian Theory which posits that low level of public debt can lead to economic growth, but may be negatively influenced by the high level of public *indebtedness* which can be characterized by tax increases, fall in investment, and increased consumption spending. Based on the results of this study, we can conclude that, if public debt grows in the transition countries of Central Europe for long periods, the effects will be negative on economic growth.

As seen from the Table 1, export has a positive impact on economic growth in the transition countries of Central Europe. An increase of export by 1% its effect will be positive by 0.279% on economic growth. Furthermore, if the final consumption increases by 1%, it will have a positive effect of 0.584% on the economic growth. Current account has a negative impact on economic growth, whereas the gross saving has a positive impact on economic growth. These results are consistent with the theory of Harrod and Solow growth theory, which highlighted the positive impact of the gross savings on economic growth in the long term. In addition, the final government expenditure has a negative impact on economic growth and the coefficient is statistically significant. An increase of final government expenditure by 1%, it will have a negative impact on the economic growth by 0.72% in the transition countries of Central Europe. The coefficient is statistically significant. The result is consistent with result of Adam and Bevan (2005), Cohen (1993), Elmendorf and Mankiw (1999).

(ii) Threshold effect of public debt on economic growth in transition countries of Eastern Europe

Table 2 shows the results of the panel data model and panel threshold value for transition countries in Eastern Europe such as Bulgaria, Belarus, Hungary, Moldova, Romania, Slovakia and Ukraine. Moreover, we employ different econometric techniques in order to test the relationships between public debt-to GDP ratio and

GDP per capita in those countries. The result for panel threshold value is estimated, using bootstrap method (see estimation in Appendix C, Table C2).

Table 2: Results from regression analysis

Variables	OLS	Fixed Effects	Random Effects	Hausman-Taylor	GMM
GDP_lag				0.1441** (0.083)	-0.1538** (0.081)
Debt	-0.0356 (0.041)	0.0192** (0.0041)	-0.0356 (0.054)	-0.0311 (0.065)	0.0466** (0.0071)
Debt_Square	-0.6817 (0.094)	-0.8790*** (0.094)	-0.6817 (1.036)	-0.5011 (0.096)	-2.0436** (1.021)
Export	0.0205	0.0399*	0.0205	0.0183	0.1703***
Final_Consum	0.0411*	0.1191*	0.0411*	0.0431*	0.0958**
Gross_Saving	0.2524***	0.4294***	0.2524***	0.246***	0.5631***
Current_Account	-0.0956*	-0.1805**	-0.0956*	-0.0892*	-0.1426*
Final_Govern_Exp	-0.0120	-0.0142	-0.0120	-0.0268	-0.0745
Constant	0.14	-10.66	0.14	-2.45	–
Observation	140	140	140	139	132
Arellano – Bond test for AR (1)	–	(-4.75)	–	–	(-4.75)
Arellano – Bond test for AR (2)	–	(-2.16)	–	–	(-2.16)
Sargan Test	–	–	–	–	(148.46)
$\chi^2(56)_{prob.}$					
Turning Point 95% CI bootstrap – normal-based CI					71.90 (71;72)

Note: GDP Per capita (Economic Growth) is a dependent variable. In all GMM regression are used with robust standard error. Robust standard error in parenthesis, *, **, ***, denote significance at the 10%, 5% and 1% respectively. Sargan test shows the p-value for null hypothesis of the validity of instruments (obtained second steps result). The AR (1) and AR (2) are p-values for the first and second order of auto correlated of errors term (obtained in the second order). The confidence intervals (CI) of the debt turning point are generated through bootstrapping based on a normal distribution.

Source: Authors' calculations

Table 2 report the results of the OLS, fixed and random effects, Hausman-Taylor and GMM estimator. The results of GMM estimator show that if the debt- to-GDP is below the threshold value, it will have a positive impact on GDP per capita in the transition countries in Central Europe. Findings show that, if the debt-to-GDP ratio increases for 1%, it will in turn lead to a positive impact on GDP per capita growth by 0.046%. The Debt Square (debt²) to GDP shows a non-linear effect of debt to

GDP on GDP per capita in the transition countries in Eastern Europe, which is a concave (inverted U-shape) relationship between the public debt and the economic growth. This finding is similar to that of Checherita and Rother (2010).

As seen in Table 2, the turning point of public debt-to-GDP is showed in the interval between 71% and 72%, namely the turning point value or threshold is established at a level of 71.90%. Therefore, if the debt-to-GDP ratio is lower than this level of the threshold, it will have a positive effect on economic growth. And, vice versa, if the debt-to-GDP ratio is beyond this level, it will have negative effect on economic growth in transition countries of Eastern Europe. We may conclude that, if public debt rises for long periods in those countries, the impact of debt-to GDP ratio will be negative on economic growth.

Table 2 reports the results of other independent variables. The export, gross saving and final consumption have a positive effect on economic growth in transition countries in Eastern Europe, whereas current accounts and final government expenditures have a negative effect on economic growth in those countries. The coefficients are statistically significant, but only the coefficient for final government expenditure is statistically insignificant. This result is consistent with the result of Adam and Bevan (2005), Cohen (1993), Elmendorf and Mankiw (1999).

(iii) Threshold effect of public debt on economic growth in Western Balkans countries

The regression results of panel data model and threshold value is showed in table 3 for Western Balkans countries such as Albania, Bosna and Hercegovina, North Macedonia, Serbia, Montenegro and Kosovo. As in the transition countries of Central, Eastern Europe, we employ different econometric techniques, in order to find the relationships between the debt-to-GDP ratio and GDP per capita growth in the Western Balkans countries. The estimation of panel threshold model is estimated by applying bootstrap method (Hansen 1999) (see estimation in Appendix C, Table C3).

The level of the threshold is at level of 58.20%, which is ranged between 57.40% and 64.75%. An increase of debt-to-GDP above the threshold level at 58.20% will have a negative effect on GDP per capita in the Western Balkans. On the other hand, if the debt-to-GDP ratio will be below the threshold level at 58.20% will have a positive effect on economic growth. As seen from table 3, the results from GMM estimator shows that an increase of the debt-to-GDP ratio for 1% it in turn leads to an increase of economic growth by 0.08% in the Western Balkan countries. The coefficient is statistically significant. Furthermore, the findings show that Debt Square (debt^2) to GDP has a non-linear effect of debt to GDP on GDP per capita in the Western Balkan countries, and thus it produces a concave (inverted U-shape) relationship between the public debt and the economic growth. The coefficient is statistically significant. The result is consistent with result of Checherita and Rother (2010).

Table 3: Results from regression analysis

Variables	OLS	Fixed Effects	Random Effects	GMM
Gdp_Lag			0.013** (0.0076)	-0.0419* (0.00295)
Debt	0.014* (0.00816)	0.0849** (0.00170)	0.0183* (0.0076)	0.0846** (0.00215)
Debt_Square	-0.02* (-0.0004)	-0.04*** (-0.0075)	-0.002* (-0.001)	-0.0004** (-0.0001)
Export	-0.025**	0.7009*	-0.02**	0.0794*
Final_Consum	0.0951**	0.1212*	0.09***	0.1264**
Gross_Saving	0.254**	0.2355***	0.247*	0.252***
Current_Account	-0.15***	-0.1083**	-0.14**	-0.1064*
Final_Government_Exp	0.1081*	0.0979***	0.096**	0.1382**
Constant	-12.41**	-19.64**	-12.29*	–
Observation	106	106	105	98
Arellano – Bond test for AR (1)	–	(0.000)	–	(0.000)
Arellano – Bond test for AR (2)	–	(0.363)	–	(0.363)
Sargan Test	–	–	–	(24.543)
$\chi^2_{(56)prob.}$				(0.8123)
Turning Point 95% CI bootstrap - normal-based CI				58,20 (57;65)

Note: GDP Per capita (Economic Growth) is a dependent variable. In all GMM regression are used with robust standard error. Robust standard error in parenthesis, *, **, ***, denote significance at the 10%, 5% and 1% respectively. Sargan test shows the p-value for null hypothesis of the validity of instruments (obtained second steps result). The AR (1) and AR (2) are p-values for first and second order of auto correlated of errors term (obtained in the second order). The confidence intervals (CI) of the debt turning point are generated through bootstrapping based on a normal distribution.

Source: Authors' calculations

As seen from the Table 3, export has a positive impact on economic growth in the Western Balkans countries. An increase of export for 1% will have a positive effect on economic growth by 0.0794%. Moreover, if the final consumption will increase for 1%, it will have a positive effect of 0.1264% on the economic growth. Current account has a negative impact on economic growth, whereas the gross saving has a positive impact on economic growth. These results are consistent with the theory of Solow growth model, which claimed that the gross savings has a positive on economic growth in the long term. In addition, government expenditures have a positive coefficient estimated by GMM estimator, which means that if the government expenditures will increase by 1% it will have a positive effect by 0.1382% on economic growth. The coefficient is statistically significant.

5. Results and discussion

This paper empirically examines and assess the effect of debt-to- GDP ratio on economic growth and identify and determine the threshold values of debt-to GDP ratio in the European transition countries from 1995 to 2017 (both years inclusive). Determining the threshold values of debt-to-GDP ratio for European transition countries, this study gives us an important understanding of the current indebtedness situation of public sector. The result, across all dynamic panel regression models reveals that the connection between levels of the debt-to-GDP ratio and economic growth has a nonlinear and a concave (U-shape) relationship with threshold values of debt-to-GDP ratio. The dynamic panel regression results show that at low levels debt-to-GDP ratio has a positive effect on economic growth, whereas beyond a certain threshold value debt-to-GDP ratio has a deleterious effect on economic growth for the European transition countries.

The most important result of the paper is the findings of the public debt threshold values of 81.60%, 71.90% and 58.20% of GDP, which is an average for all transition countries of Central Europe, Eastern Europe, and Western Balkans countries, respectively. The public debt-to-GDP ratio, which is above the threshold value of GDP is associated, on average, with lower long-term growth. Public debt-to-GDP ratio below the threshold values are associated, on average, with higher long-term economic growth in the respective countries of European transition economies. The result is in line with general theoretical assumption and previous literature. Our investigation of debt and economic growth in European transition countries leads to the implication that there is a clear linking: higher debt is bad for economic growth. In addition, targeting with higher debt-to-GDP ratio to stimulate economic growth is not a good policy option, because it may lead to tax increases, a decrease in private investment, and increased consumption spending. Furthermore, the results suggest that for some European countries in transition current debt levels may already have a negative impact on GDP growth, given the fact that the average debt-to-GDP ratios are currently at levels higher than the public debt threshold value of GDP estimated for European transition countries. The 2017 data show that public debt as part of the GDP in European transition countries have already reached or exceeded the threshold value of GDP. For example, in Slovenia public debt as part of the GDP is 74.1%, in Croatia it is 77.5%, Hungary (72.9%), Ukraine (71.3%), Albania (71.8%), Serbia (62.5%), and Montenegro (67.2%). However public debt as part of the GDP is below the threshold value in other European transition countries such as Estonia, Lithuania, Latvia, Czech Republic, Poland, Bulgaria, Belarus, Moldova, Romania, Slovakia, Bosna and Herzegovina, North Macedonia and Kosovo. The European transition countries with higher debt levels than threshold must consider in reducing their public debt up to condition that national income is enough to pay back the debt. If the countries are not able to pay back the debt and need additional sources of financing, increasing a tax rate to replace the debt is not a good option.

Thus, the government should create friendly business environment in order to attract more investments in supporting the economic growth.

The scientific contribution of this study to the current empirical evidence is twofold, first, there is only a handful of empirical studies that have addressed the threshold of public debt-to-GDP ratio, and its effect on economic growth in the European transition countries. Second, we have shown that a different threshold value of debt-to-GDP ratio exists among European transition countries. This suggests that the more developed European transition economies may have a higher debt-to-GDP ratio threshold values than the less developed transition economies. To the best of our knowledge, this is first study that has examined and assessed with clear methodology, the threshold value of the debt-to-GDP ratio that exists in the different transition European countries, more specifically, in Central Europe, Western Europe, and Western Balkans countries.

The study is useful for governments of the European transition countries, since it provides them with useful information about the level of public debt, i.e. the point at which the positive effects of public debt on economic growth turn to be negative. *In addition*, the study provides valuable information and additional warning signal to policymakers/governments in the European transition countries that targeting with a higher debt level to support growth is not a viable policy option. The European transition countries with debt levels above GDP turning points need to take measure to not/just stabilize public debt but to place it on a downward trajectory in the medium and long term. So that, the only wise strategy for policymakers of European transition countries is to maintain public debt at levels below the debt-to-GDP threshold values in order to withstand the unpredictable external shocks that may hit the economies.

6. Conclusion

The findings of this empirical study, on European transition economies for the period from 1995 to 2017 (both years inclusive), has revealed that at a low level, the impact of public debt is positive on economic growth, however, this effect turns negative beyond a certain point. Thus, the results suppose H1, which is in line with the general theoretical assumption on public debt which posits that a higher public debt, all else being constant, is harmful for economic growth. The accumulated public debt beyond the debt-to-GDP level, where the positive effect inverts to a negative effect on economic growth, is 81,60% for Central Europe, 71,90% for Eastern Europe and 58.20% for countries in the Western Balkan region.

We also find support for H2 which theorizes that the threshold value of debt-to-GDP ratio is lower for less developed European transition countries than it is for the developed European transition countries. H2 could be viewed as a new contribution

of this study. To the best of our knowledge, this is the first and only empirical study that has employed the panel threshold model and found debt-to-GDP threshold values for three sub-groups for European transition countries. The result is in line with previous empirical evidence on developed and emerging countries.

In view of the fact that many European transition countries already have debt levels that are higher than level than threshold level given their GDP, the only possible sound economic advice for those countries is quickly take conclusively actions and measure to address their fiscal problems. The longer, they wait, the bigger the negative impact the debt will have on economic growth which will make it harder, in the future, to undertake measures that will lead to fiscal consolidation. A word of caution for European transition countries that have experienced positive effect of public debt on economic growth; they too need to be careful in designing their fiscal policies, periodically examine their debt levels to ensure that they maintain the appropriate debt-to-GDP ratio, and borrow only for productive public purpose. Failure to manage debt and use it for only productive purposes may turn a positive effect of debt on economic growth to negative effect.

We conclude, based on the results of this study, that different sub-groups of the European transition countries should design their own fiscal initiative to fight higher level of debt in order to support economic growth. Increasing higher tax rate to replace debt level is not a good strategy for the governments of all European transition countries, particularly for the low national income countries. They may have to undertake other fiscal initiatives and measures to boost private sector as an engine of economic growth.

Despite the insights gained from the current study, lack of data in some of the transition countries was a major limitation. Furthermore, this study could be extended by investigating the impact of public debt that may indirectly affect economic growth, and also by investigating the conditions and mechanisms through which public debt will reduce economic growth.

References

- Afonso, A., Alves, J. (2015) 'The Role of Government Debt in Economic Growth', Hacienda Pública Española, *Review of Public Economics, Instituto de Estudios Fiscales*, Vol. 215, No. 4 , pp. 9–26, doi:10.7866/HPE-RPE.15.4.1.
- Adam, C, S., Bevan, D, L. (2005) 'Fiscal deficit and growth in developing countries', *Journal of Public Economics*, Vol. 89, No. 4, <https://doi.org/10.1016/j.jpubeco.2004.02.006>.
- Arellano, M, Bond, S. (1991) 'Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations' *The Review of*

Economic – Studies, Vol. 58, No. 2, pp. 277–297, <http://www.jstor.org/stable/2297968>.

- Arellano, M, Bover, O. (1995) ‘Another look at the instrumental variable estimation of error- components models’, *Journal of Econometrics*, Vol. 68, No. 1 pp. 29–51, [https://doi.org/10.1016/0304-4076\(94\)01642-D](https://doi.org/10.1016/0304-4076(94)01642-D).
- Baldacci, E, Kumar, M.S., (2010) ‘Fiscal Deficits, Public Debt, and Sovereign Bond Yields’, *IMF Working Paper Fiscal Affairs Department*, Working Paper No. 10/184, pp. 1–30, doi: 10.5089/9781455202188.001.
- Baum, A., Checherita-Westphal, C., Rother, P. (2013) ‘Debt and Growth: New Evidence for the Euro Area’, *Journal of International Money and Finance*, Vol. 32, pp. 809–821, <http://dx.doi.org/10.1016/j.jimonfin.2012.07.004>.
- Bexheti A., Sadiku L., Sadiku M. (2020) ‘The Impact of Public Debt on Economic Growth: Empirical Analyses for Western Balkan Countries’, In: Janowicz-Lomott M., Łyskawa K., Polychronidou P., Karasavoglou A. (eds) *Economic and Financial Challenges for Balkan and Eastern European Countries, Proceedings in Business and Economics*, Springer, Cham, https://doi.org/10.1007/978-3-030-39927-6_2.
- Blundell, R, Bond, S. (1998) ‘Initial conditions and moment restrictions in dynamic paneldata models’, *Journal of Econometrics*, Vol. 87, No. 1, pp. 115–143, [https://doi.org/10.1016/S0304-4076\(98\)00009-8](https://doi.org/10.1016/S0304-4076(98)00009-8).
- Blundell, R, Bond, S. (2000) ‘GMM Estimation with Persistent Panel Data: An Application to Production Functions’, *Econometric Reviews*, Vol. 19, No. 3, pp. 321–340, <https://doi.org/10.1080/07474930008800475>.
- Blundell, R., Bond, S., Windmeijer, F. (2000) ‘Estimation in Dynamic Panel Data Models: Improving on the Performance of the Standard GMM Estimator’, *Advances in Econometrics*, Vol. 15, No. 2, pp. 53–91, [http://dx.doi.org/10.1016/S0731-9053\(00\)15003-0](http://dx.doi.org/10.1016/S0731-9053(00)15003-0).
- Checherita, C., Rother, P. (2010) ‘The Impact of high and growing government Debt on Economic Growth an Empirical Investigation for the Euro Area’, *European Central Bank, Working papers series*, No. 1237, <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1237.pdf>.
- Cohen, D. (1993) ‘Low Investment and Large LDC Debt in the (1980s)’, *American Economic Review*, Vol. 83, No. 3, pp. 437–449, <https://www.jstor.org/stable/2117527>.
- Egert, B. (2013) ‘The 90% Public Debt Threshold: The Rise and Fall of a Stylised Fact, Economics Department’, *Working Papers*, No. 1055, pp. 1–30, [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ECO/WKP\(2013\)47&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ECO/WKP(2013)47&docLanguage=En).
- Elmendorf, D.W., Mankiw, G.N. (1999) ‘Government Debt Published: Handbook of Macroeconomics’, Vol. 1, Taylor, J.B. and M. Woodford, eds., *Elsevier Science*, B.V., pp. 1615–1699, doi: 10.3386/w6470.

- Gnegne, Y., Jawadi, F. (2013) 'Boundedness and nonlinearities in public debt dynamics', *Economic Modelling*, No. 34, pp. 154–160, <https://doi.org/10.1016/j.econmod.2013.04.006/>.
- Ghosh, A. et al. (2013) 'Fiscal Fatigue FiscalSpace and Debt Sustainability in Advanced Economies', *Economic Journal*, vol. 0, pages F4-F30.
- Hansen, B., (1999) 'Threshold effects in non-dynamic panels: Estimation, testing, and inference', *Journal of Econometrics*, vol. 93, pp. 345–368, [https://doi.org/10.1016/S0304-4076\(99\)00025-1](https://doi.org/10.1016/S0304-4076(99)00025-1).
- Irons, J., Bivens, J. (2010) 'Government Debt and Economic Growth', *Economic Policy Institute, Briefing Paper*, No. 271, pp. 1–9, <https://www.epi.org/publication/bp271>.
- Kumar, M. S., Woo J., (2010) 'Public Debt and Growth', *IMF Working Papers*, No. 10/174, pp.1–47, <https://www.imf.org/external/pubs/ft/wp/2010/wp10174.pdf>.
- Mencinger, J., Aristovnik, A., Verbic, M. (2015) 'Revisiting the Role of Public Debt in Economic Growth: The Case of OECD Countries', *Inzinerine Ekonomika-Engineering Economics*, Vol. 26, No. 1, pp. 61–66, doi: <http://dx.doi.org/10.5755/j01.ee.26.1.4551>.
- Panizza, U., Presbitero, A. F. (2014) 'Public Debt and Economic Growth in Advanced Economies', A Survey, *Mo Fir Working Paper*, No. 78, Ancona, Italy: MoFiR, Research group (Mo.FiR.) – Univ. Politecnica Marche – Dept. Economic and Social Sciences, <http://docs.dises.univpm.it/web/quaderni/pdfmofir/Mofir078.pdf>.
- Panizza, U., Presbitero, A. F. (2013) Public Debt and Economic Growth in Advanced Economies: A Survey, *Swiss Journal of Economics and Statistics*, Vol. 149, pp. 175–2014, <https://doi.org/10.1007/BF03399388>.
- Pescatori, A., Sandri, D., Simon, J. (2014) 'Debt and Growth: Is There a Magic Threshold', *IMF Working Paper*, No. 14/34, pp. 1–19, <https://www.imf.org/external/pubs/ft/wp/2014/wp1434.pdf>.
- Rankin, N., Roffia, B. (2003) 'Maximum sustainable government debt in the overlapping generations model', *The Manchester School*, Vol. 71, No. 3, pp. 217–241, <https://doi.org/10.1111/1467-9957.00344>.
- Reinhart, C.M, Rogoff, K.S. (2010) 'Growth in a Time of Debt', *American Economic Review: Papers & Proceedings* Vol. 100, pp. 573–578, <http://www.aeaweb.org/articles.php?doi=10.1257/aer.100.2.573>.
- Schclarek, A. (2004) 'Debt and Economic Growth in Developing Industrial Countries' *Working Papers*, No. 34, http://swopec.hhs.se/lunewp/abs/lunewp2005_034.htm.
- Sala-i-Martin, X., Doppelhofer, G., Miller, R. (2004) 'Determinants of Long-Term Growth: A Bayesian Averaging of Classical Estimates (BACE) Approach', *American Economic Review*, Vol. 94, No. 4, pp. 813–835, <http://dx.doi.org/10.1257/0002828042002570>.

- Wang, Q. (2015) 'Fixed-effect panel threshold model using Stata', *The Stata Journal*, Vol. 15, No. 1, pp. 121–134, <https://doi.org/10.1177/1536867X1501500108>.
- Wigger, B. U. (2009) 'A note on public debt, tax-exempt bonds, and Ponzi games', *Journal of Macroeconomics*, Elsevier, Vol. 31, No. 3, pp. 492–499, <https://doi.org/10.1016/j.jmacro.2008.07.003>.
- Woo, J., Kumar, M. (2015) 'Public debt and growth', *Economica*, Vol. 82, pp. 705–739, <https://onlinelibrary.wiley.com/doi/abs/10.1111/ecca.12138>.

Granični učinak javnog duga na gospodarski rast: empirijska analiza u tranzicijskim zemljama Europe

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Sažetak

U radu se empirijski ispituje i procjenjuje odnos između javnog duga i gospodarskog rasta u europskim tranzicijskim zemljama od 1995. do 2017. (uključujući obje godine). Cilj ovog istraživanja je identificirati i odrediti granične vrijednosti ili opseg u kojem udio javnog duga u BDP-u ima pozitivan učinak na gospodarski rast, a nakon kojeg udio duga u BDP-u negativno utječe na gospodarski rast u tranzicijskim zemljama Europe. U tu svrhu primjenjujemo različite ekonometrijske modele i tehnike kao što su objedinjeni OLS (metoda najmanjih kvadrata), modeli fiksnih i slučajnih učinaka, GMM (generalizirana metoda momenata) i bootstrap metoda kako bismo odredili granične vrijednosti udjela javnog duga u BDP-u. Nalazi dokazuju opću teoretsku pretpostavku da na niskoj razini udio javnog duga u BDP-u pozitivno utječe na gospodarski rast, dok nakon određene prekretnice prevladava negativan učinak na rast u tranzicijskim zemljama Europe. Uz to, rezultati pokazuju različite razine graničnih vrijednosti udjela javnog duga u BDP-u među europskim tranzicijskim zemljama. Do sada je potvrđeno da su granične vrijednosti duga prema BDP-u za manje razvijene tranzicijske zemlje niže u odnosu na razvijenije zemlje Europe. Stoga rezultati pružaju dodatne informacije europskim tranzicijskim zemljama, čija je razina duga iznad praga vrijednosti, kako bi smanjile svoj javni dug i poduprle dugoročne izgledе gospodarskog rasta.

Cljučne riječi: ekonomski rast, javni dug, prekretnica, panel podaci, tranzicijske zemlje Europe

JEL klasifikacija: E60, E69, E011, H63

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Appendices

Appendix A

Table A1: Descriptive statistics of exogenous and endogenous variables (Central European)

Variables	OBS	Std.Dev	Min	Max
GDP	146	4 9.5293	-11.83	92.12
GDP lag	146	9.5662	-11.83	92.12
Debt	146	25.804	9.8	224.8
Debt Square	146	1.0179	4.5647	10.83
Export	146	10.5429	5.61	55.4
Final Consum	146	10.622	80.79	138.53
Gross Saving	146	18.1786	-8.3	180.22
Current Account	146	19.5395	-194.55	13.96
Final_Government_Expenditure	146	5.1149	9.45	39.28

Source: Author's calculation

Table A2: Descriptive statistics of exogenous and endogenous variables (Eastern European)

Variables	OBS	Std.Dev	Min	Max
GDP	140	4.7781	-14.42	12.95
GDP lag	140	4.793	-14.42	12.95
Debt	140	22.933	8.4	136
Debt_Square	140	1.1158	4.2564	9.8253
Export	140	16.8582	22.86	96.3
Final_Consum	140	11.6901	61.62	116.81
Gross_Saving	140	5.0296	4.99	32.79
Current_Account	140	5.3079	-25.75	10.66
Final_Government_Expenditure	140	3.0117	11.63	28.81

Source: Author's calculation

Table A3: Descriptive statistics of exogenous and endogenous variables (Eastern Balkans)

Variables	OBS	Std.Dev	Min	Max
GDP	106	4 9.5293	-11.83	92.12
GDPlag	106	9.5662	-11.83	92.12
Debt	106	25.804	9.8	224.8
Debt Square	106	1.0179	4.5647	10.83
Export	106	10.5429	5.61	55.4
Final_Consum	106	10.622	80.79	138.53
Gross Saving	106	18.1786	-8.3	180.22
Current Account	106	19.5395	-194.55	13.96
Final_Government_Expenditure	106	5.1149	9.45	39.28

Source: Author's calculation

Appendix B

Table B1: List of the Central Europe countries

Nr.	Countries of the Central Europe
1	Estonia
2	Lithuania
3	Latvia
4	Slovenia
5	Czech Republic
6	Poland
7	Croatia

Source: Eurostat (<https://ec.europa.eu/eurostat>), World Bank (<https://data.worldbank.org/>);
International Monetary Fund (<https://www.imf.org/en/Data>)

Table B2: Description of variables (Central Europe)

Nr.	Variables	Code
1	GDP (GDP Per Capita -Annual %)	GDP lag
2	Public Debt (% of GDP)	Debt
3	Debt Square (% of GDP)	Debt square
4	Export (% of GDP)	Export
5	Final Consumption (% of GDP)	final_consum
7	Gross Saving (% of GDP)	gross saving
8	Current Account (% of GDP)	current account
9	Government Expenditure (% of GDP)	final_government_expenditure

Source: Eurostat (<https://ec.europa.eu/eurostat>), World Bank (<https://data.worldbank.org/>);
International Monetary Fund (<https://www.imf.org/en/Data>)

Table B3: The list of Eastern Europe countries

Nr.	Countries of the Eastern Europe
1	Bulgaria
2	Belorussia
3	Hungary
4	Moldova
5	Romania
6	Slovakia
7	Ukraine

Source: Eurostat (<https://ec.europa.eu/eurostat>), World Bank (<https://data.worldbank.org/>);
International Monetary Fund (<https://www.imf.org/en/Data>)

Table B4: Description of the variables (Eastern Europe)

Nr	Variables	Code
1	GDP (GDP Per Capita -Annual %)	GDP lag
2	Public Debt (% of GDP)	Debt
3	Debt Square (% of GDP)	debt_square
4	Export (% of GDP)	Export
5	Final Consumption (% of GDP)	final_consum
7	Gross Saving (% of GDP)	gross_saving
8	Current Account (% of GDP)	current_account
9	Government Expenditure (% of GDP)	final_government_expenditure

Source: Eurostat (<https://ec.europa.eu/eurostat>), World Bank (<https://data.worldbank.org/>);
 International Monetary Fund (<https://www.imf.org/en/Data>)

Table B5: List of the Western Balkan countries (Western Europe)

Nr.	Countries of the Western Balkan
1	Albania
2	Bosnia and Herzegovina
3	Republic of North Macedonia
4	Serbia
5	Montenegro
6	Kosovo

Source: Eurostat (<https://ec.europa.eu/eurostat>), World Bank (<https://data.worldbank.org/>);
 International Monetary Fund (<https://www.imf.org/en/Data>)

Table B6: Description of the variables (Western Balkans)

Nr.	Variables	Code
1	GDP (GDP Per Capita- Annual %)	GDP lag
2	Public Debt (% of GDP)	Debt
3	Debt Square (% of GDP)	debt_square
4	Export (% of GDP)	Export
5	Final Consum (% of GDP)	final_consum
7	Gross Saving (% of GDP)	gross_saving
8	Current Account (% of GDP)	current_account
9	Government Expenditure (% of GDP)	final_government_expenditure

Source: Eurostat (<https://ec.europa.eu/eurostat>), World Bank (<https://data.worldbank.org/>);
 International Monetary Fund (<https://www.imf.org/en/Data>)

Appendix C

Table C1: Identification of Turning Point in Central Europe

Threshold estimator (level = 95):							
model	Threshold	Lower	Upper				
Th-1	81.60	40.50	82.30				
Threshold effect test (bootstrap = 250):							
Threshold	RSS	MSE	Fstat	Prob	Crit10	Crit5	Crit1
Single	0.0000	0.0000	-72.16	1.0000	122.77	158.79	340.86

Source: Authors' calculations

Table C2: Identification of Turning Point in Eastern Europe

Threshold estimator (level = 95):							
model	Threshold	Lower	Upper				
Th-1	71.90	71.1	72.0				
Threshold effect test (bootstrap = 250):							
Threshold	RSS	MSE	Fstat	Prob	Crit10	Crit5	Crit1
Single	980.68	11.53	20.99	0.0000	9.76	10.88	15.49

Source: Authors' calculations

Table C3: Identification of Turning Point in Western Balkans

Threshold estimator (level = 95):							
model	Threshold	Lower	Upper				
Th-1	58.20	57.40	64.75				
Threshold effect test (bootstrap = 250) :							
Threshold	RSS	MSE	Fstat	Prob	Crit10	Crit5	Crit1
Single	0.0000	0.000	-79.83	1.0000	65.10	131.67	167.186

Source: Authors' calculations

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The impact of macroeconomic and financial factors on shadow banking in the new EU member states*

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Abstract

The goal of this paper is to examine the impact of macroeconomic and financial determinants of the shadow banking dynamics in the selected 11 new EU member states using yearly data from 1999-2018. We apply three methods: fixed effects model, the difference-GMM and the system-GMM (Generalized Method of Moments). Empirical results provide evidence that the most important factors are the developments in the financial sectors (insurance and pension sectors), banking sector; money market rate, as well as the general economic growth. We also found that global financial crisis has a negative impact on the shadow banking growth. From the results we may conclude that traditional banks, insurance sector and pension funds are complementary with shadow banking. This results was opening new issues for macroprudential policy, bearing in mind the Basel III norms. Namely, one of the main goals of Basel 3 is to reduce procyclicality of bank lending, and the rise of shadow banking may have an impact on both capital-based regulation and income-based limits.

Key words: shadow banking, EU new member states, panel data analysis

JEL classification: E44, E52, G21, G23

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1. Introduction

Shadow bank financing is a valuable alternative to bank financing for many firms and households, fostering competition in the supply of financing and supporting economic activity. Hence, it can constitute a useful part of the financial system (Pozsar, 2010; FSB, 2011; EC, 2012). However, shadow bank financing may also become a source of systemic risk, both directly and through its interconnectedness with the conventional banking system, if it involves activities that are typically performed by banks, such as maturity/liquidity transformation and creation of leverage (FSB, 2019).

While this is a remarkably interesting topic, there have not been many studies that provide empirical evidence on the determinants of shadow banking. The explanations vary from lack of statistical data on shadow banking to the ambiguity of its definition (IMF, 2014). Namely, the Financial Stability Board (FSB, 2011) offers two definitions of the shadow banking system. The broad definition is that it encompasses “credit intermediation involving entities and activities outside the regular banking system”, whereas the narrow definition refers to “a system of credit intermediation that involves entities and activities outside the regular banking system, and raises (1) systemic risk concerns, in particular by maturity/liquidity transformation, leverage and flawed credit risk transfer, and/or (2) regulatory arbitrage concern.” Wesley (2014: 317) defines the shadow banks as “private financial entities that create ex-nihilo credit-money without deposits”. More specifically, Guttman (2016) conceptualizes four pillars of shadow banking: money markets; repurchasing agreements; securitization; and over-the-counter derivatives (e.g., swaps and credit derivatives). Shadow banks are often less regulated than traditional banks, lack a formal safety net and typically receive indirect or implicit enhancements (e.g., Claessens and Ratnovski, 2014).

The shadow banking in European context has unique roots, as it occurs both outside and partially within the banking system. For instance, the European Economic and Social Committee (EESC, 2012) underlined [that] “there are many ways in which shadow banks replicate traditional banks, and some shadow banks *are part of* traditional banks.” Jeffers and Plihon (2014) trace back the blossoming of market-based financing (shadow banking) in Europe to the financialization and the extensive financial deregulation in 1980s. As opposed to the diverse non-bank financial intermediaries in the “old” EU member states, the main entities that form the shadow banking system in Central, Eastern and South-Eastern Europe are simple and easy to identify (Ghosh et al., 2012).

Definitional ambiguities offer only a partial explanation for the scarce empirical literature. Most of the studies are still in an incipient or a working-paper stage, and mainly focus on the United States, the United Kingdom, or the euro area countries, while the new EU member states remain slightly neglected. These countries in the

past shared a socialist central planning system and to day they still invest significant efforts in order to establish a well-functioning financial system, thus depriving shadow banking of a context that could allow for its institutions and activities to flourish Du Li et al. (2017).

This paper therefore aims to fill an important gap in the literature and to empirically estimate how selected determinants will affect the dynamics of shadow banking sector in selected 11 new EU Member States. We provide a sector decomposition to better understand the underlying trends and tendencies. Furthermore, the panel data estimation techniques involve static and dynamic (General Method of Moments, GMM) models and explore the role of potential drivers of shadow banking, which are frequently discussed in the related literature.

The basic hypothesis of this paper is that selected macroeconomic and financial factors have statistically significant impact on shadow banking growth.

Our article contributes to the advancement of the knowledge on shadow banking, by providing information on development and determinants in the 11 new EU Member States. We believe that a deeper understanding of the shadow banking determinants may help national policy makers to mitigate the related risks, while benefiting from the main advantages.

The remainder of the article is organized as follows: Section 2 overviews some of the main empirical findings on the size, scope and determinants of shadow banking; Section 3 describe the data and methodology; and Section 4 presents the empirical results. Section 5 outlines the conclusions of the research.

2. Literature review

As already noted, most of the existing studies on shadow banking focus on the United States and to a lesser extent on Europe (e.g., Girasa, 2016; Nesvetailova, 2018). Even though shadow banking extends well before the Global Financial Crisis (GFC), our focus is on the post-crisis research. The academic literature in European context has progressed along several strands: (1) examinations of the size and evolution of shadow banking (e.g., Maddaloni et al., 2011; Grillet-Aubert et al., 2016; Malatesta et al., 2016); (2) investigations of potential determinants behind the decade-long boom of the shadow banking system (e.g., Barbu et al., 2016; Grillet-Aubert et al., 2016; Hodula, 2018; 2019; Apostoaie and Bilan, 2019); (3) assessments of the implications of shadow banking for systemic risk, financial stability, and growth (e.g., Lysandrou and Nesvetailova, 2015; Dumičić and Ridzak, 2016; Langfield and Pagano, 2016); (4) analyses of jurisdictional competition, regulation and supervision of shadow banking (e.g., O'Sullivan and Kinsella, 2012; 2013; Adrian, 2014). Given the main hypothesis, our literature review is

limited only to the first two strands of the empirical literature. Surprisingly, little empirical work has been done to analyze the relative importance of specific driving forces for the development of a shadow banking system, suggesting that obstacles or challenges to such research do exist. Another signal of the analytical gap in the literature on shadow banking in Europe is that many studies exist as working papers, rather than as published work in refereed journals.

Academic attempts for measuring shadow banking have encountered problems in defining its scope. Some authors adopted a broad definition, encompassing all non-monetary financial institutions, with exception of pension funds and insurance companies (Bakk and Simon et al., 2012; Apostoiaie and Bilan, 2020). Other studies using higher frequency data apply a narrower definition in European context, by also excluding the money market funds, due to a lack of quarterly data (e.g., Apostoiaie and Bilan, 2020). The implications can be sizable.

Due to the complexity of the phenomenon and data limitations, authors and institutions have either resorted to entity-based or activity-based measurement approaches. The entity-based approach to measuring shadow banking is based on aggregation of the financial assets of selected non-monetary financial intermediaries (e.g., Pozsar et al., 2013). Some authors use the gross value of financial assets (e.g. Apostoiaie and Bilan, 2019), whereas others (e.g., Barbu et al., 2016) use the net value of total assets. The entity- or institution-based approach has drawbacks, as some intermediaries may not (fully) engage in shadow banking activities. For instance, the Financial Stability Board excludes financial activities with no direct relation to credit intermediation (e.g., equity investment funds) or activities that are already consolidated into banking groups (FSB, 2014; 2015; Agresti and Brence, 2017). To remedy this definitional problem, other studies adopted an activity-based approach, focusing on financial instruments or markets (e.g., Gorton and Metrick, 2012; Mehrling et al., 2013; Claessens and Ratnovski, 2014). For example, Botta et al., (2018) explain that shadow banking is based on three main activities (processes) connecting commercial banks and financial firms: (1) securitization of mortgages by commercial banks; (2) production and issuance by financial firms of structured financial products, and (3) provision by commercial banks of credit to financial firms through the repo market. Although methodologically sounder, to our best knowledge, the 'pure' activity-based approach has not been applied in the European case, because of data limitations.

The empirical literature has identified several hypotheses regarding the main driving forces of shadow banking: (1) *the procyclicality and high liquidity hypotheses*: overall macroeconomic and global liquidity factors; (2) *the search for yield hypothesis*: financial products offered outside the traditional banking system usually bring a higher yield; (3) *the complementarity hypothesis*: shadow banking grows together with the conventional banking system, as it can expand access to credit, enhance maturity transformation, and promote risk sharing; (4)

overcapitalization/substitution hypothesis: the high capital requirements, high funding costs and regulation burden in the traditional banking system contributes to the very phenomenon of shadow banking; (5) *the institutional cash pool hypothesis*: the demand from institutional investors contributes to the development of shadow banking. Given the limited number of empirical investigations of the determinants of shadow banking in European context, we present the main findings in these studies by associating them with the dominant hypotheses.

IMF (2014) analyzes the determinants of shadow banking in a set of 26 mostly developed economies, covering some European countries over the 1990-2013 period. The study highlights that tightening bank capital requirements creates incentives for banks to shift their activities to the non-bank sector, hence positively influencing the growth of shadow banking. In addition, the size of the banking sector is positively correlated with the extent of shadow banking, thereby supporting the complementarity hypothesis. Furthermore, the results show that the relationship between institutional investors' growth and shadow banking development is positive. The results of the study indicate a negative relationship between real short-term interest rates and shadow banking growth.

Malatesta et al. (2016) estimated the determinants of shadow banking in the euro area countries over the period 1999Q1-2014Q. The results of their study show that as a main determinants of shadow banks are: the GDP growth, inflation, and the term spread). They also find evidence of a possible crowding-out effect, suggesting that the growth rate of loans from traditional banks is inversely related with the relative role of shadow banks.

The empirical literature does not offer an explicit support for the procyclicality hypothesis. Barbu et al. (2016) estimate the macroeconomic determinants of shadow banking for a panel of 15 EU member states (including four CEE economies) using quarterly data (2008Q1-2015Q3). As a proxy for shadow banking, they use the net value of total assets. On one hand the results of their paper shows that long-term interest rates and stock index have positive impact of shadow banking, while on the other hand the shadow banking is negatively associated with GDP growth, development of investment funds, liquidity and short-term interest rates.

Furthermore, Hodula (2018) analyzed determinants of shadow banking growth using data of 24 EU countries for the period 2004-2017. The results show that the EU shadow banking system is positively correlated to more stringent capital regulation, increasing demand of long-term institutional investors, financial development and interest rates in the economy. Based on the results of the empirical model, the author concludes that the main determinants of shadow banking were different in the old and new EU member states, mainly due to the missing legal framework for securitization in the new members. Hodula (2019) provides empirical evidence that the tightening of monetary conditions negatively affected

the growth of traditional banking but strengthened the growth of shadow banking. This lends some support to the validity of the substitution hypothesis during monetary tightening.

Apostoaie and Bilan (2019) estimated the determinants of shadow banking dynamics in 11 EU member states from Central and Eastern Europe (CEE) over the period 2004-2017, using fixed-effects estimation and a quarterly data. They applied two dependent variables that correspond to two different measures of the shadow banking sector – the broad one (including all non-monetary financial institutions, except insurance corporations and pension funds) and the narrow one (excluding from the above one the investment funds other than money market funds). They used six macroeconomic and financial variables as independent determinants.

Country-specific empirical investigations of shadow banking also shed light on the driving forces, but these studies are even more scarce. Hodula et al. (2020) investigate the Czech shadow banking sector over the last decade and find evidence in favor of the procyclicality and complementarity hypotheses.

Despite the great interest in the topic, most studies refer to the developed countries, whereas emerging markets and developing economies are deprived of a more in-depth investigation of this phenomenon.

3. Methodology

In order to analyse the determinants that affected the shadow banking in the new EU Member States, we conducted a panel data analysis. We opted for this type of analysis as it provides several benefits (Hsiao, 2003): (1) the use of panel data enables us to control for individual heterogeneity; (2) panels provide more informative data, more variability, less collinearity among the variables, greater degree of freedom, and higher efficiency; (3) with panel data, one is better equipped to study the dynamics of adjustment; (4) panel data are more suitable for identifying and measuring effects that are simply not detectable in pure cross-sections or pure time-series data, and (5) panel data models allow for the construction of and testing more complicated behavioural models than pure cross-section or time data models.

In order to provide consistent and unbiased results, we implemented three alternative estimation techniques. Our analysis we start with the assessment of fixed and random effects. With the fixed-effects model, we assume that the units of interest (in our case, countries) are fixed, and that the differences between them are not of interest. On the other hand, with the random model, we assume that the units are a random sample extracted from a larger population. Accordingly, for our analysis of the 11 new EU Member States from Central, Eastern and South-Eastern Europe, the model of fixed effects will be adequate, since the data set covers all

11 new EU member states and the conclusions drawn from this analysis will only apply to them. In addition, we will also conduct the statistical test of Hausman (1978) for distinguishing between the models of fixed and random effects.

The specification (2) of the empirical model with fixed effect is as follows:

$$y_{it} = x_{it}\beta + \tau_t + \delta_i + \varepsilon_{it} \quad (2)$$

i and t are the indices of countries and years, respectively; τ_t 's denote time effects to capture macroeconomic circumstances; δ_i 's are called unobserved country fixed effects; ε_{it} 's are all unobserved idiosyncratic errors (i.i.d); y_{it} 's are the broad measure of shadow banking as a percent of GDP of country i in period t , x_{it} 's contain control variables, and β is the coefficient vector that we are interested in. Thus, we estimate models with fixed effects estimator, allowing for the correlation between δ_i and x_{it} .

While the approach is rather simple and intuitive, this model is not suitable for our paper due to potential inertia of the dependent variable. Namely, the assets of OFI in our model can involve persistence in their movement, that is, its present value to a certain extent depends on its past value. Bearing this in mind, we are more inclined to employ a dynamic panel estimation (3) as follows:

$$y_{it} = \sum_{j=1}^p \alpha_j y_{i,t-j} + x_{it}\beta + \tau_t + \delta_i + \varepsilon_{it} \quad (3)$$

The dynamic model includes lagged dependent variables, $y_{i,t-j}$. It also allows for the correlation between δ_i and x_{it} ($\text{cov}(\delta_i, x_{it}) \neq 0$). In order to capture the persistence of the assets of OFI and to eliminate the fixed effects (and their correlations), we difference the model and adopt the difference Generalized Method of Moments including the lagged difference of the dependent variable was introduced by Arellano and Bond (1991). We use the one-step generalized method of moments estimator (GMM) developed by Arellano-Bond (1991), because according to Judson and Owen (1999), his estimator outperforms the two-step estimator both in terms of producing a smaller bias and a smaller standard deviation. Then, we obtain

$$\Delta y_{it} = \sum_{j=1}^p \alpha_j \Delta y_{i,t-j} + \Delta x_{it}\beta + \Delta \tau_t + \Delta \delta_i + \Delta \varepsilon_{it} \quad (4)$$

In the differenced model (4), there still exists a correlation between lagged values of dependent variable $\Delta y_{i,t-j}$ and the differenced errors, $\Delta \varepsilon_{it}$. According to Nickell (1981), the standard fixed effects estimator is not consistent, because this correlation produces biased estimates. Bearing this in mind, we employ the system-GMM estimator based on Arellano and Bover (1995) and Blundell and Bond (1998), which addresses the endogeneity problem caused by the correlation.

In order to avoid the problem of too many instruments in comparison to the number of groups (Roodman, 2009), the number of instruments are kept lower than the number of countries. In the standard (unconstrained) form, each instrumenting variable creates one instrument for each time period and the lag available to that period, whereas – in the collapsed form – a single column vector of instruments is created instead of a whole matrix of instruments. Although collapsing can reduce statistical efficiency in large samples, it can be very helpful as a tool in avoiding the bias in finite samples, which are usually characterized by instrument proliferation. In other words, we control the number of instruments by limiting our analysis to the second lag. This helps avoid any bias due to too many instruments in a relatively small sample. The validity of the parameter estimation instruments selected can be tested using the Hansen test. Furthermore, we will test serial correlations in the differenced residuals (first-order [AR1]) and second-order [AR2] serial correlations). According to Arellano and Bond (1991), the first-order autocorrelation in the differenced residuals does not imply that the estimates are inconsistent. However, the second-order autocorrelation would imply that this is the case.

According to all the above, the analysis in the next section will evaluate the economic model (1) through 3 panel methods: the method of fixed effects, the difference – GMM and the system-GMM methods.

4. Empirical data and analysis

For the purposes of this research, we use an unbalanced panel of annual data for 11 NMS from Central, Eastern and South-Eastern Europe (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia) for the period 1999-2018. The sample selection is based on similarities in the level of economic and institutional development, historical legacies, geographical and cultural proximity, which greatly influences the creation of economic relations between these countries. The choice of time period in this paper was contingent upon the availability of time series data of all determinants included in the model, particularly of our dependent variable. According to Rinaldi and Sanchis-Arellano (2006), unbalanced panel data allow for more observations and their results are less dependent on a particular period.

The determinants selected in our model are mostly used in the academic literature (Kim, 2016; Barbu et al., 2019; Apostoae and Bilan, 2019). The data sources used for our model include Eurostat, other databases from credible international and European sources, IMF's International Financial Statistics and Monetary and Financial Statistics database, ECB's Statistical Data Warehouse database and World Bank data.

The econometric model is depicted by equation (1):

$$SB_{it} = \beta_j DET_{j,it} + u_{i,t} \quad (1)$$

where i refers to the country ($i=1-11$); t refers to time periods (years) ($t=1-19$); SB is the dependent variable; DET_j is a vector of independent variables; β_j are the coefficients of the explanatory variables, and $u_{i,t}$ are the idiosyncratic (observation-specific) errors.

Before presenting the potential determinants of SB, it is necessary to identify the dependent variable. As mentioned in the literature review, there is no internationally harmonised definition that has been applied in all or most of the countries in the world for a considerable period of time. Bearing this in mind, we follow (Kim, 2016) and Apostoaie and Bilan (2019) and as a measure of shadow banking, we use OFI (total assets of Other Financial Intermediaries, expressed in percent of GDP), as defined by the European Commission and Eurostat. This broad measure of shadow banking encompasses the asset size of OFI, which consists of the financial sector other than banks, pension funds and insurance companies, public financial institutions, and financial auxiliaries. One advantage of the OFI statistics is the high degree of international consistency, thus allowing for comparisons and aggregations across countries (e.g. Broos et al., 2012).

We employ the following explanatory variables:

- macroeconomic determinants: real GDP growth (*gdp*); the three-month inter-bank rate (*short*), and M2/GDP ratio (*m2gdp*);
- financial determinants: size of banks as a percent of GDP (*bank*); insurance as a percent of GDP (*penetra*); and pension funds as a percent of GDP (*pens*);
- a dummy variable for the occurrence of the Global Financial Crisis 2007-08 (*crisis*).

Within the core determinants of all previously mentioned studies, the variables related to Gross Domestic Product (GDP) are among the main macroeconomic determinants of shadow banking growth. In this context, several variations of this determinant, such as the annual growth rate of real GDP, the growth rate of income per capita, etc., are well known in the literature. However, the real GDP growth rate is by far the most common macroeconomic determinant, used for example in Duca (2016), Malatesta et al. (2016) and Hodula et al. (2017). For this determinant we expect a positive and significant impact of real GDP growth that is consistent with the shadow banking procyclicality hypothesis mentioned by Adrian and Shin (2009) and empirically evidenced by (Duca 2016; Malatesta et al., 2016; Hodula et al., 2017).

Furthermore, we will follow the approach by Barbu et al. (2016) and include the monetary aggregate M2 in GDP, expecting a negative relationship. This expectation

comes from the mere composition of M2, which includes the currency in circulation and deposits of all maturities. Namely, if we have a decreasing trend of deposit interest rates, economic agents will be looking to save or invest at higher yields and will tend to shift to other types of financial investments. Furthermore, if bank deposits decrease, this will impact their ability to offer loans. This will lead to a decrease in the money supply through the traditional banking channel, which will be supplemented (substituted) by an increase in the volume of activity of shadow banking.

We include the three-month inter-bank rate in the model in order to capture changes in the monetary policy settings. Regarding this determinant, we may generally assume that it has a negative impact on shadow banking growth, since the lower yields associated with lower market interest rates motivate investors to search for attractive returns in riskier places (*the search for yield hypothesis*). Yet, there are also studies that document a positive relationship (Den Haan and Sterk, 2011; Loutskina, 2011; Nelson et al., 2017). More specifically, Nelson et al. (2017) elaborate a “waterbed effect” of the monetary policy, i.e. the view that credit extension by banks and non-banks tends to respond in the opposite direction to monetary shocks. Banks can circumvent the increased funding costs by increasing their securitization activity, which leads to a migration of lending beyond the traditional banking system. Bearing this in mind, we expected the impact of this determinant to be ambiguous.

In order to capture any potentially complementary properties of shadow banking vis-à-vis traditional banking, we follow Kim (2016) and include growth of banking sector assets as a percent of GDP. According to Hodula (2018), there is some evidence that not only banks frequently sponsor shadow banking activities, often through financial vehicle corporations, but also traditional banks might be involved in investment funds. In other words, banks originate loans and sell them to brokers and dealers, and hedge funds. The buyers pool and securitize them and then distribute them to investors with different risk appetites, including hedge funds, asset managers, and insurance companies. Pozsar (2008) and Pozsar et al. (2010) illustrate this Originate-to-Distribute model in more detail. Subsequently, we expect a positive association between this determinant and shadow banking.

In our model, we also include variables representing other segments of the financial systems in the countries under investigation: the data on asset size of banks calculated as a percent of GDP; insurance penetration levels; and pension funds as a percent of GDP. We include these determinant, in order to capture complementarities with SBS and demand-side effects. Given the empirical findings by IMF (2014), Malatesta et al. (2016), we expect these variables to be positively associated with the growth of the shadow banking sector.

In addition to these determinants, we will include one dummy variable in the empirical model. We will use a binary dummy for the occurrence of a financial

crisis to mark the Global Financial Crisis as taking the value of one for the period from 2007 to 2008 and zero for all other periods. The periods of financial crises were selected based on the new European financial crises database (ESRB, 2017).

Table 1 presents the descriptive statistics for the determinants involved in the regression model. According to Table 1, there were missing data observations for nearly all determinants. Moreover, there are significant differences among the countries in all selected variables. An example of this heterogeneity is OFI (Other Financial Intermediaries, expressed in percent of GDP) with a minimum of -39.1% and a maximum of 445.6%. This is also valid for other variables, such as the GDP growth and the short-term interest rate.

Table 1: Descriptive statistics

	OFI	GDPG	MONEY	SHORT	BANKGDP	PENETRA	PENS
Mean	24.72	3.25	51.20	5.02	55.96	2.81	6.06
Median	11.20	3.60	51.95	3.33	56.91	2.70	4.76
Maximum	445.60	11.89	84.84	74.21	105.1	6.00	27.40
Minimum	-39.10	-14.81	19.81	-0.33	10.9	0.71	0.02
Std. Dev.	55.76	3.99	15.40	7.83	20.59	1.11	5.21
Number of observations	215	220	162	196	202	213	185

Source: Authors' calculations

Furthermore, we will analyze multi-collinearity among selected determinants. According to Gujarati and Porter (2009), multi-collinearity is a problem when the correlation is above 0.80. As we presented in Table 2, all correlation coefficients were found to be below this threshold, suggesting the continuation of use of all the variables included in running the regression model.

Table 2: Correlation matrix

	OFI	GDPG	MONEY	SHORT	BANKGDP	PENETRA	PENS
OFI	1						
GDPG	0.3627	1					
MONEY	-0.1858	0.3691	1				
SHORT	0.1961	0.1003	-0.4904	1			
BANKGDP	0.2721	0.5112	0.6344	-0.2439	1		
PENETRA	0.0025	0.0584	0.3643	-0.0218	0.0888	1	
PENS	0.1934	0.3767	0.5451	-0.2240	0.6307	0.2151	1

Source: Authors' calculations

In the next stage, Table 3 depicts the empirical results of the static fixed-effects model, and the difference- and system-GMM models. Despite the methodological differences, all approaches arrive at essentially similar results as to the sign and the statistical significance of most variables in the regression specification.

Table 3: Estimation results

Explanatory variables	Fixed Effects (FE) Model [1]	Difference GMM Model [2]	System GMM Model [3]
Lagged dependent variable OFI_{t-1}	/	0.28*** (0.21)	0.11*** (0.10)
Constant	45.21 (24.86)	42.25 (21.34)	-51.2 (40.19)
Macroeconomic determinants			
Real GDP growth (<i>gdp</i>)	1.76*** (0.56)	4.02 (1.81)	4.93 (1.65)
M2/GDP ratio (<i>m2gdp</i>)	-0.20* (0.27)	-1.14 (1.27)	-1.27 (0.62)
Three-month inter-bank rate (<i>short</i>)	2.91*** (1.12)	2.36 (2.25)	4.43 (2.11)
Financial determinants			
Size of banks as a percent of GDP (<i>bank</i>)	0.80*** (0.35)	0.57*** (0.68)	0.60** (0.54)
Insurance funds as a percent of GDP (<i>penetra</i>)	4.12* (6.55)	1.61** (0.17)	0.91* (0.56)
Pension funds as a percent of GDP (<i>pens</i>)	0.98 (0.61)	0.04 (1.93)	0.10* (1.36)
Global Financial Crisis dummy variable (<i>crisis</i>)	-6.36** (6.19)	-5.93 (5.74)	-5.44 (4.25)
Number of countries	11	11	11
Hausman test	0.367		
Sargan test (p-value) H_0 : The instruments are valid		0.665	0.345
Arellano-Bond test [AR (1)]		0.007	0.004
Arellano-Bond test [AR (2)]		0.665	0.693

Notes: Standard errors are presented in parentheses.

Source: Authors' calculations

This confirms that our results are robust to different specifications, although the precision of the coefficients estimated differs across different methods used in our study. From a diagnostics perspective, the Sargan test shows that the instruments selected are valid (with a p -value of 0.67 for the difference GMM, and 0.35 for the system GMM model). The estimator ensures efficiency and consistency provided that the residuals do not show serial correlation of second order (even though the equations indicate that negative first order autocorrelation is present, this does not imply that the estimates are inconsistent). Inconsistency would be implied if second-order autocorrelation was present (Arellano and Bond, 1991), but this case was rejected by the test for $AR(2)$ errors. As Roodman (2009: 128) highlights, dynamic panel estimators are more appropriate for “small T , large N ” panels. Given that the number of countries (N) in our sample is small, the dynamic panel bias becomes insignificant, and a more straightforward fixed-effects estimator could be more appropriate.

The lagged dependent variable is statistically significant and has a positive value in the difference and system GMM models, confirming the dynamic character of the models and the persistence of shadow banking system growth.

Among the macroeconomic determinants, we found evidence that the gross domestic product has a significant and positive impact on shadow banking growth in all three models. This relationship emphasizes that higher GDP might lead to an important rise in OFIs. The positive signs are in line with the literature. Namely, according to Ghosh et al. (2012), shadow banking in the sector in the CEE countries (where our 11 NMS also belong), due to its particular structure (consisting mainly of cooperative banks, credit unions, leasing and factoring companies, microfinance companies), is that of providing alternative funding to the economy.

Furthermore, regarding the influence of monetary policy, we report mixed and mostly statistically insignificant results across different model specifications, ranging from positive to negative. Thus, the M2/GDP ratio results show that this determinant has a significant and negative impact on shadow banking growth, but only in the fixed model. The results indicate that, in times of shadow banking expansion, financing through the traditional banking channel decreases, as banks are restricted to create money. When deposit interest rates follow a decreasing trend, economic agents are looking to save or invest at higher yields and tend to shift to other types of financial investments, which the mainstream banking might not provide. Thus, the financial resources collected by banks by means of deposits record a decrease, which further impacts their ability to grant loans. Consequently, the financing of the real economy through bank loans compresses and the money supply through the traditional banking channel decreases, being supplemented by an increase in shadow banking volume of activity (similar to Barbu et al., 2016).

The positive effect of short-term interest rates emphasized in the literature is confirmed by the results of this study in all three models, also showing support of

the “waterbed” hypothesis of monetary policy for the NMS. The results suggest that tightening the monetary policy might increase the growth of OFIs, implying that a higher cost of funding increases traditional banks’ incentives to engage in securitization, carried out and operationalized by OFIs. Our results are consistent with the findings of Den Haan and Sterk (2011), Loutskina (2011) and Nelson et al. (2017).

The results of the coefficients who associated with the banking sector show that this determinant has strong positive effect on shadow banking supporting the view that shadow banking can progress alongside traditional banking. This results that is accompanied with the growth of the traditional bank as Originate-to-Distribute model implies and the existence of some common roots of both processes (the European integration development of ITC technologies, financial innovation).

The results from the financial sectors (insurance and pension funds) are in line with the literature (Lemma, 2016; Kim, 2016; and Hodula, 2018). The empirical results show that these determinants are statistically significant in almost all models and that shadow banking is complementary not only to the banking sector, but to the rest of the financial system as well. Namely, insurance companies provide protection against financial loss and subscribe collateralized debt obligations to invest their cash. On the other hand, pension funds invest in securities issued in the shadow credit intermediation process, such as asset-backed commercial papers, asset-backed securities, and collateralized debt obligations (Hodula, 2018).

As for the dummy variable, which was introduced to cover the global economic crisis, we found that *crisis* dummy variable was statistically significant at the 1% level of significance, in all three models. This is likely because banks reduced their activities (primarily lending) during the crisis, while at the same time this meant expansion of OFI products. The results are in line with those of Hodula (2018), but different from those of Apostoaie and Bilan (2019).

5. Results and discussions

The results presented in Table 3 confirm that macroeconomic and financial factors play a role in affecting the shadow banking growth. The impact of financial factors is statistically significant and more consistent across the different empirical specifications. Moreover, these results indicate complementarity between the development of shadow banking and therest of the financial system as well. In these economies, shadowbanks provide alternative funding where traditional banking is not able to do soespecially the complementarity could be viewed in the perspective of mortgage financing. Namely where regulatory constrains do not permit traditional banks to provide mortgage on the full property value, shadow banks might step in to offer a way to finance the rest of the borrower’s claims.

Furthermore, the results indicate that the shadow banking system is highly procyclical, owing to the identified positive relationship with real GDP growth. This finding should be viewed in the light of bank regulation, where especially Basel III norms made an effort to reduce bank lending procyclicality. In some countries, shadow loans may turn out to undermine the effectiveness of capital-based regulations (such as the counter-cyclical capital buffer) or the introduction of loan-to-value limits.

Such results were opening new issues for macroprudential policy, for the current policy debate and for financial stability. This results pointing the need of consider risk factors in analyzing monetary policy effectiveness. Pass-through strength of monetary policy rates through the non-bank financial sector and the banking sector is affected by the resilience of the financial sector. Also this results may consider bearing in mind the Basel III norms, bearing in mind that one of the main goal of Basel III is to reduce procyclicality of bank lending, and the rise of shadow banking may have impact of both capital-based regulation and income-based limits

6. Conclusion

Based on the results presented, the hypothesis that selected macroeconomic and financial variables have statistically significant impact on shadow banking growth could be confirmed. The empirical findings of this study show that the shadow banking sector (in terms of total assets of other financial intermediaries as a percent of GDP) has been positively influenced by, among other things, the developments in the financial insurance and pension sectors, banking sector, money market rates, as well as by the general economic growth. We also found that global financial crisis in 2007-2008 has a negative impact on the shadow banking growth. On the other hand, there is a limited evidence that the impact of money supply (M2/GDP ratio) on shadow banking growth is negative, because that result is relevant only in the fixed model. This study complements the existent economic literature by analyzing the determinants of shadow banking growth in the 11 new EU member states. To the best of the authors' knowledge, this is only the second study analyzing the new EU member states.

This study does not face significant limitations, but their removal will certainly contribute to more robust results. Firstly, there are some missing data observations for the selected determinants over a longer period. The existence of long time series of data would allow for obtaining more accurate and more reliable results. Secondly, the selected variables fail to catch the effects of regulatory arbitrage opportunities on the development of bank-like activities outside the regulated banking system.

The future avenues of conducting research on the phenomenon of shadow banking should be focused on investigating the impact of other potentially relevant

determinants, such as the effective reserve requirements ratio, the long-term interest rate, and the inflation rate. Furthermore, if data on narrowly defined shadow banking (in accordance with the Financial Stability Board's methodology) emerge for a longer time span, it is believed that additional analysis on the determinants of shadow banking can be conducted from various perspectives. As data accumulates over time, researchers can also apply the method of two- or three-least squares or panel co-integration models. Additional research is needed to estimate not only the size and determinants of the shadow banking system, but also its complexity, interconnectedness, and risk of contagion of the other segments of the financial system.

References

- Adrian, T. (2014) Financial stability policies for shadow banking, FRBNY Staff Reports, Vol. 66, No. 4, New York: Federal Reserve Bank of New York.
- Adrian, T., Shin, H. S. (2009) "The Shadow Banking System: Implications for Financial Regulation" *Financial Stability Review*, issue 13, pp. 1–10, <https://EconPapers.repec.org/RePEc:bfr:fisrev:2009:13:1>.
- Agresti, A., Brence, R. (2017) "Statistical work on shadow banking: development of new datasets and indicators for shadow banking", Irving Fisher Committee-National Bank of Belgium *Workshop on Data needs and Statistics compilation for macroprudential analysis*, Brussels, Belgium, 18-19 May 2017, <https://www.bis.org/ifc/publ/ifcb46p.pdf>.
- Arellano, M., Bond, S. (1991) "Some tests of specification for panel data. Monte Carlo evidence and an application to employment equations", *The Review of Economic Studies*, Vol. 58, Issue 2, pp. 277–297, <https://doi.org/10.2307/2297968>.
- Arellano, M., and Bover, O. (1995) "Another Look at the Instrumental Variables Estimation of Error-Component Models", *Journal of Econometrics*, No. 68, pp. 29–51, <https://www.sciencedirect.com/science/article/abs/pii/030440769401642D>.
- Bakk-Simon, et al. (2012) "Shadow banking in the euro area: An overview", *ECB Occasional Paper Series*, No. 133, pp. 1–33, <https://www.ecb.europa.eu/pub/pdf/scpops/ecbocp133.pdf>.
- Barbu, T. C., Boitan, I. A., Cioaca, S. I. (2016) "Macroeconomic determinants of shadow banking—Evidence from EU countries", *Review of Economic and Business Studies*, Vol. 9, No. 2, doi: <https://doi.org/10.1515/rebs-2016-0037>.
- Blundell, R., Bond, S. (1998) "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics*, Vol. 87, No. 1, pp. 115–143, <https://EconPapers.repec.org/RePEc:eee:econom:v:87:y:1998:i:1>.
- Beck, G. W., Kotz, H.-H. (2016) "Les activités de shadow banking dans un contexte de bas taux d'intérêt: une perspective de flux financiers." *Revue d'économie financière*, Vol. 121, No. 1, pp. 235–256.

- Bryan, N., Sengupta, R. (2011) "Is Shadow Banking Really Banking?" *The Regional Economist*, Federal Reserve Bank of St. Louis, pp. 8–13, https://www.stlouisfed.org/~media/Files/PDFs/publications/pub_assets/pdf/re/2011/d/shadow_banking.pdf.
- Claessens, S., Ratnovski, (2014) "What Is Shadow Banking?", IMF Working Paper, WP/14/25, <https://www.imf.org/external/pubs/ft/wp/2014/wp1425.pdf>.
- Constantin-Marius, A., Bilan, I. (2019) "Macro determinants of shadow banking in Central and Eastern European countries", *Economic Research-Ekonomska Istraživanja*, Vol. 32, <https://doi.org/10.1080/1331677X.2019.1633943>.
- Du, J., Li, C., Wang, Y. (2017) "A comparative study of shadow banking activities of nonfinancial firms in transition economies", *China Economic Review*, Vol. 46, pp. S35–S49, <https://doi.org/10.1016/j.chieco.2016.09.001>.
- Duca, J. V. (2016) "How Capital Regulation and Other Factors Drive the Role of Shadow Banking in Funding Short-Term Business Credit", *Journal of Banking & Finance*, Vol. 69, pp. 10–24, doi: 10.1016/j.jbankfin.2015.06.016.
- EC. (2012) Green paper on shadow banking, http://ec.europa.eu/internal_market/bank/docs/shadow/green-paper_en.pdf.
- ESRB (2017) "EU Shadow Banking Monitor 2017", *European Systemic Risk Board*: Frankfurt.
- Den Haan, W. J., Sterk, V. (2011) "The Myth of Financial Innovation and the Great Moderation", *The Economic Journal*, Vol. 121, No. 553, pp. 707–739.
- Dumičić, M., and Ridzak, T. (2016) "Are Shadow Banks Hiding in Croatia as Well?", *Surveys S-20*, Croatian National Bank, Zagreb.
- FSB. (2011) "Shadow Banking: Strengthening Oversight and Regulation", Recommendations of the Financial Stability Board.
- FSB. (2014) Global Shadow Banking Monitoring Report 2014, Retrieved from http://www.fsb.org/wp-content/uploads/r_141030.pdf.
- FSB. (2015) Global Shadow Banking Monitoring Report 2015, www.fsb.org/wp-content/uploads/global-shadow-banking-monitoring-report-2015.pdf.
- FSB. (2019) Global Monitoring Report on Non-Bank Financial Intermediation 2019, <https://www.fsb.org/2020/01/global-monitoring-report-on-non-bank-financial-intermediation-2019/>.
- Ghosh, S., Gonzalez del Mazo, I., Otker-Robe, I. (2012) "Chasing the Shadows: How Significant Is Shadow Banking in Emerging Markets?", *Economic Premise*, No. 88, <https://openknowledge.worldbank.org/bitstream/handle/10986/17088/724450BRI0EP880OWLEDGE0NOTES0SERIES.pdf?sequence=1&isAllowed=y>.
- Global Monitoring Report on Non-Bank Financial Intermediation 2018 4 February 2019, <https://www.fsb.org/wp-content/uploads/P040219.pdf>.

- Giron, C., Matas-Mir, A. (2017) "Interconnectedness of shadow banks in the euro area", Vol. 46, Bank for International Settlements Basel, Switzerland, <https://www.bis.org/ifc/publ/ifcb46r.pdf>.
- Girasa, R. (2016) *Shadow banking. The rise, risks, and rewards of non-bank financial services*, New York: Palgrave Macmillan.
- Grillet-Aubert et al. Assessing shadow banking – non-bank financial intermediation in Europe No. 10, https://www.esrb.europa.eu/pub/pdf/occasional/20160727_occasional_paper_10.en.pdf.
- Gorton, G., Metrick, A. (2012) "Securitized Banking and the Run on Repo," *Journal of Financial Economics*, Vol. 104, No. 3, pp. 425–51, <http://www.sciencedirect.com/science/article/pii/S0304405X1100081X>.
- Hausman, J. A. (1978) "Specification Tests in Econometrics", *Econometrica*, Vol. 46, No. 6, pp. 1251–1271, <http://links.jstor.org/sici?sici=0012-9682%281978O%3B2-X&origin=repec>.
- Hodula, M., Machacek, M., Melecky, A. (2017) "Macroeconomic determinants of shadow banking: Evidence from Spain" In J. Proceedings of the 14th International Scientific Conference, Vol. 1, pp. 204–212, Brno: Masaryk University. https://obd.vsb.cz/fcgi/verso.fpl/fname/obd_public_det/id/286098669.
- Hodula, M. (2018) "Off the Radar: Exploring the Rise of Shadow Banking in the EU", *The Working Paper Series of the Czech National Bank (CNB)* https://www.cnb.cz/export/sites/cnb/en/economicresearch/.galleries/research_publications/cnb_wp/cnbwp_2018_16.pdf.
- Hodula, M. (2019) "Monetary Policy and Shadow Banking: Trapped between a Rock and a Hard Place", *Working Papers 2019/5*, Czech National Bank https://www.cnb.cz/export/sites/cnb/en/economiresearch/.galleries/research_publications/cnb_wp/cnbwp_2019_05.pdf.
- Hodula, M., Macháček, M., Meleck, A. (2020) "Placing the Czech Shadow Banking Sector under the Light", *Prague Economic Papers* Vol. 29 No. 1, pp. 3–28, doi: 10.18267/j.pep.710.
- Hsiao, C. (1986) "Analysis of Panel Data. Econometric Society Monographs", No. 11, New York: *Cambridge University Press*.
- IMF. (2014) "Shadow Banking around the Globe: How Large, and How Risky? In Global financial stability report. Risk taking, liquidity, and shadow banking. Curbing excess while promoting growth", International Monetary Fund, Washington, DC, pp. 65–104, <https://www.imf.org/en/Publications/GFSR/Issues/2016/12/31/Risk-Taking-Liquidity-and-Shadow-Banking-Curbing-Excess-While-Promoting-Growth>.
- Judson, R. A., Owen, L. A. (1999) "Estimating Dynamic Panel Data Models: A Guide for Macroeconomists", *Economics Letters*, Vol. 65, pp. 9–15, <https://faculty.smu.edu/millimet/classes/eco6375/papers/judson%20owen%201999.pdf>.

- Jeffers, E., Plihon, D. (2016) "What is so special about European Shadow banking? FEPS Studies, Vol. 26.
- Kim, S (2016) "What drives shadow banking? A dynamic panel evidence Eighth IFC Conference on Statistical implications of the new financial landscape" Basel, 8–9 September 2016.
- Langfield, S., Pagano, M. (2016) "Bank bias in Europe: Effects on systemic risk and growth", *Economic Policy*, Vol. 31, No. 85, pp. 51–106, doi: 10.1093/epolic/eiv019.
- Lambin, J. (2014) "Rethinking the Market Economy: New Challenges, New Ideas, New Opportunities", Palgrave Macmillan.
- Lysandrou, P., Nesvetailova, A. (2015) "The role of shadow banking entities in the financial crisis: A disaggregated view", *Review of International Political Economy*, Vol. 22, No. 2, pp. 257–279, doi:10.1080/09692290.2014.896269.
- Loutskina, E. (2011) "The Role of Securitization in Bank Liquidity and Funding Management", *Journal of Financial Economics*, Vol. 100, No. 3, pp. 663–684. [http://www.sciencedirect.com/science/article/pii/S0304-405X\(11\)00038-9](http://www.sciencedirect.com/science/article/pii/S0304-405X(11)00038-9).
- Malatesta, F., Masciantonio, S., Zaghini, A. (2016) "The shadow banking system in the Euro area: Definitions, key features and the funding of firms", *Italian Economic Journal*, Vol. 2, No. 2, pp. 217–237, <https://link.springer.com/article/10.1007/s40797-016-0032-0>.
- Maddaloni, A. and Peydró, J.-L. (2011) "Bank risk-taking, securitization, supervision and low interest rates: evidence from the euro area and the US lending standards", *Review of Financial Studies*, Vol. 24, pp. 2121–2165.
- Mehrling et al. (2013) "Bagehot was a Shadow Banker: Shadow Banking, Central Banking, and the Future of Global Finance", *SSRN Electronic Journal*, doi: 10.2139/ssrn.2232016.
- Nelson, B., G. Pinter., Theodoridis, K. (2018) "Do Contractionary Monetary Policy Shocks Expand Shadow Banking?", *Journal of Applied Econometrics*, Vol. 33, pp. 198–211, <https://doi.org/10.1002/jae.2594>
- Nesvetailova, A. (2018) *Shadow Banking: Scope, Origins and Theories (Routledge Critical Studies in Finance and Stability) 1st Edition*.
- Nickell, S. (1981) "Biases in Dynamic Models with Fixed Effects", *Econometrica*, Vol. 49, No. 6, pp. 1417–1426, <https://doi.org/10.2307/1911408>.
- O’Sullivan, V., Kinsella, S. (2012) Chasing shadows: Europe prepares to regulate shadow banking *Journal of Banking Regulation*, Vol. 13, pp. 173–177, <https://link.springer.com/article/10.1057%2Fjbr.2012.8>.
- Petkovski, M., Kjosevski, J., Jovanovski, K. (2018) "Empirical Panel Analysis of Non-Performing Loans in the Czech Republic. What are their Determinants and How Strong is Their Impact on the Real Economy?", *Finance a úvěr-Czech Journal of Economics and Finance*, Vol. 68, No. 5, http://journal.fsv.cuni.cz/storage/1420_460_490_kjosevski_final_issue_05_2018.pdf.

- Portes, R. (2018) “Interconnectedness: Mapping the shadow banking system”, *Banque de France European Stability Review*, pp. 2–10, <https://repositori.upf.edu/bitstream/handle/10230/35505/Ademu-WP-1172018%20Interconnectedness.pdf?sequence=1&isAllowed=y>.
- Pozsar, Z. (2008) “The rise and fall of the shadow banking system”, *Regional Financial Review*, pp. 13–25, <https://www.economy.com/sbs>.
- Pozsar, Z. et al. (2010) “Shadow banking”, Federal Reserve Bank of New York Staff Report, No. 458, https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr458.pdf.
- Rinaldi L., Sanchis-Arellano, A. (2006) “Household Debt Sustainability, what Explains Household Non-Performing Loans?”, An Empirical Analysis, *Working Paper Series*, No. 570, European Central Bank <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp570.pdf>.
- Roodman, D. (2009) “How to do xtabond2: An introduction to difference and system GMM in Stata”, *The Stata Journal*, Vol. 9, No. 1, pp. 86–136, <https://doi.org/10.1177/1536867X0900900106>.
- Svirydzenka, K. (2016) “Introducing a New Broad-Based Index of Financial Development”, *IMF Working Paper* 16/5, <https://www.imf.org/en/Publications/WP/Issues/2016/12/31>.
- Wesley C.M. (2014) “Inside shadow banking: understanding the doomsday machine”, *European Journal of Economics and Economic Policies Intervention*, Vol. 11, No. 3, pp. 315–332, doi: 10.4337/ejeep.2014.03.06.

Utjecaj makroekonomskih i financijskih čimbenika na bankarstvo u sjeni u novim državama članicama EU-a

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Sažetak

Cilj ovog rada je ispitati kako različite varijable iz makroekonomskog i financijskog okruženja utječu na dinamiku bankarskog sektora u sjeni u odabranih 11 novih država članica EU-a koristeći godišnje podatke za razdoblje 1999-2018. Primjenjuju se tri alternativne tehnike procjene: model s fiksnim efektima, metoda procjene GMM razlika i GMM sustava. Empirijski rezultati dokazuju da su najvažniji čimbenici razvoja u financijskom sektoru (sektoru osiguranja i mirovinskom sektoru), bankarskom sektoru, te stopi na tržištu novca kao i opći ekonomski rast. Također je utvrđeno da globalna financijska kriza negativno utječe na rast bankarstva u sjeni. Dobiveni rezultati ukazuju na to da je bankarski sustav u sjeni komplementaran, ne samo tradicionalnim bankama, već i ostatku financijskog sustava, te otvara nova pitanja makrobonitetne politike imajući u vidu Basel III norme. Naime, jedan od glavnih ciljeva Basela III je smanjiti procikličnost bankarskog kreditiranja, a porast bankarstva u sjeni može utjecati kako na regulaciju koja se temelji na kapitalu tako i na ograničenja temeljena na dohotku.

Ključne riječi: bankarstvo u sjeni, nove države članice EU-a, panel analiza podataka

JEL klasifikacija: E44, E52, G21, G23

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Income smoothing through loan loss provisions in south and Eastern European banks*

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Abstract

This study provides empirical evidence on income smoothing from the banking sector in nine South-Eastern Europe (SEE) countries for the period 2005-2014 by applying a number of methodological approaches. First, by using a sample of 321 banks this paper confirms our first hypothesis that banks in the SEE region use loan loss provisions (LLPs) to smooth their incomes. Second, by dividing the loan loss provision into its two components (discretionary and non-discretionary,) the study provides new evidence on the effects of loan loss provisions components on growth in bank lending. The results clearly prove our second hypothesis that the components of LLPs do matter on growth in bank lending. Third, this paper estimates the use of loan loss provisions for capital management by banks. The empirical results do not support the hypothesis of capital management for SEE banks. The novelty of this paper, unlike other works, is the inclusion of SEE countries.

Key words: loan loss provisioning, South and Eastern European banks, income smoothing, capital management hypothesis, discretionary component, non-discretionary component

JEL classification: G21, M10, M41, M49

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1. Introduction

Income smoothing in the banking sector is a process in which banks use high earnings to create buffers that are used in periods of low earnings. Recent studies have examined bank managers' using of LLPs to smooth their incomes and manage regulatory the ratio of capital (such as Lobo and Yang, 2001; Shrieves and Dahl, 2003; Kanagaretnam et al., 2004a; Ozili and Outa, 2018; Habib et al., 2020). As a result, the income smoothing in the banking sector has made earnings less volatile over time. If potential perceived performance is projected to be low, managers have an opportunity to move current earnings towards the future to keep down the possibility of poor future performance, also, managers' concerns about their job security create an incentive to use LLPs for income smoothing. In doing so, it allows them to 'save' earnings for possible use in the future. Managers are motivated to use their discretion over accruals to smooth the volatility of performance. Consequently, banks will smooth their incomes by using LLPs when their incomes are high, and lowering the LLPs if their incomes are low (Kanagaretnam et al., 2003; Ozili and Outa, 2018; Ozil, 2019).

Another important matter in which the recent studies have focused is whether banks use LLPs to manage regulatory capital requirements. The capital management hypothesis says that banks use the LLPs to manage with their regulatory capital (e.g., Pérez et al., 2008; Leventis et al., 2011; Beccalli and Poli, 2015; Curcio and Hasan, 2015).

The main purpose of this paper is to test the possibility of using LLPs by banks in CEE countries. Therefore, this paper will answer three important hypotheses, based on the literature review. The first hypothesis of this paper is that LLPs are used by banks for income smoothing in SEE countries (Albania, Bulgaria, Bosnia and Herzegovina, Croatia, Kosovo, Serbia, Montenegro, Macedonia, Romania and Slovenia). Since LLPs have a non-discretionary (NDISC) component and a discretionary component (DISC), the study separates the discretionary part of the provisions so that it can be examined whether bank managers used the discretionary component to manage their incomes for the period 2005-2014. So, the second hypothesis, is that LLP components have an effect on growth in bank lending in SEE countries. The third hypothesis is that LLPs are not used for capital management for countries in the sample.

For the following purposes, our study is very important. First, there is no study that tested the income smoothing hypothesis for SEE banks, so our study aims to shed some light on whether SEE banks used LLPs to smooth their incomes. Second, including this region this research will also contribute to the income smoothing and capital management literature. Our study contributes to the extant literature through empirical findings. First, our findings confirm that banks in SEE countries use LLPs to smooth their incomes. Second, by controlling for components of LLP,

we contribute to the literature that examines the effects of these components on loans growths among banks. The results find that both of them have an effect on loan growth. Third, by controlling for capital management hypothesis, our study contributes to literature on bank capital regulation.

This topic is of particular importance for banks supervisors and banks' external auditors, as it helps them to understand better if the managers of banks did use LLPs for their objectives.

The rest of the paper is organized as follows. The following section reviews previous literature. Section three describes methodological issues related to income smoothing (the analytical methods used to separate LLP discretionary and non-discretionary components, a description of the models used by previous authors to test income smoothing). Section four data, includes sample selection and description of variables in details. The last two sections (five and six) discuss the results of the study from the needs for prevention of misuse of LLPs.

2. Literature review

Research on LLPs remains a very important aspect of banking research, for four key purposes. First, LLPs is a significant discretionary accrual at the disposal of bank directors. Second, LLPs has a strong impact on the margin of bank interest and therefore affects average bank earnings. Three, LLPs is related to micro-prudential supervision by bank regulators and is related to the informativeness of accounting disclosures needed by accounting standard-setters in financial reports (Ozili, 2017).

LLPs are a fairly large big accrual for commercial banks, and therefore, for many activities LLPs are used by managers. In recent years, research in the banking sector focuses on the using of LLPs for income smoothing and capital management as well as the relationship of LLPs to the respective countries' macroeconomic conditions (Majnoni and Cavallo, 2001; Lobo and Yang, 2001; Bikker and Metzmakers, 2005; Bouvatier and Lepetit, 2008; Fonseca and González, 2008; Packer and Zhu, 2012; Bonin and Kosak, 2013; Bouvatier et al., 2014; Olszak et al., 2017; Caporale et al., 2018; Ozili, 2018).

Income smoothing is a subject that was discussed very early by different authors and continues to be explored even today, especially after the recent financial crisis. More recently, several empirical studies in commercial banks, particularly American banks, have revealed various smoothing practices.

Kanagaretnam et al. (2003) analyses the Fudenberg-Tirole model's projections by evaluating how bank managers smooth their incomes through LLPs. Their empirical analysis shows that managers use LLPs to smooth their incomes. Their

results suggest that when actual earnings are relatively low (high), but predicted relatively high (low) potential unmanaged earnings, managers may release (build) reserves. In reality, bank managers are “borrowing” earnings from the future. According to Kanagaretnam et al. (2004), bank managers appraise LLPs to represent changes in expected future loan losses. Their research underlines that managers are using the LLPs to meet more than one target results. Kanagaretnam et al. (2004a) findings evidence that US banks use discretionary loan loss provisions to reduce earnings fluctuations and to manage their capital. These findings are compatible with the income smoothing hypothesis to keep down income volatility. Bushman and Williams (2012) study the case of forward-looking LLPs and find that banks use their discretion in forward-looking provisioning to smooth their incomes. According to Bushman and Williams (2012), loan loss provisioning is a primary accounting method that directly affects the stability and cyclicity of bank earnings. Using U.S. data, Bushman and Williams (2015) find out that trying of bank to postpone provisions on losses in the balance sheet will contribute more to systemic risk and the effect is greater during economic downturns. According to Bushman and Williams (2015) decreases in transparency will contribute to increased consumer confusion regarding to weaken market discipline over risk-taking behavior. During the global financial crisis, Morris et al. (2016) studied the economic determinants and value significance of the LLP of US banks. They find that discretionary provisions are used for smoothing and signaling, but smoothing happens more often.

There are also many studies for European countries. The income-smoothing hypothesis was tested by Norden and Stoian (2014) based on quarterly data from 85 Dutch banks covering the period from 1998 to 2012. Norden and Stoian (2014) note that general provisions are not tax-deductible in the Dutch tax law system as in many other EU countries. In addition, Dutch banks' general LLPs are not recognized as Tier Two capital. They find that banks use LLPs, in fact, banks are changing LLPs to prevent fluctuations in their assets weighted against risk. Pérez et al. (2008) examined data from financial statements for 142 Spanish banks, they emphasize that banks must reach minimum regulatory capital standards, which means that income smoothing through LLPs may result from accounting practices intended to meet those requests. According to Pérez et al. (2008) in many countries' bankers have broad flexibility in deciding the sum of LLPs to accumulate and LLPs offer a unique tool for banks to smooth their incomes. They verified the income smoothing hypothesis in Spanish banks through general and specific LLPs, but they did not find the using of LLPs for capital management. Therefore, the authors mention that the introduction of the transparent statistical provision, which is separately reported by banks on a line in their income statements, contributes to improving the quality of accounting data. Working on a panel of European commercial banks, Bouvatier and Lepetit (2008) figure out that banks use LLPs to smooth their incomes in all the different countries that they include.

Leventis et al. (2011) analyzed the usage of LLPs for income smoothing and capital management hypothesis between 91 listed European banks that approve IFRS (International Financial Reporting Standards) standards, and figure out evidence that LLPs are used by early and late adopters of IFRS to smooth their incomes, but this behavior is low after the IFRS. They have also found that, overall, while riskier banks participate more in income smoothing using LLPs prior to IFRS implementation, these banks' propensity to engage in identical behavior in the post-IFRS regime has been significantly lower. They have not found any evidence to indicate that LLPs are used for capital management.

Curcio and Hasan (2015) analyzed the Euro and non-Euro Area cases and find that banks outside the Euro Area use LLPs as an income-smoothing tool during the financial crisis years 2007–2010, but not to manage their capital ratios or to transfer private information to the market. They have found no similar evidence for credit institutions in the Euro Area. Curcio et al. (2017) also examined the use of discretionary LLPs, during the time when Euro Area banks faced a declining credit standard and a significant decline in profitability, when banks were subject to a new form of stricter supervision, called the 2010 and 2011 European Banking Authority (EBA) stress testing exercises. Curcio et al. (2017) find proof for income smoothing through LLPs at banks that were subject of EBA. In addition, during the years 2004–2012, Skała (2015) analyzed 179 commercial banks in 11 Central European countries, providing empirical evidence that banks in Central European countries use LLPs to smooth their incomes. Skała (2015) stated that LLPs directly have an effect on the net profit amount and thereby retain earnings which are a portion of bank capital. According to Skała (2015) income smoothing through LLPs is closely connected to capital adequacy and in the economic downturn Central European banks create additional reserves, leading to higher LLPs. Also, Ozili and Thankom (2018) finds that European banks use LLPs to smooth their incomes.

Taktak et al. (2010a) also conducted a regression analysis study, using a data set of 278 banks operating in OECD countries. The results indicate that commercial banks tend to adhere to real income smoothing more often than to artificial ones by selling shares instead of managing provisions on loan losses. According to Taktak et al. (2010) artificial smoothing results from manipulating or controlling accounting figures, meanwhile real smoothing, results from manipulating or controlling real activities. Bikker and Metzmakers (2005) emphasize that banks are setting higher levels of reserves aside during good years, for example, as a precaution – provisions are increased in good years for use in lean ones. The capital-to-asset ratio (CAP) is negatively correlated with provisions, supporting the hypotheses of capital management predicting higher provisioning when the capital ratio is relatively low. Fonseca and Gonzalez (2008) analyzed a sample from 41 countries. They also show proof of income smoothing via LLPs. According to Fonseca and Gonzalez (2008), bank income smoothing in the form of LLPs varies from one country to another

depending on factors such as investor protection, disclosure, regulation, financial structure and development, etc.

The results are mixed among Asian studies. Some of them find that Chinese banks engaged in income smoothing (Packer and Zhu, 2012; Bonin and Kosak, 2013; Wu et al., 2015; Curcio et al., 2017; Ozili, 2018; Vishnani et al., 2019). However, Bryce et al. (2015) find that Vietnamese banks did not engage in income smoothing.

Present studies also show that LLPs is related to capital management. According to Beatty and Liao (2014) the motivations of banks to use accounting discretion to manage regulatory capital ratio can rely on how costly it is to hold extra equity capital. Beatty et al. (1995) concluded that while accrual decisions for managers are complicated by other capital-raising activities, LLPs are used as capital-management mechanism. Capital management hypothesis claims that bank executives use LLPs to reduce the potential regulatory costs correlated with the violation of capital adequacy requirements (Ahmed et al., 1999; Fonseca and Gonzales, 2008). The hypothesis of capital management foresee that the capital ratio is negatively connected to LLPs because bank managers with low capital ratios can raise them by charging more LLPs, to keep down regulatory costs required by regulations on capital adequacy ratios (Lobo and Yang, 2001). Ahmed et al. (1999) claim that, because bank regulators expect banks to retain minimum regulatory capital for the risk they face, bank managers have some ability to manipulate the amount of LLPs so that they can fulfill minimum regulatory capital standards, if LLPs are included in the measurement of minimum regulatory capital ratios. According to Kanagaretnam et al. (2004), while bank managers with low regulatory capital have stimulations to increase LLPs because bank regulators require banks to keep minimum regulatory capital ratios (CAP). They suggest that the coefficient on CAP should be negative. Pérez et al. (2008) also emphasis that banks can use LLPs to modify retained earnings, thereby managing their regulatory capital, in order to meet their targets for regulatory capital. However, their results show that, contrary to the capital management hypothesis predictions, the coefficient of CAP is positive and statistically significant. Bikker and Metzmakers (2005) argue that the CAP ratio is negatively correlated with provisions, supporting the hypotheses of capital management predicting higher provisioning when the capital ratio is relatively small. According to Taktak et al. (2010) a negative sign of the CAP indicates that the lower the capital ratio, the higher the LLP will be. According to the authors, this finding supports the claim that well-capitalized banks enter less risky activities.

Olszak (2012) analyses quarterly data for Poland from 1998 through 2009. There is no statistically significant relation between LLPs and CAP ratio, so the analysis indicates the rejection of the hypothesis of capital management. According to Olszak (2012) this could be a result of Polish commercial banks' very favorable capital positioning. Caporale et al. (2018) examined data from a panel of 400 Italian banks to investigate the determinants of LLP between 2001 and 2015. Caporale et

al. (2018) find proof that the CAP ratio and the LLPs had a negative relationship. According to Taktak et al. (2010) a negative sign of CAP indicates that the lower the capital ratio, the higher the LLPs will be. According to the authors, this finding supports the claim that well-capitalized banks enter less risky activities. But, Aristei and Gallo (2019) do not support the hypothesis of income smoothing and capital management and indicate that LLPs by Italian banks are mainly motivated by non-discretionary factors relevant to expected credit risk during the crisis time. Also, Ozil, (2017) for a bank sample of selected Western European banking institutions find that banks use LLPs for income smoothing and capital management.

Abu-Serdaneh (2018) analysis all listed Jordanian banks and covers the 2005-2014 period. The findings show that there is no definitive evidence to support the use of provisions by Jordanian banks to smooth their incomes, manage capital ratios or engage in pro-cyclical behavior. Soedarmono et al. (2017) investigates whether LLPs in Islamic banks is procyclical from a study of Islamic banks worldwide from 1997 to 2012. A closer analysis further documents that Islamic banks also use LLPs for capital management, where reserves and provisions for loan losses are inflated as bank capitalization declines.

3. Methodology

There are two ways to test income smoothing. First, the first one, testing the relation between the variables of LLPs with earnings before taxes and provisions (EBTPs) and the second way, by dividing the LLPs into its two components and then continuing to test the relationship between the discretionary part (DISC) and the EBTPs. According to Bouvatier and Lepetit (2008), two components of LLPs are mentioned in the literature. The first one, named the non-discretionary component (NDISC), is done in a bank's loan portfolio to cover expected future credit losses. The second part, named the discretionary component (DISC), is attributed to the usage of LLPs for goals of management. Bouvatier and Lepetit (2008) in their equation included EBTPs to test income smoothing and CAP ratio to test the capital management hypothesis. The DISC component according to Bouvatier and Lepetit (2012), is primarily related to non-performing loans (NPLs). Also, Wahlen (1994) and Kanagaretnam et al. (2004) splits LLPs into two components: the non-discretionary and the discretionary. The authors note that information about non-discretionary provision for loan losses may allow investors to assess the discrete components of the LLPs.

Consistent with earlier studies, a two-stage method is adopted for testing of income smoothing through the discretionary component of LLPs (Kanagaretnam, et al., 2004; Kwak et al., 2009; Taktak et al., 2010; Leventis et al., 2011; Bouvatier et al., 2014; Othman and Mersni, 2014; Shawtari et al., 2015; Bryce et al., 2015; Aristei

and Gallo, 2019). The non-discretionary component of LLP is estimated in the first stage using the model in equation (1), so that the discretionary component is isolated from the total of LLPs. In keeping with earlier studies, following variables are used to estimate the non-discretionary component of LLPs:

$$LLP_{it} = \beta_0 + \beta_1 \Delta NPL_{it} + \beta_2 L_{it} + \beta_3 CAP + \beta_4 EBTP + \beta_5 NPL_{it} + \beta_6 GDP_{it} + \varepsilon_{it} \quad (1)$$

where:

LLPs – Loan loss provisions over total bank assets for bank *i* at time *t*.

ΔNPL – The change in non-performing loans deflated by beginning total loan.

LOANS/TA – Growth rate of net loans to total assets.

EBPT – Ratio of earnings before taxes and LLPs divided by total asset.

NPL – Ratio of non-performing loans divided by total loans.

GDP – Real growth of GDP.

According to Bouvatier and Lepetit (2008 & 2012), Aristei and Gallo (2019) in non-discretionary component of LLPs are considered variables which statistically significant. If a variable is not significant or has the opposite sign from expected, the variable associated with this coefficient is dropped (Bouvatier and Lepetit, 2012). Whereas the past equation estimates the non-discretionary portion of LLP, in equation (2) the discretionary component is estimated as residual. Also, following Jin et al. (2018) the residuals of Equations (1) are computed as DISC:

$$DISC_{it} = LLP_{it} - \hat{\beta}_1 NDISC_{it} \quad (2)$$

where:

LLPs – Loan loss provisions over total bank assets for bank *i* at time *t*.

DISC – Discretionary portion of LLP.

NDISC – The non-discretionary portion of LLP.

According to Bouvatier and Lepetit (2012), the advantages of this definition are double, it tends to be applied for each dataset, paying little attention to the importance of variables catching the discretionary behavior. These discretionary and non-discretionary components are used to test the impact of provisioning behaviors on bank loans fluctuations. According to Bouvatier and Lepetit (2008) the variable NDISC it includes all the variables which may explain the non-discretionary component.

In the second stage, the relationship between the discretionary component and other variables is being tested. The independent variables in equation (3) hereinafter presents variables hypothesized to impact the discretionary component. Following

many other authors (Kanagaretna et al., 2004 & 2004a; Kwak et al., 2009; Bouvatier and Lepetit, 2012; Norden and Stoian, 2014; Shawtari et al., 2015) in this way, directly was tested the relationship between EBTPs and DISC:

$$DISC_{it} = \beta_0 + \beta_1 \Delta NPL_{it} + \beta_2 L_{it} + \beta_3 CAP + \beta_4 EBTP + \beta_5 NPL_{it} + \beta_6 GDP_{it} + \beta_7 LD_{it} + \beta_8 Size_{it} + \varepsilon_{it} \quad (3)$$

where:

DISC – Discretionary portion of LLP.

ΔNPL – The change in non-performing loans deflated by beginning total loan.

LOANS/TA – Growth rate of net loans to total assets.

CAP – Capital to total assets.

EBPT – Ratio of earnings before taxes and LLPs divided by total asset.

NPL – Ratio of non-performing loans divided by total loans.

GDP – Real growth of GDP.

LD – Total loans to total deposits.

Size – Logarithm of total assets.

If the coefficient of EBTPs is positive and significant with discretionary component, the result shows that banks have used LLPs for income smoothing.

Bouvatier and Lepetit (2008) show that provisions relating to non-discretionary loan loss exacerbate a pro-cyclical effect because higher non-discretionary provisions keep down growth in bank loans. By comparison, DISC, particularly those associated to income smoothing behavior, has no significant effect on the growth of bank loans. Within various banking systems, though, the provisioning activities and their subsequent impact on lending growth will vary considerably. Their findings indicate that the non-discretionary portion of LLP has a negative and significant impact on growth in bank lending in all the countries that they listed, with larger frequency for developing countries excluding Japan.

Based on the models used in the Bouvatier and Lepetit (2012) studies, in equation 4 it was tested for the effects of the non-discretionary and discretionary components on lending growth:

$$L_{it} = \alpha + \beta_1 + \beta_2 NDISC_{it} + \beta_3 DISC_{it} + \beta_4 D_{it} + \beta_5 E_{it} + \beta_6 SIZE_{it-1} + \varepsilon_{it} \quad (4)$$

where:

L – Growth rate of net loans to total assets.

DISC – Discretionary portion of LLP.

NDISC – The non-discretionary portion of LLP.

D – Growth rate of deposits.

E – Capital to total assets.

EBPT – Ratio of earnings before taxes and LLPs divided by total asset.

SIZE – Logarithm of total assets.

In this paper countries from South and East Europe are involved. The database contains information of active commercial banks that reported financial statements to Bankscope database for the period 2005-2014 in 9 countries (Albania, Bulgaria, Bosnia and Herzegovina, Croatia, Kosovo, Serbia, Montenegro, Macedonia, Romania and Slovenia). Table 1 shows the number of banks involved for each country.

Table 1: Number of banks included in the sample

Country	Symbol	Number of banks
Albania	AL	20
Bosnia and H.	BA	44
Bulgaria	BG	40
Croatia	HR	80
Macedonia	MK	24
Serbia	RS	49
Slovenia	SI	41
Kosovo	KV	8
Monetenegro	ME	15
Total		321

Source: Authors’

In next section we will explain the variables that are included in models.

4. Empirical data and analysis

Models include several control variables. Definitions of variables are presented in Table 2.

Table 2: Summary of the variables

Variable	Predicted sign	Definition
<i>LLPs</i>	+/-	Loan loss provisions over total bank assets for bank <i>i</i> at time <i>t</i>
Δ NPL	+/-	The change in non-performing loans deflated by beginning total loan.
L	+/-	Growth rate of net loans to total assets.
E	+/-	Capital adequacy ratio.
D	+/-	Growth rate of deposits.
EBPT	+	Ratio of earnings before taxes and LLPs divided by total asset.
<i>GDP</i>	-	Real growth of GDP
<i>CAP</i>	-	Capital to total assets
<i>NPL</i>	+/-	Ratio of non-performing loans divided by total loans
<i>LOANS/TA</i>	+/-	Total loans divided by total assets
<i>SIZE</i>	+/-	Logarithm of total assets
<i>LD</i>	+/-	Total loans to total deposits
<i>NDISC</i>	-	The non-discretionary portion of LLP.
<i>DISC</i>	-	Discretionary portion of LLP.

Note: Bank-level data are from the Bankscope database. GDP growth, inflation and unemployment data are from the World Bank development indicators.

Source: Authors'

The most important variable in this research is $EBTP_{it}$, as it measures income smoothing. For the income smoothing hypothesis, as suggested by many authors (Wahlen, 1994; Collins et al., 1995; Beatty et al., 1995; Ahmed et al., 1999; Jin et al., 2018) should be a positive relationship between EBTPs and LLPs. Specifically, banks can use LLPs according to the income-smoothing hypothesis to smooth their incomes by overstating (understating) LLPs when incomes are expected to be high/low (Aristei and Gallo, 2019).

A growing share of non-performing loans (NPLs) in the loan portfolio of banks signifies greater risks affecting both the liquidity and profitability of banks. Moreover, it represents a weakening balance sheet of banks (Ghosh, 2015). According to Škarica (2014) the high levels of NPLs are becoming a growing concern, provided the experiences from previous financial crises indicate that a lasting recovery needs

a “clean-up” in the financial sector. According to previous literature, NPLs may be introduced as a bad output (or, in terms of the profit function, an expense that reduces total profits) into the production function of the bank (García-Alcober et al., 2019). Bouvatier and Lepetit (2012) used the ratio of NPLs divided by total assets at the end of the year t (NPL_{it}) and the first difference of NPL_{it} ($TNPL_{it} = NPL_{it} - NPL_{it-1}$) as explanatory variables. Bouvatier and Lepetit (2008) argue that NPLs are a good indicator of the expected loss identified by banks for their loan portfolio.

Also, the ratio of NPLs to gross loans at the end of the year t (NPL_{it}) is a good evidence of the risk of non-payment on banks' loans (Kim and Kross, 1998; Lobo and Yang, 2001; Bouvatier and Lepetit 2008; Skala, 2015).

Empirical studies that test the capital management hypothesis focus on the negative relationship between the coefficients of LLP and CAP ratio (Collins et al., 1995; Kim and Kross, 1998; Ahmed et al., 1999; Lobo and Yang, 2001; Anandarajan et al., 2007; Leventis et al., 2011; Curcio and Hasan, 2015; Simper et al., 2019).

Loan to deposit ratio (LD_{it}) has been used as proxy for external financing in studies. Following Kanagaretnam et al. (2003 & 2004a) the ratio of total loans to total deposits is used as a measure of banks' need for external financing. If the loan portfolio of a bank is larger than its total deposits, it would need to borrow to finance its lending portfolio. Banks are typically financed by customer deposits, but they require sufficient equity resources to meet bank regulatory capital ratios. Many researchers (such as Kwak et al., 2009; Shawtari et al., 2015) used the LD_{it} as an indicator for external financing of the banking sector. According to Shawtari et al. (2015) if the ratio is high, the bank needs external funding, and thus there is a tendency for the banks to record low discretionary LLPs to show low figure out credit risks and higher reported profits to draw more deposits from the borrowers and give the depositors assurance to allocate their funds to the banks. A lower level of the ratio of LD_{it} represents a lower dependence on wholesale funding which means that the bank is less market constrained in its asset growth (Cucinelli, 2015).

Another control variable, which measures the size of the bank, is the natural logarithm of total assets (Size). Based on many studies (such as Anandarajan et al., 2007; Pérez et al., 2008; Leventis et al., 2011) larger banks might have higher levels of activity than small banks, so they have higher LLPs because they are required to take greater activity and risk into account. From the other hand, considering opportunities for portfolio diversification, becoming more likely to be exploited in a larger credit portfolio, the relation between bank size and the usage of LLPs may be predicted to be negative. Leventis et al. (2011) also suggest that relatively smaller banks often hold higher LLPs ratio. This can be due to less effective diversification of credit risk policies. Meanwhile, according to Tran et al. (2019) large banks tend to have more stable activities and better risk diversification capacity. Large banks are expected to report smaller amounts of DISC, while small banks are more likely

to have deficiencies in internal control and are more likely to correct previously reported earnings. In addition, larger banks may be subject to stricter regulatory scrutiny and monitoring.

Variable (L_{it}) is the ratio of total loans divided by total assets and represents a measure for the risk profile of the bank (Taktak et al., 2010). Bouvatier and Lepetit (2008) also include the risk of default for the overall credit portfolio, calculated by the ratio of net loans divided by total assets (L_{it}).

Moreover, Bouvatier and Lepetit (2008 & 2012), Soedarmono et al. (2012) study the effect of discretionary vs. non-discretionary LLPs on bank lending. Both find that non-discretionary provisions amplify credit fluctuations. Therefore, both components of LLPs are relevant to determine growth in lending.

GDP is the rate of growth of gross domestic product in year t . It aims to catch the effect of macroeconomic conditions on LLPs (Laeven and Majnoni, 2003; Bikker and Metzmakers, 2005; Taktak et al., 2010; Aristei and Gallo, 2019). Coherent with recent methodological literature (Ghosh, 2007; Bouvatier and Lepetit, 2008; Fonseca and Gonzalez, 2008; Leventis et al., 2011; Bushman and Williams, 2012; Aristei and Gallo, 2019) a significant and negative coefficient of the growth rate of GDP confirms provide evidence on the strong pro-cyclical pattern of LLPs.

We implemented a panel data approach using a model of fixed effects to test three hypotheses, that for the presence of income smoothing, capital management and the effect of components of LLPs on bank lending growth, in which we included variables usually applied in other studies. To examine the effect of these components of LLPs on lending behavior, first, the dependent variable (LLPs/TA) was analyzed with the independent variables included in the first equation.

A positive and significant result between EBTPs and LLPs would be compatible with the income smoothing hypothesis, implying that in periods of strong profitability banks raise their provisioning, whilst declines in profits contribute to the use of the earlier generated loan loss reserve buffers. It is important to note that EBTPs has a positive relationship but insignificant with LLPs. The positive sign of the coefficient of the EBTPs/ TA variable is consistent with the results of other authors (such as Bikker and Metzmakers 2005; Pérez et al., 2008; Fonseca and Gonzales 2008; Bouvatier and Lepetit, 2008 & 2012; Taktak et al., 2010). This is also the first way to test income smoothing directly through the positive coefficient of EBTPs/TA.

In addition, banks can use LLPs for capital management. The total capital ratio (CAP/TA) is used to capture this behavior for SEE banks. Findings show that the capital ratio coefficient is positive and statistically significant, contrary to the predictions of the capital management hypothesis. This confirms our third hypothesis that banks in SEE countries did not use the LLPs to manage their

capital. Therefore, is no statistical evidence to indicate that banks employ capital management through LLPs. This means that banks in SEE were well capitalized and have no need to use LLPs to manage their capital. Our findings, however, are similar to that reported by Fonseca and Gonzalez, (2008), Pérez et al. (2008), etc. According to Pérez et al. (2008) this indicates that the absence of capital management implies that banks adopt the strategy of covering expected losses with provisions and unexpected losses with capital.

The coefficient of variable NPL_TA is positive and significant (Tab. 3). According to Kanagaretnam et al. (2004) an increase in NPLs is likely to result in an increase in the LLPs. This is to say, with a higher level of beginning NPLs, banks should have to make higher LLPs. The risk of default (LOANS/TA) for the overall credit portfolio was also included in model following Bouvatier and Lepetit (2008), measured by the ratio of loans divided by total assets.

The ratio of loans to total asset is negative and significant (Tab. 3). After controlling for the rest of the variables, the business cycle does not affect bank's LLPs. Also, the variable of NPL_change is not statistically significant (Tab. 3). GDP growth is negative but is not statistically significant.

Table 3: The decomposition of loan loss provisions (Model 1)

LLPs/TA	Coefficient	(t-value)	P > t
EBTPs/TA	1.783	1.17	0.242
CAP/TA	0.046**	2.25	0.026
NPL/TA	11.961***	7.10	0.000
LOANS/TA	-0.029**	-2.58	0.010
GDPgr	-0.020	-0.95	0.341
NPL_change	-0.015	-0.23	0.819
_cons	-0.085	-0.07	0.945
Nr. of observations = 336			

Notes: Significant at: *10, * *5 and * * *1 percent levels. The results are from Eq. (1)

Variable definitions: LLPs/TA: loan loss provisions/total assets, CAP/TA: equity/total assets, NPL/TA: non-performing loans/gross loan, NPL_change: change in non-performing loans, EBTPs/TA: current earnings before tax and provisions/total assets, GDP growth rate.

Source: Author's calculations

The calculation of DISC and NDISC component of LLP is also estimated at equation (1). In NDISC component of provisions will include all those variables that are significant with the dependent variable (LLPs/TA) in equation (1). There are three significant variables: loans to total assets, capital to total assets and non-performing

loans to total assets. LLP's discretionary portion is the difference between LLPs and the non-discretionary portion. Then was tested for the presence of income smoothing by taking the DISC component of LLPs as a dependent variable (Tab. 4).

Table 4: Income smoothing in SEE countries (Model 3)

DISC	Coefficient	(t-value)	P > t
EBTPs_TA	3.124**	2.01	0.045
CAPITAL/TA	-0.976***	-43.21	0.000
LOANS/TA	-1.032***	-79.63	0.000
NPL_TA	11.517***	6.67	0.000
TA_log	-1.238***	-3.25	0.001
GDPgr	-0.023	-1.09	0.276
NPL_change	0.031	0.45	0.656
LOANS/DEPOSIT	-0.002	-0.63	0.528
_cons	16.207***	3.13	0.002
Nr. of observations = 336			

Notes: Significant at: *10, * *5 and * * *1 percent levels. The results are from Eq. (3)

Source: Author's calculations

With regard to the discretionary behavior, the findings are consistent with the assumption that banks use LLPs to smooth their incomes. Indeed, the coefficient of EBTPs is significant and positive (Tab. 4). The results indicate that banks in SEE countries have made income smoothing through LLPs, more precisely with the DISCs component of LLPs, thus confirming our first hypothesis. That means LLPs are deliberately understated when earnings are expected to be low to reduce adverse effects of other earnings factors. From the other side, banks choose discretionary income-reducing accruals when the earnings are unusually high. Thus, under the behavior of income smoothing; banks choose LLPs to minimize the variance in reported earnings. This means that LLPs rise during a period of growth and decline during a period of contraction. With respect to discretionary behavior, results are consistent with the existing literature (Kanagaretnam et al., 2003; Laeven and Majnoni, 2003; Anandarajan et al., 2007; Fonseca and Gonzales, 2008; Kwak, et al., 2009; Leventis et al., 2011; Shawtari et al., 2015) as find that banks are using the discretionary component of LLP to smooth their incomes. This is the main question in this study.

The second hypothesis of this paper is to investigate the effect of the DISC (income smoothing) and the NDISC on growth in bank lending. The results show that both variables are negative and statistically significant. The finding is in line with Bouvatier and Lepetit (2008 & 2012).

Table 5: The effect of discretionary vs. non-discretionary LLPs on bank lending (Model 4)

LOANS _{gr}	Coefficient	(t-value)	P > t
NDISC	-4.054***	-5.43	0.000
DISC	-4.297***	-5.89	0.000
DEPOSITS _{gr}	0.394***	5.52	0.000
TA_log	-10.293**	-2.13	0.035
CAPITAL/TA	-0.441	-1.31	0.192
_cons	139.883**	2.02	0.045
Nr. of observations = 230			

Notes: Significant at: *10, * *5 and * * *1 percent levels. The results are from Eq. (4b)

Source: Author's calculations

The coefficient of size is very important to highlight (Tab. 5). The estimation test shows the sign of variable of size is negative. This means that the discretionary component less emphatic at large banks. The results are similar with Cornett et al. (2009) and Shawtari et al. (2015) suggesting that smaller banks were more interested in the discretionary component. According to Cornett et al. (2009) larger banks are the ones most likely to be monitored by industry analysts. Likewise, whilst regulators are charged with maintaining the stability and soundness of the financial system as a whole, they at least appear to control the largest institutions more closely.

The coefficient associated with the growth rate of deposits is also significant and positive in all regressions. Shawtari et al. (2015) indicated that increased external financing requirements would inspire bankers to smooth their incomes. In order to draw more funds, managers are more encouraged to indulge in discretionary LLPs to smooth income and reduce instability. This confirms our second hypothesis which states that LLPs components have an effect on growth in bank lending in SEE countries.

5. Results and discussion

The results in the above section demonstrate the verification of three hypotheses. Firstly, the statistically significant coefficient of EBTP with DISC, indicates that banks in SEE countries use LLPs to smooth their incomes. Secondly, the positive coefficient of CAP ratio, explains that banks did not use the LLPs for capital management. Thirdly, the results clearly show that the components of LLPs do matter on growth in bank lending.

Following the implementation of the legislation (IFRS and Basel II & III) we would expect a decrease in the weight of the discretionary part of those provisions and, at the same time, an improvement in the portion of the provisions determined by credit risk considerations. However, providing a comprehensive collection of rules for LLPs does not preclude managers from decreasing volatility in earnings. The discussion on the usage of principles vs. comprehensive rules has drawn the attention of both accounting experts and setters of criteria (Pérez et al., 2008). The use of principles allows greater authority to managers, but this practice encourages authorities to ask for more comprehensive disclosure. Our paper indicates, though, that regulators ought to engage with accountants in an open discussion. It also reinforces the need for disclosure standards that increase bank transparency and control of the actions and incentives of bank managers by investors.

According to the results, banks in SEE countries did not use the LLPs for capital management. This shows that banks are well capitalized, but capital management motivations, do exist and may be a strong incentive for banks facing increased costs for violating capital requirements (Anandarajan et al., 2003).

We further jointly consider, in specification (4) the effect of the non-discretionary component and the total discretionary component of LLP on growth in lending. Both of them are negative and significant that is mean they are relevant to determine growth in lending (Bouvatier and Lepetit, 2008).

The evidence of these results for SEE countries should recommend increasing banking supervision by regulatory authorities and a higher quality of external audit.

Our analysis contributes to a growing body of literature in many ways: 1) prior studies focus on the level of a single country, reducing the generalization of findings. We use a specific dataset of 336 observations from 9 European countries; 2) this is the first study to test whether and how LLPs are being used in SEE countries for income smoothing and capital management.

6. Conclusion

There have been widely different reported management behavior characteristics in the banking loan loss provisioning literature, such as: income smoothing, capital management, etc. From the point of view of the banking regulators, LLPs should only be used to offset potential losses, but studies have also shown that LLPs are mainly used as an instrument for banks' capital management and income smoothing.

Our first hypothesis was to test whether bank managers use LLPs for income smoothing. Furthermore, the second hypothesis was to examine whether provisioning

practice amplifies growth in bank lending. In the absence of empirical literature on this topic in SEE countries, for a sample of banks with unbalanced data during the period 2005-2014, this study conducted research on income smoothing through LLPs. Income smoothing in regression model was verified through the relation between EBTP and LLPs and the relation between DISC component of the LLPs with EBTPs coefficient. Therefore, after separating the LLPs into the two components, the income smoothing was tested through the DISC component of the LLPs, the EBTPs coefficient has a positive sign and significant in favor of income smoothing. Also, results show that the DISC and NDISC components have a negative and significant effect on bank lending; therefore, both components are relevant to explain credit fluctuations. This common characteristic allows us to ensure that banking regulators could consider the beneficial aspects of a dynamic provisioning system. Our third hypothesis was to test the use of LLPs for capital management. Results also show that banks in SEE countries didn't use LLPs for capital management.

To the best information, this study represents the first effort of conducting research on income smoothing and effects of LLPs on growth on bank lending in SEE countries. The empirical evidence for income smoothing in SEE banks lay out here has substantial policy implications for national regulators, auditors, and investors, and the public at large. Despite the considerable effort exerted in conducting the study in order to ensure that the objectives of the study were met and research questions were answered, one of the limitations of the study is the small sample size. This study for the regulators can be very helpful, warning them to make effective policy restricting the intensive use of discretion over LLPs to manage their incomes. In addition, when reviewing, auditing, and expressing their opinion on financial statements, an auditor can pay more attention to the LLPs estimation policy. Future research could investigate other credit risk factors that influence the level of discretionary provisions among SEE banks. Also, future research could investigate whether discretionary provisions are influenced by the risk culture of banks SEE. Future studies should also include periods after 2014 in order to investigate the impact of IFRS 9 on the decrease or increase of the use of LLPs for income smoothing in SEE countries.

References

- Ahmed, A. S., Takeda, C., Thomas, S. (1999) "Bank loan loss provisions: a reexamination of capital management, earnings management and signaling effects", *Journal of accounting and economics*, Vol. 28, No.1, pp. 1–25, [https://doi.org/10.1016/S0165-4101\(99\)00017-8](https://doi.org/10.1016/S0165-4101(99)00017-8).
- Anandarajan, A., Hasan, I., Lozano-Vivas, A. (2003) "The role of loan loss provisions in earnings management, capital management, and signaling: The Spanish experience", *Advances in International Accounting*, Vol. 16, pp. 45–65, [https://doi.org/10.1016/S0897-3660\(03\)16003-5](https://doi.org/10.1016/S0897-3660(03)16003-5).

- Anandarajan, A., Hasan, I., McCarthy, C. (2007) "Use of loan loss provisions for capital, earnings management and signalling by Australian banks", *Accounting & Finance*, Vol. 47, No. 3, pp. 357–379, <https://doi.org/10.1111/j.1467-629x.2007.00220.x>.
- Abu-Serdaneh, J. (2018) "Bank loan-loss accounts, income smoothing, capital management, signaling and procyclicality", *Journal of Financial Reporting and Accounting*, Vol. 16, No. 4, pp. 677–693, <https://doi.org/10.1108/JFRA-06-2016-0041>.
- Aristei, D., Gallo, M. (2019) "Loan loss provisioning by Italian banks: Managerial discretion, relationship banking, functional distance and bank risk", *International Review of Economics & Finance*, Vol. 60, pp. 238–256, <https://doi.org/10.1016/j.iref.2018.10.022>.
- Beccalli, E., Poli, F. (2015) *Bank Risk, Governance and Regulation*, Springer.
- Beatty, A. et al. (1995) "Managing financial reports of commercial banks: The influence of taxes, regulatory capital, and earnings", *Journal of accounting research*, Vol. 33, No. 2, pp. 231–261, <https://doi.org/10.2307/2491487>.
- Beatty, A., Liao, S. (2014) "Financial accounting in the banking industry: A review of the empirical literature", *Journal of Accounting and Economics*, Vol. 58, Issues: 2-3, pp. 339–383, <https://doi.org/10.1016/j.jacceco.2014.08.009>.
- Bikker, J.A., Metzmakers, P.A. (2005) "Bank provisioning behaviour and procyclicality", *Journal of international financial markets, institutions and money*, Vol. 15, No. 2, pp. 141–157, <https://doi.org/10.1016/j.intfin.2004.03.004>.
- Bonin, J., Kosak, M. (2013) "Loan/Loss Provisioning in Emerging Europe: Precautionary or ProCyclical?" No. 2013-010, Wesleyan University, Department of Economics, <https://doi.org/10.1787/888932359891>.
- Bouvatier, V., Lepetit, L. (2008) "Banks' procyclical behavior: Does provisioning matter?", *Journal of international financial markets, institutions and money*, Vol. 18, No. 5, pp. 513–526, <https://doi.org/10.1016/j.intfin.2007.07.004>.
- Bouvatier, V., Lepetit, L. (2012) "Effects of loan loss provisions on growth in bank lending: some international comparisons", *Economie internationale*, Vol. 132, pp. 91–116, <https://doi.org/10.2139/ssrn.1663580>.
- Bouvatier, V., Lepetit, L., Strobel, F. (2014) "Bank income smoothing, ownership concentration and the regulatory environment", *Journal of Banking & Finance*, Vol. 41, No. 1, pp. 253–270, <https://doi.org/10.1016/j.jbankfin.2013.12.001>.
- Bushman, R.M., Williams, C.D. (2012) "Accounting discretion, loan loss provisioning, and discipline of banks' risk-taking", *Journal of Accounting and Economics*, Vol. 54, No. 1, pp. 1–18, <https://doi.org/10.1016/j.jacceco.2012.04.002>.
- Bushman, R. M., Williams, C. D. (2015) "Delayed expected loss recognition and the risk profile of banks", *Journal of Accounting Research*, Vol. 53, No. 3, pp. 511–553, <https://doi.org/10.1111/1475-679x.12079>.

- Bryce, C. et al. (2015) “An analysis of loan loss provisioning behaviour in Vietnamese banking”, *Finance Research Letters*, Vol. 14, pp. 69–75, <https://doi.org/10.1016/j.frl.2015.05.014>.
- Caporale, G. M. et al. (2018) “Loan loss provisions and macroeconomic shocks: Some empirical evidence for Italian banks during the crisis”, *Finance Research Letters*, Vol. 25, pp. 239–243, <https://doi.org/10.1016/j.frl.2017.10.031>.
- Collins, J. D. et al. (1995) “Bank differences in the coordination of regulatory capital, earnings and taxes”, *Journal of Accounting Research* Vol. 33, No. 2, pp. 263–292, <https://doi.org/10.2307/2491488>.
- Cornett, M. M., McNutt, J. J., Tehranian, H. (2009) “Corporate governance and earnings management at large US bank holding companies”, *Journal of Corporate Finance*, Vol. 15, No. 4, pp. 412–430, <https://doi.org/10.1016/j.jcorpfin.2009.04.003>.
- Curcio, D., Hasan, I. (2015) “Earnings and capital management and signaling: the use of loan-loss provisions by European banks”, *The European Journal of Finance*, Vol. 21, No.1, pp. 26–50, <https://doi.org/10.1080/1351847x.2012.762408>.
- Curcio, D., De Simone, A., Gallo, A. (2017) “Financial crisis and international supervision: New evidence on the discretionary use of loan loss provisions at Euro Area commercial banks”, *The British Accounting Review*, Vol. 49, No. 2, pp. 181–193, <https://doi.org/10.1016/j.bar.2016.09.001>.
- Cucinelli, D. (2015) “The impact of non-performing loans on bank lending behavior: evidence from the Italian banking sector”, *Eurasian Journal of Business and Economics*, Vol. 8, No. 16, pp. 59–71, <https://doi.org/10.17015/ejbe.2015.016.04>.
- Fonseca, A.R., Gonzalez, F. (2008) “Cross-country determinants of bank income smoothing by managing loan-loss provisions”, *Journal of Banking & Finance*, Vol. 32, No. 2, pp. 217–228, <https://doi.org/10.1016/j.jbankfin.2007.02.012>.
- Habib, A. et al. (2020) “Financial statement comparability, earnings smoothing and loan-loss provisioning in banking”, *Earnings Smoothing and Loan-Loss Provisioning in Banking*, <http://dx.doi.org/10.2139/ssrn.3622974>.
- García-Alcober, M. et al. (2019) “Risk-taking behavior, earnings quality, and bank performance: A profit frontier approach”, *BRQ Business Research Quarterly*, <https://doi.org/10.1016/j.brq.2019.02.003>.
- Ghosh, A. (2015) “Banking-industry specific and regional economic determinants of non-performing loans: Evidence from US states”, *Journal of financial stability*, Vol. 20, pp. 93–104, <https://doi.org/10.1016/j.jfs.2015.08.004>.
- Jin, J. Y., Kanagaretnam, K., & Liu, Y. (2018) “Banks’ funding structure and earnings quality”, *International Review of Financial Analysis*, Vol. 59, pp. 163–178, <https://doi.org/10.1016/j.irfa.2018.08.009>.
- Kanagaretnam, K., Lobo, G. J., Mathieu, R. (2003) “Managerial incentives for income smoothing through bank loan loss provisions”, *Review of Quantitative Finance and Accounting*, Vol. 20, No. 1, pp. 63–80, <https://doi.org/10.2139/ssrn.292674>.

- Kanagaretnam, K., Lobo, G. J., & YANG, D. H. (2004) “Joint tests of signaling and income smoothing through bank loan loss provisions”, *Contemporary Accounting Research*, Vol. 21, No. 4, pp. 843–884, <https://doi.org/10.1506/udwq-r7b1-a684-9ecr>.
- Kanagaretnam, K., Lobo, G. J., Mathieu, R. (2004a) “Earnings management to reduce earnings variability: Evidence from bank loan loss provisions”, *Review of Accounting and Finance*, Vol. 3, No. 1, pp. 128–148, <https://doi.org/10.1108/eb043399>.
- Kim, M.S., Kross, W. (1998) “The impact of the 1989 change in bank capital standards on loan loss provisions and loan write-offs”, *Journal of Accounting and Economics*, Vol. 25, No. 1, pp. 69–99, [https://doi.org/10.1016/s0165-4101\(98\)00015-9](https://doi.org/10.1016/s0165-4101(98)00015-9).
- Kwak, W., Lee, H. Y., Eldridge, S. W. (2009) “Earnings management by Japanese bank managers using discretionary loan loss provisions”, *Review of Pacific Basin Financial Markets and Policies*, Vol. 12, No. 1, pp. 1–26, <https://doi.org/10.1142/s0219091509001526>.
- Laeven, L., Majnoni, G. (2003) “Loan loss provisioning and economic slowdowns: too much, too late?”, *Journal of financial intermediation*, Vol. 12, No. 2, pp. 178–197, [https://doi.org/10.1016/s1042-9573\(03\)00016-0](https://doi.org/10.1016/s1042-9573(03)00016-0).
- Leventis, S., Dimitropoulos, P. E., & Anandarajan, A. (2011) “Loan loss provisions, earnings management and capital management under IFRS: The case of EU commercial banks”, *Journal of Financial Services Research*, Vol. 40, No. 1-2, pp. 103–122, <https://doi.org/10.1007/s10693-010-0096-1>.
- Lobo, G.J., Yang, D.H. (2001) “Bank managers’ heterogeneous decisions on discretionary loan loss provisions”, *Review of Quantitative Finance and Accounting*, Vol. 16, No. 3, pp. 223–250, <https://doi.org/10.1023/a:1011284303517>.
- Majnoni, G., Cavallo, M. (2001) “Do banks provision for bad loans in good times? Empirical evidence and policy implications”, The World Bank, <https://doi.org/10.1596/1813-9450-2619>.
- Morris, R. D., et al. (2016) “The determinants and value relevance of banks’ discretionary loan loss provisions during the financial crisis”, *Journal of Contemporary Accounting & Economics*, Vol. 12, No. 2, pp. 176–190, <https://doi.org/10.1016/j.jcae.2016.07.00>.
- Norden, L., Stoian, A., (2014) “Bank earnings management through loan loss provisions: a double-edged sword?”, De Nederlandsche Bank Working Paper No. 404, <http://dx.doi.org/10.2139/ssrn.2369798>.
- Olszak, M. (2012) “Procyclicality of Loan Loss Provisions – The Case of Poland”, *Advances in Business-Related Scientific Research Journal*, Vol. 3, No. 2, pp. 20–32, Available at SSRN: <<https://ssrn.com/abstract=2378305>> [Accessed: 07.08.2020].

- Olszak, M. et al. (2017) "What drives heterogeneity of cyclicity of loan-loss provisions in the EU?", *Journal of Financial Services Research*, Vol. 51, No. 1, pp. 55–96, <https://doi.org/10.1007/s10693-015-0238-6>.
- Othman, H. B., Mersni, H. (2014) "The use of discretionary loan loss provisions by Islamic banks and conventional banks in the Middle East region: A comparative study", *Studies in Economics and Finance*, Vol. 31, No. 1, pp. 106–128, <https://doi.org/10.1108/sef-02-2013-0017>.
- Ozili, P. K. (2017) "Discretionary provisioning practices among Western European banks", *Journal of Financial Economic Policy*, Vol. 9, No. 1, pp. 109–118, <https://doi.org/10.1108/JFEP-07-2016-0049>.
- Ozili, P. K. (2018) "Bank loan loss provisions, investor protection and the macroeconomy", *International Journal of Emerging Markets*, Vol. 13, No. 1, pp. 45–65, <https://doi.org/10.1108/IJoEM-12-2016-0327>.
- Ozili, P. K. (2019) "Bank loan loss provisions, risk-taking and bank intangibles", *Afro-Asian Journal of Finance and Accounting*, Vol. 9, No. 1, pp. 21–39, <https://doi.org/10.1504/AJFA.2019.096910>.
- Ozili, P. K., Outa, E. R. (2018) "Bank income smoothing in South Africa: role of ownership, IFRS and economic fluctuation", *International Journal of Emerging Markets*, Vol. 13, No. 5, pp. 1372–1394, <https://doi.org/10.1016/j.bar.2018.03.001>.
- Ozili, P. K., Thankom G. A. (2018) "Income smoothing among European systemic and non-systemic banks", *The British Accounting Review*, Vol. 50, No. 5, pp. 539–558, <https://doi.org/10.1016/j.bar.2018.03.001>.
- Packer, F., Zhu, H. (2012) "Loan loss provisioning practices of Asian banks", Bank for International Settlements, No. 375, <http://dx.doi.org/10.2139/ssrn.2038215>.
- Pérez, D., Salas-Fumas, V., Saurina, J. (2008) "Earnings and capital management in alternative loan loss provision regulatory regimes", *European Accounting Review*, Vol. 17, No. 3, pp. 423–445, <https://doi.org/10.1080/09638180802016742>.
- Simper, R., Dadoukis, A., Cormac, B. B. (2019) "European bank loan loss provisioning and technological innovative progress", *International Review of Financial Analysis*, Vol. 63, pp. 119–130, <https://doi.org/10.1016/j.irfa.2019.03.001>.
- Shawtari, F.A. et al. (2015) "The impact of efficiency on discretionary loans/finance loss provision: A comparative study of Islamic and conventional banks", *Borsa Istanbul Review*, Vol. 15, No. 4, pp. 272–282, <https://doi.org/10.1016/j.bir.2015.06.002>.
- Shrieves, R.E., Dahl, D. (2003) "Discretionary accounting and the behavior of Japanese banks under financial duress", *Journal of Banking & Finance*, Vol. 27, No. 7, pp. 1219–1243, [https://doi.org/10.1016/s0378-4266\(02\)00252-2](https://doi.org/10.1016/s0378-4266(02)00252-2).
- Skąła, D. (2015) "Income Smoothing and Procyclicality of Loan Loss Provisions in Central European Banks", *International Finance*, Vol. 1, No. 18, pp. 25–46, <https://doi.org/10.1111/1468-2362.12058>.

- Soedarmono, W. et al. (2012) “Loan loss provisions and lending behaviour of banks: Asian evidence during 1992-2009, Available at SSRN: <https://ssrn.com/abstract=2049217> or <http://dx.doi.org/10.2139/ssrn.2049217>.
- Soedarmono, W., Pramono, S. E., Tarazi, A. (2017) “The procyclicality of loan loss provisions in Islamic banks”, *Research in International Business and Finance*, Vol. 39, pp. 911–919, <https://doi.org/10.1016/j.ribaf.2016.05.003>.
- Škarica, B. (2014) “Determinants of non-performing loans in Central and Eastern European countries”, *Financial theory and practice*, Vol. 38, No. 1, pp. 37–59, <https://doi.org/10.3326/fintp.38.1.2>.
- Taktak, N. B., Zouari, S. B. S., Boudriga, A. (2010) “Do Islamic banks use loan loss provisions to smooth their results?”, *Journal of Islamic Accounting and Business Research*, Vol.1, No. 2, pp. 114–127, <https://doi.org/10.1108/17590811011086714>.
- Taktak, N. B., Shabou, R., Dumontier, P. (2010a) “Income smoothing practices: evidence from banks operating in OECD countries”, *International Journal of Economics and Finance*, Vol. 2, No. 4, pp. 140–151, <https://doi.org/10.5539/ijef.v2n4p140>.
- Tran, D. V., Hassan, M. K., Houston, R. (2019) “Discretionary loan loss provision behavior in the US banking industry”, *Review of Quantitative Finance and Accounting*, Vol. 55, pp. 1–41, <https://doi.org/10.1007/s11156-019-00854-z>.
- Vishnani, S., Agarwal, S., Agarwalla, R., Gupta, S. (2019) “Earnings management, capital management and signaling behaviour of Indian banks”, *Asia-Pacific Financial Markets*, Vol. 26, No. 3, pp. 285–295, <https://doi.org/10.1007/s10690-018-09265-x>.
- Wahlen, J.M. (1994) “The nature of information in commercial bank loan loss disclosures”, *The Accounting Review*, Vol. 69, pp. 455–478, <http://www.jstor.org/stable/248234>.
- Wu, M. W., Shen, C. H., Lu, C. H. (2015) “Do more foreign strategic investors and more directors improve the earnings smoothing? The case of China”, *International Review of Economics & Finance*, Vol. 36, pp. 3–16, <https://doi.org/10.1016/j.iref.2014.11.003>.

Podešavanje prihoda kroz rezervacije za gubitke po kreditima u bankama Južne i Istočne Europe

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Sažetak

Ovo istraživanje primjenom brojnih metodoloških pristupa pruža empirijske dokaze o izravnavanju prihoda u bankarskom sektoru u devet zemalja jugoistočne Europe (JIE) za razdoblje 2005.-2014. Prvo, korištenjem uzorka od 321 banke, ovaj rad potvrđuje našu prvu hipotezu da banke u regiji Jugoistočne Europe koriste rezervacije za gubitke po kreditima (LLP) kako bi izravnale svoje prihode. Drugo, dijeljenjem rezerviranja za kreditne gubitke na njegove dvije komponente (diskrecijsku i ne-diskrecijsku), ovo istraživanje pruža nove dokaze o učincima komponenata rezervacija za kreditne gubitke na rast bankarskog kreditiranja. Rezultati jasno potvrđuju našu drugu hipotezu da su komponente LLP-a bitne za rast bankarskog kreditiranja. Treće, ovaj rad procjenjuje upotrebu banaka za rezerviranje gubitaka po kreditima za upravljanje kapitalom. Empirijski rezultati ne podupiru hipotezu o upravljanju kapitalom za banke u jugoistočnoj Europi. Za razliku od ostalih istraživanja, novost u ovome radu je uključivanje zemalja jugoistočne Europe..

Ključne riječi: rezervacije za gubitke po kreditima, banke Južne i Istočne Europe, izravnanje prihoda, hipoteza o upravljanju kapitalom, diskrecijska komponenta, ne-diskrecijska komponenta.

JEL klasifikacija: G21, M10, M41, M49

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The effect of regulatory changes on relationship between earnings management and financial reporting timeliness: The case of COVID-19 pandemic*

Toni Šušak¹

Abstract

The purpose of this paper was to examine the effect of regulatory changes regarding financial reporting deadlines introduced because of COVID-19 pandemic on relationship between earnings management and financial reporting timeliness. Using sample of companies listed on stock exchange in Republic of Croatia for the period from 2015 to 2019, pooled OLS regression model was estimated with panel data. Financial reporting timeliness was measured with financial reporting delay, while level of earnings management was proxied by discretionary accruals. Empirical results supported the hypothesis that the aforementioned changes of regulatory framework during the extraordinary pandemic circumstances had a statistically significant positive effect on relationship between earnings management and financial reporting delay, indicating that financial reporting delays after regulatory changes during pandemic could be attributed to earnings management activities. Furthermore, after separating income-increasing and income-decreasing accruals, moderating effect of regulatory changes was significant and negative only in case of income decreasing accruals, suggesting that companies were adjusting their financial information in accordance with pessimistic economic forecasts to mitigate probable profitability deterioration in future periods.

Key words: COVID-19, coronavirus, earnings management, financial reporting delay, financial reporting timeliness

JEL classification: G01, K20, M41, M42

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1. Introduction

The worldwide outbreak of the COVID-19, which was declared as a pandemic on 11th March 2020, has had an intensive impact on all aspects of life, as well as business activities. This catastrophic event led to halt of international trade and national lockdowns intended to limit spreading of virus. Suddenly, many prosperous companies had been affronted with extreme reduction of demand for their products. With the exception of few industries that highly benefited on situation, such as food production, almost all of them were negatively affected, especially service industries, such as tourism and aviation (He et al., 2020). Large companies were less susceptible to financial repercussions than small and medium companies (Rababah et al., 2020). Uncertainty deepened by media coverage (Haroon and Rizvi, 2020), proved to be detrimental for financial markets where most of the companies experienced extreme volatility that wiped out 25 percent of shareholders' wealth worldwide (Ali et al., 2020).

This situation stressed the need for urgent reactions to alleviate repercussions of economic standstill and stimulate economic activity, such as moratorium on repayments of loans, various fiscal reliefs etc. Among these measures, regulatory actions were taken in order to extend deadlines for disclosing financial information to public. At the time, some companies already submitted their financial statements prior to deadline extension, certain of them decided not to exercise the right on additional reporting time, while significant number of them did so. Investors and other stakeholders scrutinize various aspects of business operations in order to determine future financial prospects of a company, and the time needed to deliver financial statements is one of them.

Despite the importance investors attach to financial reporting timeliness and the fact that deadline for submission of financial statements was relatively close, considerable part of companies decided to exercise the right provided by regulatory changes. In this context, potential problem arises because accounting standards offer flexibility in financial reporting which could be opportunistically abused. Given that stakeholders were probably more tolerant in assessment of corporate reporting behaviour because of ongoing pandemic, there was a possibility that companies tried to utilize accounting discretion in order to adjust to pessimistic expectations for future.

The objective of this paper was to determine the effect of financial reporting regulation changes during COVID-19 pandemic on relationship between earnings management and financial reporting timeliness. It was hypothesized that regulatory changes that extended financial reporting deadlines introduced during COVID-19 pandemic had statistically significant and positive moderating effect on the relationship between earnings management and accounting information delay. This relationship was also examined after dividing discretionary accruals, which are

used as a measure of earnings management, into income-increasing and income-decreasing. Considering the previous research in this field, hypotheses were formulated as follows:

Hypothesis 1 – There is a statistically significant and positive moderating effect of regulatory changes extending financial reporting deadlines introduced during COVID-19 pandemic on the relationship between earnings management and financial reporting delay.

Hypothesis 2 – There is a statistically significant and positive moderating effect of regulatory changes extending financial reporting deadlines introduced during COVID-19 pandemic on the relationship between income-increasing earnings management and financial reporting delay.

Hypothesis 3 – There is a statistically significant and negative moderating effect of regulatory changes extending financial reporting deadlines introduced during COVID-19 pandemic on the relationship between income-decreasing earnings management and financial reporting delay.

The remainder of paper is organized as follows – section 2 comprises literature relevant for the development of research hypotheses, in section 3, the methodology used for data collection and hypotheses testing was specified and in section 4, the research sample was described and results of empirical analysis provided. Section 5 contains explanations of results shown in previous section, their comparison with existing research, as well as scientific and practical implications. Section 6 concluded the paper with a discussion on hypotheses acceptance, scientific contribution of research, limitations and avenues for future research.

2. Literature review

According to the timeline provided by the World Health Organization, COVID-19 pandemic has started on the eve of 2020 when several cases of pneumonia were reported (World Health Organization, 2020a). Two weeks after, the first case outside China was recorded in Thailand and on 30th January, when the COVID-19 had already spread to 18 countries worldwide, the World Health Organization's Emergency Committee confirmed concerns for international health by giving high risk assessment (World Health Organization, 2020a). Finally, global pandemic was declared on 11th March 2020 because of "the alarming levels of spread and severity" (World Health Organization, 2020a). First European cases of coronavirus contagion were confirmed in France on 24th January (World Health Organization Europe, 2020b). Briefly after – on 27th January, first cases were also detected in Italy (Reuters, 2020), neighbouring country of Croatia. The initial case in the Republic of Croatia was recorded on 25th February 2020 (Croatian Institute of Public Health, 2020).

The outbreak of coronavirus was an event unparalleled for decades which caused a sudden and intense impact on economic activities and financial markets worldwide. The approximate 11 percent fall of China's stock market index CSI 300 from 23rd January to 3rd February 2020 (China Securities Index, n. d.) was the overture of subsequent financial repercussions in other countries. U. S. stock market index S&P 500 plunged nearly 34 percent from 20th February to 23rd March 2020 (Bloomberg, n. d.). The value decrease of Croatian index CROBEX and its timeline was identical (Zagreb Stock Exchange, n. d.).

At the time, it was not evident how long will the crisis last nor how detrimental its effects will be, what created favourable environment for earnings management behaviour. When confronted with pressure, company's management can be tempted to manipulate accounting information. Previous research in this area are inconclusive given that some of them proved increase of earnings management during financial and economic crises (Da Silva et al., 2014; Flores et al., 2016; Koowattananai, 2018), while others document decrease of earnings management during crisis, attributing it to poor corporate performance which reduced purposefulness of earnings management (Chintrakarn et al., 2018) or need to attract investors (Cimini, 2015). Economic crisis which resulted from pandemic of COVID-19 isn't comparable to any of crises over the period of last few decades. It was sudden and caused by non-economic reason which had an intense economic and social impact worldwide. From macroeconomic standpoint, there was a stable growth of Croatian economy as well as Croatian stock market just before the COVID-19 outbreak. Preparation of financial statements for public disclosure was under way and then, all of a sudden, unexpected catastrophic event disrupted all activities and radically changed future economic prospects for subsequent years.

From theoretical standpoint of fraud triangle² (Cressey, 1950; Schuchter and Levi, 2016), this was the motivation for companies to adjust their financial results to future expectations. Second component of fraud triangle was opportunity for prolonging public disclosure of audited non-consolidated and consolidated financial statements that emerged with enactment of Law amending and supplementing the Accounting Act (Official Gazette, 2020a), which introduced legal concept of "special circumstances", and Regulation on deadlines for submission of financial statements and accounting documentation in special circumstances (Official Gazette, 2020b). Until that moment, there were three deadlines for submitting non-consolidated and consolidated financial statements stipulated in Accounting Act (Official Gazette, 2015, Art. 30 and 32) – first deadline was for submitting financial reports for statistical purposes (30th April 2020), second deadline was for public disclosure of non-consolidated financial statements (30th June 2020), while

2 Not all earnings management activities are fraudulent, but fraud triangle can be applied in terms of earnings management because of similar cognitive processes that managers experience.

third one was for consolidated financial statements (30th September 2020). After the regulatory changes, first two deadlines were prolonged for two months, while third one was prolonged for one month (Official Gazette, 2020b). It is important to note that Croatian financial reporting framework is specific because of business community's tacit consensus of the 30th April as a final deadline for submitting all of these statements, until which large majority of listed companies usually publicly discloses audited financial information.

Given that they are "often the only reliable sources of information" (Leventis et al., 2005, in Ghafran and Yasmin, 2018: 9), the date of public disclosure of audited financial statements is highly important to investors and other stakeholders, creating pressure for large companies to reduce delays in delivering such information (Dyer and McHugh, 1975, in Ashton et al., 1989). Timely financial information is relevant for protection of investors (Al-Ajmi, 2008; Turel, 2010, in Agyei-Mensah, 2018) and decision-making (Efobi and Okougbo, 2014; Agyei-Mensah, 2018). If they are not provided with timely audited information, investors may resort to alternative sources (Knechel and Payne, 2001). Significant number of authors highlight the importance of financial reporting timeliness as qualitative characteristic of accounting information (Payne and Jensen, 2002, in Cohen and Leventis, 2013; Chan et al., 2016).

Financial reporting timeliness can be classified by two aspects (Abernathy et al., 2017): (1) frequency of interim reports and (2) reporting delay. Latter aspect, which is also a subject of this research, can be measured with a number of days between the first day of financial year and the date of publicly disclosing financial statements – financial reporting delay (Atiase et al., 1989, in Reheul et al., 2014; Clatworthy and Peel, 2016) or number of days between the first day of financial year and the date of audit report – audit report delay (Ashton et al., 1987, in Abernathy et al., 2017; Nelson et al., 2019). Duration of audit process is considered to be cardinal determinant of reporting timeliness (Sultana et al., 2014; Chan et al., 2016).

From the academic standpoint, the importance of financial reporting timeliness is denoted by abundance of research which analysed it in relation to various variables such as audit committee characteristics (Abernathy et al., 2015; Salleh et al., 2017; Ghafran and Yasmin, 2018; Bhuiyan and D'Costa, 2020), chief executive officer characteristics (Baatwah et al., 2015), financial reporting inspections (Yuan et al., 2020), auditor industry specialization and auditor reputation (Rusmin and Evans, 2017), religiosity (Al-Ebel et al., 2020), auditor narcissism (Church, 2020) etc.

Previous studies had not given so much attention on relationship between reporting timeliness and earnings management. Asthana (2014) documented negative relationship between abnormal audit delays and earnings quality and stated that delays influence perception of investors who take them into account when analysing company's earnings. Identical conclusions were made by Luypaert et al. (2016: 29)

who asserted that “extremely late filings can be considered as an important negative signal with regard to the quality of the financial statements”. In this context, Habib and Huang (2019: 20) founded positive relationship between audit report delay and future price crash and noticed that their results are in line with remark that “excessively long audit report delay often signals financial reporting quality issues emanating from bad news hoarding by the management”. Since companies have strong incentives to make early disclosures of financial information because of an inverse relationship between disclosing earnings and share prices (Chambers and Penman, 1984, Kross and Schroeder, 1984, in Trueman, 1990), it is not rational for them to lengthen the process of financial reporting. With regard to business environment’s complexity, mentioned elongation could be explained by other benefits which exceed the advantages of timely disclosure.

Lambert et al. (2017) documented a negative effect of shortened reporting deadlines on earnings quality, but situation analysed in this paper is opposite. It is questionable if additional time for financial reporting was counter-effective, providing legalised opportunity for adjusting accounting information, given that it could mitigate investors’ negative perception regarding financial reporting delay in these extraordinary circumstances. Furthermore, DeFond and Park (1997) founded that after financially successful year and when estimated performance in future is below that standard, management has tendency to transfer earnings to the future period and vice versa. Since COVID-19 crisis occurred shortly after the end of previous financial year, companies found themselves in a position to shift part of their income from previous year to the turbulent period ahead of them.

Chai and Tung (2002: 3) stated that “market anticipates unfavourable earnings news when it observes reporting delays” and that “late reporters appear to make the most of a bad situation by employing income-decreasing accruals in big-bath-type earnings management”. Similar findings were presented by Rahmawati (2018: 12) who founded that companies with a prolonged reporting period have higher discretionary accruals because they “store up income-increasing accruals potential for subsequent periods”. Previous notions are complemented by remarks that auditors are more sensitive to client’s income-increasing accruals since they increase litigation risk (Lys and Watts, 1994; Heninger, 2001). The above statements were motivation for establishment of two additional hypotheses in order to differentiate income-increasing and income-decreasing earnings management behaviour in context of this research.

As said before, COVID-19 had an enormous impact on business activities. Some researchers have determined its negative impact on financial matters such as financial performance of listed companies (Rababah et al., 2020; Shen et al., 2020), negative effect of media on financial markets (Haroon and Rizvi, 2020) etc. But, as far as the author is aware, earnings management and financial reporting timeliness during COVID-19 pandemic were not the subject of this research.

3. Methodology of analysis

As stated in the previous section, one of the alternatives for measuring financial reporting timeliness is using financial reporting delay, i.e. number of days between the first day of financial year and the date of submitting financial statements for the public disclosure, which was also applied in this research. Discretionary accruals as a measure of earnings management were estimated with Modified Jones model (Ilmas et al., 2018):

$$TA_{it} / A_{it-1} = \alpha_1 [1 / A_{it-1}] + \alpha_2 [\Delta INC_{it} - \Delta REC_{it} / A_{it-1}] + \alpha_3 [PPE_{it} / A_{it-1}] + \mu_{it} \quad (1)$$

where TA_{it} = total accruals for company i at the end of financial year t , A_{it-1} = total assets for company i at the end of previous financial year $t-1$, ΔINC_{it} = difference in income between financial year t and financial year $t-1$ for company i , ΔREC_{it} = difference in account receivables between financial year t and financial year $t-1$ for company i , PPE_{it} = property, plant and equipment for company i at the end of financial year t , α_1 , α_2 and α_3 = regression coefficients and μ_{it} = residual (measure of discretionary accruals).

Total accruals were calculated as difference between net income and net operating cash flows. Absolute discretionary accruals were calculated for model 1 expressed in eq. (2) because they incorporate both income-increasing and income-decreasing manipulation (Becker, 1998, in Katmon and Al Farooque, 2017). Positive discretionary accruals had been used in model 2 expressed in eq. (3), while negative discretionary accruals were used in model 3 expressed in eq. (4). In order to test established hypothesis, following research models were estimated:

$$FRD_{i,t} = \beta_0 + \beta_1 * ADAC_{i,t} + \beta_2 * C19_{i,t} + \beta_3 * ADAC \times C19_{i,t} + \beta_4 * AO_{i,t} + \beta_5 * ROT_{i,t} + \beta_6 * BIG4_{i,t} + \beta_7 * SUBS_{i,t} + \beta_8 * SIZE_{i,t} + \beta_9 * ROA_{i,t} + \beta_{10} * LOSS_{i,t} + \beta_{11} * LEV_{i,t} + \beta_{12} * RIA_{i,t} + u_{i,t} \quad (2)$$

$$FRD_{i,t} = \beta_0 + \beta_1 * PDAC_{i,t} + \beta_2 * C19_{i,t} + \beta_3 * PDAC \times C19_{i,t} + \beta_4 * AO_{i,t} + \beta_5 * ROT_{i,t} + \beta_6 * BIG4_{i,t} + \beta_7 * SUBS_{i,t} + \beta_8 * SIZE_{i,t} + \beta_9 * ROA_{i,t} + \beta_{10} * LOSS_{i,t} + \beta_{11} * LEV_{i,t} + \beta_{12} * RIA_{i,t} + u_{i,t} \quad (3)$$

$$FRD_{i,t} = \beta_0 + \beta_1 * NDAC_{i,t} + \beta_2 * C19_{i,t} + \beta_3 * NDAC \times C19_{i,t} + \beta_4 * AO_{i,t} + \beta_5 * ROT_{i,t} + \beta_6 * BIG4_{i,t} + \beta_7 * SUBS_{i,t} + \beta_8 * SIZE_{i,t} + \beta_9 * ROA_{i,t} + \beta_{10} * LOSS_{i,t} + \beta_{11} * LEV_{i,t} + \beta_{12} * RIA_{i,t} + u_{i,t} \quad (4)$$

where *dependent variable* is FRD = financial reporting delay – number of days between the first day of financial year and the date of publicly disclosing financial statements; *test variables* are $ADAC$ = value of absolute discretionary accruals; $PDAC$ = value of positive discretionary accruals; $NDAC$ = value of negative

discretionary accruals; C19 = year in which financial statements were publicly disclosed (dichotomous variable: 1 = year of COVID-19 related financial reporting regulatory changes; 0 = other years); ADAC x C19 = interaction between value of absolute discretionary accruals and year in which financial statements were publicly disclosed; PDAC x C19 = interaction between value of positive discretionary accruals and year in which financial statements were publicly disclosed; NDAC x C19 = interaction between value of negative discretionary accruals and year in which financial statements were publicly disclosed; *control variables* are AO = independent auditor's opinion (dichotomous variable: 1 = positive opinion; 0 = modified opinion); ROT = auditor rotation (dichotomous variable: 1 = new auditor appointed in year considered, 0 = no changes of auditor); BIG4 = auditor type (dichotomous variable: 1 = Big Four audit company; 0 = not Big Four audit company); SUBS = number of subsidiaries; SIZE = natural logarithm of total assets; ROA = return on assets (net income/total assets); LOSS = financial result (dichotomous variable: 1 = negative financial result – loss; 0 = positive financial result – profit); LEV = leverage (total liabilities to total assets); RIA = receivables and inventories to total assets; u = model error; β_0 = regression model intercept and $\beta_1 - \beta_{12}$ = coefficients of explanatory variables included in model.

Considering the results and remarks made in previous research, several control variables that might be associated with the financial reporting timeliness were included in model to enhance its predictive value and reduce omitted variables issue. These could be classified into client-specific and auditor-related characteristics (Ika and Ghazali, 2012, in Abernathy et al., 2017).

Client-specific characteristics are size, leverage and financial performance. Larger companies are expected to have shorter duration of audits (Ashton et al., 1987; Carslaw and Kaplan, 1991, Ettredge et al., 2006, Afify, 2009, in Oussii and Taktak, 2018). This effect is due to more intensive monitoring activities conducted by investors and other stakeholders (Dyer and McHugh, 1975, in Ashton et al., 1989), as well as more resources which they have on their disposal (Abernathy et al., 2017) that could be utilized for strengthening internal control system (Nelson et al., 2019). Also, it is likely that they will ensure higher financial reporting quality (Schmidt and Wilkins, 2013). They also have higher capacity to resist client's persistence regarding certain accounting issues (Goldman and Barlev, 1974, in Deis and Giroux, 1992) since they have reputation to safeguard (Deis and Giroux, 1992). Size of the company was also included in models constructed by Chan et al. (2016) and Abernathy et al. (2018).

Highly leveraged companies have higher probability of not meeting their loan obligations, what puts them under auditor scrutiny (Chan et al., 2016) and, consequently, increased time for conducting audit engagement (Nelson et al., 2019). On the other side, high leverage might decrease audit risk by attracting the attention of creditors as an additional monitoring mechanism (Chan et al., 2016). This variable was also incorporated in model formulated by Abernathy et al. (2014).

Financial performance measures were included because companies with lower profits and companies experiencing losses are inclined to disclose financial information later in comparison to more successful companies (Begley and Fischer, 1998, in Abernathy et al., 2018), which are motivated to communicate favourable news to public as soon as possible (Aubert, 2009). In line with these ideas are notions presented in papers by Chan et al. (2016), Abernathy et al. (2017) and Oussii and Taktak (2018). Furthermore, companies struggling in area of profitability will be perceived as risky by auditors (Che-Ahmad and Abidin, 2008, in Nelson et al., 2019), leading to increased workload (Nelson et al., 2019).

Given the high importance of audit process in determining financial reporting timeliness, variables estimating some of its aspects were included as control variables. Auditor's affiliation to reputable Big Four audit companies (Deloitte, Ernst & Young, KPMG and PricewaterhouseCoopers) is an indication of higher efficiency audit engagement, which is expected to shorten its duration (Abernathy et al., 2018). Those companies have greater capacity to attract human resources of highest quality (Sultana et al., 2014) and reputational capital (Afify, 2009, in Abernathy et al., 2017).

If independent auditor's opinion includes modification, it is likely that the financial reporting timeliness will be affected (Abernathy et al., 2018; Oussii and Taktak, 2018). Habib (2013) confirmed positive relationship between audit report delay and audit opinion modification stating disagreements between auditor and client, increased workload related to encountered problems (Habib, 2013) or perceived risk (Ireland, 2003, in Habib, 2013) as potential reasons to it.

Auditor rotation is expected to lengthen reporting process (Wan Hussin et al., 2018) because of inevitable adaptation time to new client (Ashton et al., 1987, in Abernathy et al., 2017) in order to increase knowledge on their business operations (Oussii and Taktak, 2018).

Complexity of client's operations is expected to prolong audit activities (Ashton et al., 1989, in Abernathy et al., 2017) and it is expressed with value of receivables and inventory divided by total assets (Abernathy et al., 2018) and number of subsidiaries that company has (Che-Ahmad and Abidin, 2008, Yaacob and Che-Ahmad, 2012, in Nelson et al., 2019).

4. Empirical data and analysis

Initial research sample comprised entire population of companies listed on Zagreb Stock Exchange in Republic of Croatia (106 business entities). Companies belonging to financial sector (banks, insurance companies, funds etc.) were excluded from sample due to their operational, regulatory and financial reporting

differences. In addition, their earnings management motivation may differ (Lee and Son, 2009). Also, companies which hadn't have published audited financial statements for financial year 2019 were removed from the sample, as well as companies which belonged to industries which hadn't have enough companies (threshold of six observations) to estimate earnings management using Jones model (DeFond and Jiambalvo, 1994, in Krishnan and Yang, 2009) and companies which disclosed their financial statements before 7th April 2020, when Law amending and supplementing the Accounting Act (Official Gazette, 2020a) was enacted. Since the data included five-year period (from 2015 to 2019) and 58 companies (54.7 percent of entire population), final sample consisted of 290 firm-year observations. Pooled OLS regression was conducted using Stata 13.1. (StataCorp, 2013) and data obtained from auditors' reports as well as audited financial reports publicly available on official website of Zagreb Stock Exchange.

Table 1: Correlation coefficients of independent variables included in research model

	ADAC	C19	AO	ROT	BIG4	SUBS	SIZE	ROA	LOSS	LEV	RIA
ADAC	1										
C19	-0.13*	1									
AO	-0.058	0.012	1								
ROT	-0.008	0.15*	-0.018	1							
BIG4	0.04	0.004	0.13*	0.043	1						
SUBS	0.015	-0.032	0.13*	0.109	0.14*	1					
SIZE	-0.024	-0.02	0.23*	0.007	0.48*	0.48*	1				
ROA	-0.15*	0.021	0.042	0.002	0.026	0.012	0.32*	1			
LOSS	-0.047	-0.024	0.25*	0.057	0.057	0.09	0.15*	0.45*	1		
LEV	0.066	-0.009	-0.029	-0.021	-0.055	0.042	-0.26*	-0.77*	-0.19*	1	
RIA	0.24*	-0.048	-0.037	-0.026	0.071	0.3*	0.087	0.098	0.031	0.004	1

* Correlation coefficient is statistically significant at 5 percent level.

Source: Author's analysis using data available at official website of Zagreb Stock Exchange and Stata software – StataCorp (2013). Stata Statistical Software: Release 13. College Station, TX: StataCorp LP.

Preliminary analysis of correlation coefficients was done for independent variables in order to determine if there is multicollinearity problem. As it is evident from Table 1, stronger significant correlations are present in case of SIZE and BIG4, SIZE and SUBS, LOSS and ROA as well as LEV and ROA. Because Model 1 presented in Table 2 had included all of these variables, analysis was repeated with variables SIZE and ROA eliminated. Results and conclusions regarding test variable of interest for research hypotheses are identical to those which were

based on results in Table 2. Coefficient for moderating effect was even stronger after exclusion of those variables. Variance inflation factor (VIF) values indicated absence of multicollinearity problem (highest value was 2.16).

Table 2: Results of regression – Model 1 (absolute discretionary accruals)

Variable	Coefficient	Std. Err.	t	P > t	[95% Confidence Interval]	
ADAC	-13.37712	12.22353	-1.09	0.275	-37.47105	10.71681
C19	3.544743	5.809199	0.61	0.542	-7.905835	14.99532
ADAC x C19	215.6073	67.13272	3.21	0.002	83.28128	347.9334
AO	-19.04888	4.254134	-4.48	0.000	-27.43425	-10.66351
ROT	1.504392	4.786108	0.31	0.754	-7.929559	10.93834
BIG4	7.979983	4.16629	1.92	0.057	-2.23237	16.1922
SUBS	-.0926226	.5534991	-0.17	0.867	-1.183631	.9983857
SIZE	-3.48639	5.521505	-0.63	0.528	-14.36989	7.397111
ROA	-58.2436	19.02312	-3.06	0.002	-95.74028	-20.74692
LOSS	-7.742196	4.770036	-1.62	0.106	-17.14447	1.660076
LEV	-28.42456	8.776944	-3.24	0.001	-45.72489	-11.12422
RIA	-3.086058	11.84094	-0.26	0.795	-26.42588	20.25376
_cons	184.5092	44.84298	4.11	0.000	96.11867	272.8997

Source: Author's analysis using data available at official website of Zagreb Stock Exchange and Stata software – StataCorp (2013). Stata Statistical Software: Release 13. College Station, TX: StataCorp LP.

Results of regression analysis for Model 1 necessary for making decision on acceptance of first hypothesis were presented in Table 2. The coefficient on ADAC x C19 is positive and statistically significant at 1 percent level. This result suggests that in circumstances of regulatory actions during COVID-19 pandemic which have prolonged financial reporting deadlines, companies with longer financial reporting delays tend to have higher earnings management. For every additional 0.01 increase in value of absolute discretionary accruals in year of COVID-19 related financial reporting regulation changes, financial reporting delay on average increased by approximately 2.16 days.

Table 3: Results of regression – Model 2 (positive discretionary accruals)

Variable	Coefficient	Std. Err.	t	P > t	[95% Confidence Interval]	
PDAC	-10.80645	22.06387	-0.49	0.625	-54.50673	32.89382
C19	4.333741	9.525474	0.45	0.650	-14.53266	23.20014
PDAC x C19	155.2334	130.3505	1.19	0.236	-102.9423	413.4091
AO	-22.61677	6.567023	-3.44	0.001	-35.62359	-9.609958
ROT	5.023859	7.161178	0.70	0.484	-9.159757	19.20748
BIG4	9.964526	6.357152	1.57	0.120	-2.626615	22.55567
SUBS	-1.446638	1.083297	-1.34	0.184	-3.592245	.6989687
SIZE	2.655848	8.586896	0.31	0.758	-14.35158	19.66328
ROA	-71.80501	30.05042	-2.39	0.018	-131.3236	-12.28637
LOSS	-7.691539	7.027872	-1.09	0.276	-21.61112	6.228046
LEV	-26.21284	13.75601	-1.91	0.059	-53.45835	1.032685
RIA	6.338839	19.55466	0.32	0.746	-32.39162	45.0693
_cons	133.1058	69.74193	1.91	0.059	-5.026898	271.2385

Source: Author's analysis using data available at official website of Zagreb Stock Exchange and Stata software – StataCorp (2013). Stata Statistical Software: Release 13. College Station, TX: StataCorp LP.

Furthermore, multicollinearity analyses were also conducted for Model 2 and Model 3, but statistical results were omitted for the sake of brevity. In case of Model 2 which included only positive accruals (Table 3), correlations between SIZE and BIG4, SIZE and SUBS and LOSS and ROA were proven to be stronger and statistically significant, so the model was also estimated without variables SIZE and LOSS. Coefficient of relevant moderating variable remained insignificant. Highest VIF value amounted 2.39. Results of regression analysis for Model 2 presented in Table 3 were of importance for testing second hypothesis. The coefficient on PDAC x C19 is positive which means that the similar explanation as for Model 1 could be applied, but since the coefficient is not statistically significant there is not enough evidence to support that statement. In other words, insignificant coefficients indicate that there is no moderating effect of regulatory actions during COVID-19 pandemic which have prolonged financial reporting deadlines on relationship between earnings management and financial reporting delay.

Table 4: Results of regression – Model 3 (negative discretionary accruals)

Variable	Coefficient	Std. Err.	t	P > t	[95% Confidence Interval]	
NDAC	9.761304	14.30858	0.68	0.497	-18.68798	38.21059
C19	6.00797	7.240213	0.83	0.409	-8.387512	20.40345
NDAC x C19	-275.2613	70.73861	-3.89	0.000	-415.9086	-134.614
AO	-15.02426	5.35944	-2.80	0.006	-25.68026	-4.368259
ROT	-5.190067	6.615777	-0.78	0.435	-18.344	7.963871
BIG4	7.928319	5.444827	1.46	0.149	-2.897456	18.75409
SUBS	.8664182	.5982109	1.45	0.151	-.3229853	2.055822
SIZE	-8.712623	7.130419	-1.22	0.225	-22.88981	5.46456
ROA	-45.72899	25.75233	-1.78	0.079	-96.93152	5.473541
LOSS	-8.147576	6.798171	-1.20	0.234	-21.66416	5.36901
LEV	-35.25916	11.64354	-3.03	0.003	-58.40965	-12.10868
RIA	-6.694701	14.92943	-0.45	0.655	-36.37842	22.98901
_cons	228.7288	57.83598	3.95	0.000	113.7353	343.7222

Source: Author's analysis using data available at official website of Zagreb Stock Exchange and Stata software – StataCorp (2013). Stata Statistical Software: Release 13. College Station, TX: StataCorp LP.

Results of regression analysis for Model 3 (Table 4) are relevant for decision on third hypothesis. The coefficient on NDAC x C19 is negative and statistically significant at 1 percent level. This result suggests that in circumstances of regulatory actions during COVID-19 pandemic which had prolonged financial reporting deadlines, companies with longer financial reporting delays tend to have higher earnings management. It is important to note that in case of Model 3, unlike for earnings management variable in Model 1 and Model 2, lower values of NDAC indicate higher level of earnings management. For every additional 0.01 decrease in value of negative discretionary accruals in year of COVID-19 related financial reporting regulatory changes, financial reporting delay on average increases by approximately 2.75 days. Situation regarding multicollinearity for Model 3 was similar as for Model 1. Highest VIF value was 2.76 indicating absence of multicollinearity problem. Regression model from Table 4 was repeated without variables SIZE and ROA which had stronger significant correlation values. The negative coefficient of moderating variable was slightly stronger and the conclusions made for Model 3 remain the same. It should also be noted that the confidence intervals of test variables for moderating effect in all models are wide, but they don't affect direction of coefficients nor conclusions reached for hypotheses that were accepted. In order to achieve higher precision of confidence interval, larger sample could be used in future studies. Since the number of companies cannot be increased, only temporal dimension of panel data could be

lengthened in order to increase number of observations in context of Republic of Croatia because financial information could be gathered for additional few years. For even larger samples, financial data of companies in other countries could be collected.

5. Results and discussion

Research results provided strong evidence that regulatory changes regarding financial reporting deadlines introduced because of COVID-19 pandemic had positive effect on the relationship between earnings management and financial reporting timeliness. This suggests that reporting delays after regulatory changes during pandemic could be attributed to earnings management activities. Due to financial difficulties and uncertainty caused by coronavirus, companies were more inclined to manipulate financial statement items. This is in line with previous research which proved increased intensity of earnings management during financial and economic crises (Da Silva et al., 2014; Flores et al., 2016; Koowattananaijai, 2018), as well as Asthana (2014) and Luypaert et al. (2016) who documented negative relationship between audit delays and financial reporting quality.

Furthermore, when the absolute measure of accruals was divided into income-increasing and income-decreasing accruals, results did not provide support for the income-increasing accruals, but the relationship was proven to be statistically significant in the case of income decreasing accruals. This corroborates results of research conducted by Chai and Tung (2002) and Rahmawati (2018) who founded that longer audit delays are connected to income-decreasing accruals and DeFond and Park (1997) who concluded that companies have tendency to transfer earnings to the future period if forecasts aren't favourable, like in times of COVID-19 pandemic. Also, in this context perfectly fits the fact that auditors are usually less sensitive to income-decreasing accruals as Lys and Watts (1994) and Heninger (2001) stated.

This study contributes to the existing body of literature on relationship between financial reporting timeliness and financial reporting quality through formulation of model which was utilized to estimate moderating effect of regulatory changes regarding financial reporting deadlines on relationship between financial reporting timeliness and earnings management that, to the author's knowledge, wasn't previously examined. Secondly, economic context of COVID-19 pandemic, as extremely rare occurrence, contributes to the specificity of this research. Thirdly, additional models for examining the same relationship were estimated in order to differentiate between income-increasing and income-decreasing accruals, since motivations behind them are divergent. Governments have to be extremely cautious when approving financial reporting delays and carefully analyse if they are necessary because of a potential opportunistic corporate behaviour.

6. Conclusions

This study aimed to examine whether regulatory changes regarding financial reporting deadlines introduced because of COVID-19 pandemic had effect on relationship between earnings management and financial reporting timeliness. Furthermore, the intention was to study the same effect in case of separated income-increasing and income-decreasing accruals. Results consistent with first and third hypothesis established for the absolute measure of earnings management and income-decreasing earnings management were founded, but in the case of income-increasing earnings management activities no statistical evidence was found to support the hypothesized relation. Main conclusion was that financial reporting delays after regulatory changes during pandemic could be attributed to earnings management activities. Higher tolerance of investors and other stakeholders regarding audit reporting delays in comparison to regular reporting environment was conjectured. Companies have transferred part of their good results from relatively prosperous period to the period of worst economic downturn over the past several decades. This study contributes to existing research on relationship between financial reporting timeliness and financial reporting quality because, to the author's knowledge, moderating effect of regulatory changes on this relationship weren't previously examined, especially considering that mentioned changes were during the COVID-19 pandemic, which adds to the specificity of research context. Similar to other studies, this research also has some limitations. Research sample comprises large companies in the Republic of Croatia and, therefore, conclusions of this research cannot be generalized for companies of different size or companies in other countries. Also, discretionary accruals are earnings management measure which can potentially have certain drawbacks. Future research could focus on companies which are not listed on stock exchange because of their divergent motivating factors for earnings management, extend analysis to different countries in search for specificities of different business and legal environments and consider using measures which capture some other aspects of financial reporting quality. Furthermore, research sample could be extended in order to achieve higher precision of regression model. This research provides valuable insights which may be of assistance to regulators, auditors, investors, academics and all other interested parties in enhancing and estimating financial reporting quality. Regulators should carefully analyse the need for regulatory actions regarding financial reporting extensions. Investors and auditors should be aware that companies are prone to transferring their income in future periods in times of intense crisis when they are also provided with extended deadlines for reporting. In that context, auditors should scrutinize financial information in more detail, focusing especially on income-decreasing accruals.

References

- Abernathy, J. L. et al. (2014) “The association between characteristics of audit committee accounting experts, audit committee chairs, and financial reporting timeliness”, *Advances in Accounting*, Vol. 30, No. 2, pp. 283–297, <https://doi.org/10.1016/j.adiac.2014.09.001>.
- Abernathy, J. L. et al. (2015) “How the source of audit committee accounting expertise influences financial reporting timeliness”, *Current Issues in Auditing*, Vol. 9, No. 1, pp. 1–9, <https://doi.org/10.2308/ciia-51030>.
- Abernathy, J. L. et al. (2017) “An international perspective on audit report lag: A synthesis of the literature and opportunities for future research”, *International Journal of Auditing*, Vol. 21, No. 1, pp. 100–127, <https://doi.org/10.1111/ijau.12083>.
- Abernathy, J. L., Kubick, T. R., Masli, A. (2018) “Evidence on the relation between managerial ability and financial reporting timeliness”, *International Journal of Auditing*, Vol. 22, No. 2, pp. 185–196, <https://doi.org/10.1111/ijau.12112>.
- Agyei-Mensah, B. K. (2018) “Impact of corporate governance attributes and financial reporting lag on corporate financial performance”, *African Journal of Economic and Management Studies*, Vol. 9, No. 3, pp. 349–366, <https://doi.org/10.1108/ajems-08-2017-0205>.
- Al-Ebel, A., Baatwah, S., Al-Musali, M. (2020) “Religiosity, accounting expertise, and audit report lag: Empirical evidence from the individual level”, *Cogent Business & Management*, Vol. 7, No. 1, <https://doi.org/10.1080/23311975.2020.1823587>.
- Ali, M., Alam, N., Rizvi, S. A. R. (2020) “Coronavirus (COVID-19)—An epidemic or pandemic for financial markets”, *Journal of Behavioral and Experimental Finance*, Vol. 27, No. 100341, <https://doi.org/10.1016/j.jbef.2020.100341>.
- Ashton, R. H., Graul, P. R., Newton, J. D. (1989) “Audit delay and the timeliness of corporate reporting”, *Contemporary accounting research*, Vol. 5, No. 2, pp. 657–673, <https://doi.org/10.1111/j.1911-3846.1989.tb00732.x>.
- Asthana, S. (2014) “Abnormal audit delays, earnings quality and firm value in the USA”, *Journal of Financial Reporting and Accounting*, Vol. 12, No. 1, pp. 21–44, <https://doi.org/10.1108/jfra-09-2011-0009>.
- Aubert, F. (2009) Determinants of corporate financial reporting lag: The French empirical evidence, *Journal of Accounting and Taxation*, Vol. 1, No. 3, pp. 53–60, <https://doi.org/10.2139/ssrn.1414398>.
- Baatwah, S. R., Salleh, Z., Ahmad, N. (2015) “CEO characteristics and audit report timeliness: do CEO tenure and financial expertise matter?”, *Managerial Auditing Journal*, Vol. 30, No. 8/9, pp. 998–1022, <https://doi.org/10.1108/maj-09-2014-1097>.

- Bhuiyan, M. B. U., D'Costa, M. (2020) "Audit committee ownership and audit report lag: evidence from Australia", *International Journal of Accounting & Information Management*, Vol. 28, No. 1, pp. 96–125, <https://doi.org/10.1108/ijaim-09-2018-0107>.
- Bloomberg (n. d.) "S&P 500 Index" [Internet], Available at <<https://www.bloomberg.com/quote/SPX:IND>> [Accessed: November 3, 2020].
- Chai, M. L., Tung, S. (2002) "The effect of earnings–announcement timing on earnings management", *Journal of Business Finance & Accounting*, Vol. 29, No. 9-10, pp. 1337–1354, <https://doi.org/10.1111/1468-5957.00472>.
- Chan, K. H., Luo, V. W., Mo, P. L. (2016) "Determinants and implications of long audit reporting lags: evidence from China", *Accounting and Business Research*, Vol. 46, No. 2, pp. 145–166, <https://doi.org/10.1080/00014788.2015.1039475>.
- China Securities Index (n. d.) "CSI 300" [Internet], Available at <<http://www.csindex.com.cn/en/indices/index-detail/000300>> [Accessed: November 3, 2020].
- Chintrakarn, P., Jiraporn, P., Kim, Y. S. (2018) "Did firms manage earnings more aggressively during the financial crisis?", *International Review of Finance*, Vol. 18, No. 3, pp. 477–494, <https://doi.org/10.2139/ssrn.2962020>.
- Church, B. K. et al. (2020) "The Role of Auditor Narcissism in Auditor-Client Negotiations: Evidence from China", *Contemporary Accounting Research*, Vol. 37, No. 3, pp. 1756–1787, <https://doi.org/10.1111/1911-3846.12565>.
- Cimini, R. (2015) "How has the financial crisis affected earnings management? A European study", *Applied economics*, Vol. 47, No. 3, pp. 302–317, <https://doi.org/10.1080/00036846.2014.969828>.
- Clatworthy, M., Peel, M. J. (2016) "The Timeliness of UK Private Company Financial Reporting: Regulatory and Economic Influences", *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2433962>.
- Cohen, S., Leventis, S. (2013) "Effects of municipal, auditing and political factors on audit delay", *Accounting Forum*, Vol. 37, No. 1, pp. 40–53, <https://doi.org/10.1016/j.accfor.2012.04.002>.
- Cressey, D. R. (1950) "The criminal violation of financial trust", *American sociological review*, Vol. 15, No. 6, pp. 738–743, <https://doi.org/10.2307/2086606>.
- Croatian Institute of Public Health (2020, February 25) "COVID-19 – Priopćenje prvog slučaja" [Internet], Available at <<https://www.hzjz.hr/priopcenja-mediji/covid-19-priopcenje-prvog-slucaja/>> [Accessed: November 4, 2020].
- Da Silva, A. F. D. et al. (2014) "Earnings management and economic crises in the Brazilian capital market", *Revista de Administração de Empresas*, Vol. 54, No. 3, pp. 268–283, <https://doi.org/10.1590/s0034-759020140303>.
- DeFond, M. L., Park, C. W. (1997) "Smoothing income in anticipation of future earnings", *Journal of accounting and economics*, Vol. 23, No. 2, pp. 115–139, [https://doi.org/10.1016/s0165-4101\(97\)00004-9](https://doi.org/10.1016/s0165-4101(97)00004-9).

- Deis Jr, D. R., Giroux, G. A. (1992) “Determinants of audit quality in the public sector”, *Accounting Review*, Vol. 67, No. 3, pp. 462–479.
- Efobi, U., Okougbo, P. (2014) “Timeliness of Financial Reporting in Nigeria”, *South African Journal of Accounting Research*, Vol. 28, No. 1, pp. 65–77, <https://doi.org/10.1080/10291954.2014.11463127>.
- Flores, E. et al. (2016) “Earnings management and macroeconomic crises: Evidences from Brazil and USA capital markets”, *Journal of Accounting in Emerging Economies*, Vol. 6, No. 2, pp. 179–202, <https://doi.org/10.1108/jaee-07-2013-0037>.
- Ghafran, C., Yasmin, S. (2018) “Audit committee chair and financial reporting timeliness: A focus on financial, experiential and monitoring expertise”, *International Journal of Auditing*, Vol. 22, No. 1, pp. 13–24, <https://doi.org/10.1111/ijau.12101>.
- Habib, A. (2013) “A meta-analysis of the determinants of modified audit opinion decisions”, *Managerial Auditing Journal*, Vol. 28, No. 3, pp. 184–216, <https://doi.org/10.1108/02686901311304349>.
- Habib, A., Huang, H. J. (2019) “Abnormally long audit report lags and future stock price crash risk: evidence from China”, *International Journal of Managerial Finance*, Vol. 15, No. 4, pp. 611–635, <https://doi.org/10.2139/ssrn.3010897>.
- Haroon, O., Rizvi, S. A. R. (2020) “COVID-19: Media coverage and financial markets behavior—A sectoral inquiry”, *Journal of Behavioral and Experimental Finance*, Vol. 27, No. 100343, <https://doi.org/10.1016/j.jbef.2020.100343>.
- He, P. et al. (2020) “Accounting index of COVID-19 impact on Chinese industries: A case study using big data portrait analysis”, *Emerging Markets Finance and Trade*, Vol. 56, No. 10, pp. 2332–2349, <https://doi.org/10.1080/1540496x.2020.1785866>.
- Heninger, W. G. (2001) “The association between auditor litigation and abnormal accruals”, *The Accounting Review*, Vol. 76, No. 1, pp. 111–126, <https://doi.org/10.2308/accr.2001.76.1.111>.
- Ilmas, F. et al. (2018) “Ownership structure and debt structure as determinants of discretionary accruals: An empirical study of Pakistan”, *Cogent Economics & Finance*, Vol. 6, No. 1, <https://doi.org/10.1080/23322039.2018.1439254>.
- Katmon, N., Al Farooque, O. (2017) “Exploring the impact of internal corporate governance on the relation between disclosure quality and earnings management in the UK listed companies”, *Journal of Business Ethics*, Vol. 142, No. 2, pp. 345–367, <https://doi.org/10.1007/s10551-015-2752-8>.
- Knechel, W. R., Payne, J. L. (2001) “Additional evidence on audit report lag”, *Auditing: A Journal of Practice and Theory*, Vol. 20, pp. 137–146, <https://doi.org/10.2308/aud.2001.20.1.137>.
- Koowattanatianchai, N. (2018) “The extent to which earnings are manipulated in the construction sector of the Stock Exchange of Thailand and its exogenous macroeconomic factors”. In *Proceedings of Economics and Finance*

- Conferences*, 22-25 May, London: International Institute of Social and Economic Sciences, pp. 101–117, <https://doi.org/10.20472/efc.2018.009.008>.
- Krishnan, J., Yang, J. S. (2009) “Recent trends in audit report and earnings announcement lags”, *Accounting Horizons*, Vol. 23, No. 3, pp. 265–288, <https://doi.org/10.2139/ssrn.1347649>.
- Lambert, T. A. et al. (2017) “Audit time pressure and earnings quality: An examination of accelerated filings”, *Accounting, Organizations and Society*, Vol. 58, pp. 50–66, <https://doi.org/10.1016/j.aos.2017.03.003>.
- Lee, H. Y., Son, M. (2009) “Earnings announcement timing and earnings management”, *Applied Financial Economics*, Vol. 19, No. 4, pp. 319–326, <https://doi.org/10.1080/09603100701857872>.
- Luypaert, M., Van Caneghem, T., Van Uytbergen, S. (2016) “Financial statement filing lags: An empirical analysis among small firms”, *International Small Business Journal*, Vol. 34, No. 4, pp. 506–531, <https://doi.org/10.1177/0266242615569324>.
- Lys, T., Watts, R. L. (1994) “Lawsuits against auditors”, *Journal of accounting research*, Vol. 32, pp. 65–93, <https://doi.org/10.2307/2491440>.
- Nelson, S., Ahmad, M., Mohamed, H. (2019) “Relationship between the Industry Specialist Auditors and Financial Reporting Timeliness under MFRS”, *Pertanika Journal of Social Sciences & Humanities*, Vol. 27, No. 1, pp. 213–233.
- Official Gazette of the Republic of Croatia – Narodne novine (2015) *Accounting Act*, Zagreb: Narodne Novine, d. d., 78/15, 134/15, 120/16, 116/18, 42/20, 47/20.
- Official Gazette of the Republic of Croatia – Narodne novine (2020a) *Law amending and supplementing the Accounting Act*, Zagreb: Narodne Novine, d. d., 42/20.
- Official Gazette of the Republic of Croatia – Narodne novine (2020b) *Regulation on deadlines for submission of financial statements and accounting documentation in special circumstances*, Zagreb: Narodne Novine, d. d., 43/20.
- Oussii, A. A., Taktak, N. B. (2018) “Audit committee effectiveness and financial reporting timeliness: The case of Tunisian listed companies”, *African Journal of Economic and Management Studies*, Vol. 9, No. 1, pp. 34–55, <https://doi.org/10.1108/AJEMS-11-2016-0163>.
- Rababah, A. et al. (2020) “Analyzing the effects of COVID-19 pandemic on the financial performance of Chinese listed companies”, *Journal of Public Affairs*, <https://doi.org/10.1002/pa.2440>.
- Rahmawati, E. (2018) “Information content and determinants of timeliness financial reporting: evidence from an emerging market”, *Academy of accounting and financial studies journal*, Vol. 22, No. 4, pp. 1–15.
- Reheul, A. M., Van Caneghem, T., Verbruggen, S. (2014) “Financial reporting lags in the non-profit sector: An empirical analysis”, *Voluntas: International Journal*

- of Voluntary and Nonprofit Organizations*, Vol. 25, No. 2, pp. 352–377, <https://doi.org/10.1007/s11266-012-9344-3>.
- Reuters (2020) “Two first coronavirus cases confirmed in Italy: prime minister” [Internet], Available at <<https://www.reuters.com/article/us-china-health-italy-idUSKBN1ZT31H>> [Accessed: November 4, 2020].
- Rusmin, R., Evans, J. (2017) “Audit quality and audit report lag: case of Indonesian listed companies”, *Asian Review of Accounting*, Vol. 25, No. 2, pp. 191–210, <https://doi.org/10.1108/ara-06-2015-0062>.
- Salleh, Z., Baatwah, S. R., Ahmad, N. (2017) “Audit committee financial expertise and audit report lag: Malaysia further insight”, *Asian Journal of Accounting and Governance*, Vol. 8, pp. 137–150, <https://doi.org/10.17576/ajag-2017-08-12>.
- Schmidt, J., Wilkins, M. S. (2013) “Bringing darkness to light: The influence of auditor quality and audit committee expertise on the timeliness of financial statement restatement disclosures”, *Auditing: A Journal of Practice & Theory*, Vol. 32, No. 1, pp. 221–244, <https://doi.org/10.2139/ssrn.1787008>.
- Schuchter, A., Levi, M. (2016) “The fraud triangle revisited”, *Security Journal*, Vol. 29, No. 2, pp. 107–121, <https://doi.org/10.1057/sj.2013.1>.
- Shen, H. et al. (2020) “The impact of the COVID-19 pandemic on firm performance”, *Emerging Markets Finance and Trade*, Vol. 56, No. 10, pp. 2213–2230, <https://doi.org/10.1080/1540496X.2020.1785863>.
- StataCorp (2013) “Stata Statistical Software: Release 13”, College Station, TX: StataCorp LP.
- Sultana, N., Singh, H., Van der Zahn, J.-L. W. M. (2014) “Audit Committee Characteristics and Audit Report Lag”, *International Journal of Auditing*, Vol. 19, No. 2, pp. 72–87. <https://doi.org/10.1111/ijau.12033>.
- Trueman, B. (1990) “Theories of earnings-announcement timing”, *Journal of Accounting and Economics*, Vol. 13, No. 3, pp. 285–301, [https://doi.org/10.1016/0165-4101\(90\)90035-3](https://doi.org/10.1016/0165-4101(90)90035-3).
- Wan Hussin, W. N., Bamahros, H. M., Shukeri, S. N. (2018) “Lead engagement partner workload, partner-client tenure and audit reporting lag: Evidence from Malaysia”, *Managerial Auditing Journal*, Vol. 33, No. 3, pp. 246–266, <https://doi.org/10.1108/maj-07-2017-1601>.
- World Health Organization (2020a) “Archived: WHO Timeline – COVID-19” [Internet]. Available at <<https://www.who.int/news/item/27-04-2020-who-timeline---covid-19>> [Accessed: November 4, 2020].
- World Health Organization (2020b, January 25) “2019-nCoV outbreak: first cases confirmed in Europe” [Internet], Available at <<https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2020/01/2019-ncov-outbreak-first-cases-confirmed-in-europe>> [Accessed: November 4, 2020].

Yuan, S., Lan, H., Seufert, J. H. (2020) "FRC intervention, financial reporting quality and due diligence", *Research in International Business and Finance*, Vol. 52, No. 101128, <https://doi.org/10.1016/j.ribaf.2019.101128>.

Zagreb Stock Exchange (n. d.) "CROBEX" [Internet], Available at <<https://zse.hr/hr/indeks/365?isin=HRZB00ICBEX6>> [Accessed: November 3, 2020].

Utjecaj regulativnih promjena na odnos upravljanja zaradom i pravovremenosti financijskog izvještavanja: slučaj pandemije COVID-19

Toni Šušak¹

Sažetak

Svrha ovog rada bila je ispitati učinak regulativnih promjena rokova financijskog izvještavanja koje su donesene uslijed pandemije COVID-19 na odnos između upravljanja zaradama i pravovremenosti financijskog izvještavanja. Koristeći uzorak kompanija koje su kotirale na tržištu kapitala u Republici Hrvatskoj za razdoblje od 2015. do 2019., procijenjen je združeni OLS regresijski model s pomoću panel podataka. Pravodobnost financijskog izvještavanja mjerena je s pomoću dužine vremenskog razdoblja do objave financijskih izvještaja, a razina upravljanja zaradom ustanovljena je s pomoću diskrecijskih obračunskih stavki. Empirijski rezultati potkrijepili su hipotezu prema kojoj su spomenute promjene regulativnog okvira tijekom izvanrednih okolnosti pandemije imale statistički značajan pozitivan učinak na odnos upravljanja zaradom i dužine vremenskog razdoblja do objave financijskih izvještaja, upućujući na to da se dužina vremenskog razdoblja do objave financijskih izvještaja nakon regulativnih promjena tijekom pandemije može povezati s aktivnostima upravljanja zaradom. Nadalje, nakon razdvajanja obračunskih stavki kojima se povećavaju prihodi od onih kojima se prihodi smanjuju, moderatorski učinak regulativnih promjena bio je značajan jedino u slučaju obračunskih stavki kojima se smanjuju prihodi, sugerirajući to da su kompanije prilagođavale vlastite financijske informacije pesimističnim ekonomskim prognozama kako bi ublažile vjerojatno pogoršanje profitabilnosti u budućim razdobljima.

Ključne riječi: COVID-19, koronavirus, upravljanje zaradom, dužina vremenskog razdoblja do objave financijskih izvještaja, pravovremenost financijskog izvještavanja

JEL klasifikacija: G01, K20, M41, M42

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The impact of energy consumption on economic growth in developed and post-transition countries of European Union*

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Abstract

This paper aims to investigate the impact of renewable and non-renewable energy consumption on economic growth. Analysis was conducted for 16 developed EU member states over the period from 1990 to 2018 and 11 post-transition EU member states over the period from 1995 to 2018. We also compared obtained results with results for the period until 2014. The pooled mean group (PMG) model was used to capture dynamic relationship in a short and long run. The empirical results show that consumption of both energy sources has an impact on economic growth in the long run in both groups of countries. However, the results differ between the developed and post-transition EU countries. In developed EU countries renewable energy consumption has a negative impact on economic growth, while non-renewable energy consumption has a positive impact. In post-transition EU countries results are opposite, meaning that in these countries there is a tendency to shift from less efficient and more polluting energy sources to more efficient energy options which can be a stimulus to economic growth.

Key words: non-renewable and renewable energy consumption, economic growth, developed and post-transition EU countries

JEL classification: Q43, O44, C33

1. Introduction

Energy is considered to be a crucial input in the process of economic growth. Sustainable economic growth necessitates sufficient and continuous availability of energy input. Disruption in the energy supply raised the public and academic

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awareness of the importance of energy in the economic growth of countries. The impact of energy consumption on economic growth is of crucial importance in the international debate on global warming and the reduction of greenhouse gas emissions. Furthermore, since the world's leading economies agreed on the Kyoto Protocol in 2005 to limit their greenhouse gas emissions relative to the amounts emitted in 1990, the information of this relationship has become increasingly important (Dobnik, 2011). Nowadays, the energy consumption per capita is one of the indicators that describe the economic development of a country. It is well known that the spread of energy consumption is still unequal. There are developed or developing countries "absorbing" a great amount of energy and also countries less developed, that are only consuming a thin slice of the world's energy pie (the case of African countries). The relationship between economic growth and energy consumption is not constant, but it changes with time and driven by the national differences (Pirlogea and Cicea, 2012).

The EU is the largest importer of primary energy in the world. More than half of energy consumption in the EU (58% in 2018) comes from imports, and the high proportion of imports is concentrated on a small number of countries (Eurostat, 2020) Furthermore, there is little diversification of supply lines and diversity in the use of energy resources. This makes the EU more sensitive to the political and economic impacts of countries from where they import energy and more sensitive to seasonal oscillations in energy production, which negatively affects investment decisions and economic stability. Among this, EU is also facing challenges such as high and unstable energy prices, rising global energy demand, security risks affecting producer and transit countries, rising threats to climate change, slow progress in energy efficiency, challenges brought by an increasing share of renewable energy sources and the need for greater transparency, further integration and interconnection of the energy market. In the future, is expected that the demand for energy to continue its upward trend. Another expected phenomenon, which started a long time ago and continues today, is the substitution among energy forms. Now the renewable energy is expected to take the lead in the race with fossil fuels.

For the last twenty years, the EU countries have been working on the creation of the internal energy market and energy union. The Energy Union package aims to ensure the EU, and its citizens, with a favourable, safe and sustainable energy. Specific measures include, among other things, energy security, energy efficiency and decarbonisation (European Council, 2015). However, the EU includes a heterogeneous group of countries. Between developed and post-transition EU member countries there are huge differences in the availability of own sources of energy, infrastructure, distribution system, price structure, as well as in many other factors (Vlahinić-Dizdarević, 2011). Most importantly, carbon intensive fuels account for a much higher share of the energy mix in the post-transition compared to developed EU countries. This is primarily due to a considerably higher overall

reliance on solid fuels. While solid fuels, in 2017, accounted for only 10% of gross inland energy consumption in developed EU countries, they represented 30% of the energy mix in post-transition EU countries (Eurostat, 2020). Many post-transition EU Member countries depend heavily on a relatively small number of suppliers, especially with regard to gas supply, which makes them vulnerable to energy supply disruptions. In addition, a major problem is EU's aging energy infrastructure (Farfan Orozco, 2017), as well as poorly integrated energy markets, especially cross-border.

Post-transition EU countries have come a long way in the past 20 years. In 2018 the gross domestic product (GDP) growth rate of post-transition EU countries has doubled compared to the original EU member countries (World development indicators, 2020). They have improved their energy efficiency vastly and are narrowing the gap with the old EU member states. However, part of that improvement was due to abandonment of Soviet-era heavy industry. Further reductions in energy intensity are harder, and with development of renewable energy, will require large financial investments.

In line with the EU's climate and energy policy targets by 2030 and 2050, alongside the targets set by the European Green Deal (European Commission, 2019), the EU needs to reduce its overall dependence on fossil fuels and reduce greenhouse gas emissions. To secure new energy sources and reduce greenhouse gas emissions, the EU has focused on increasing the use of renewable energy sources and improving energy efficiency. The EU reform model and creating Energy union has significantly determined reforms in post-transition countries, especially in the electricity sector (European Commission, 2017).

A new EU energy package of laws has been introduced that has significantly affected the dynamics and direction of restructuring and liberalization of the electricity and natural gas market. Given the major changes that are expected in the energy sector and in all other sectors due to the energy transition towards a low carbon future, this paper is focused on examining the impact of renewable and non-renewable energy consumption on economic growth in 16 developed and 11 post-transition EU countries. The choice to divide EU countries in developed and post-transition EU countries (countries that entered the EU after 2004) to some extent reduces the problem of heterogeneity among the countries. All the post-transition EU countries considered in the study have covered a similar path of modernizing their economies during the last 20 years, which has led to their membership in the EU. Because of this, they had to comply with the requirements regarding environment protection. As neighbours, the countries have similar climate. However, they differ with respect to the ways of obtaining energy sources and the structure of energy production (Papież and Smiech, 2013).

The EU has adopted a growing set of policy instruments to drive the energy transition toward the goal of carbon neutral EU economy by 2050 where renewable

energy sources have emerged as an important component in the energy consumption mix. Given that energy in many countries is crucial for the process of economic growth, questions are raised as to whether all energy sources contribute equally to economic growth in EU countries and what is the difference in the use of individual energy sources in developed compared to post-transition EU countries. The main hypothesis is that consumption of renewable and non-renewable energy sources has a significant impact on economic growth in EU countries. Although new and more sophisticated econometric methods have been developed over the years to (better) determine and understand this relationship, an increasing number of published empirical studies on the relationship between energy and GDP result in conflicting, inconsistent results, which in turn prevents creating credible energy programs and measures (see Menegaki, 2014). Analysis conducted in this study strives to correct the shortcomings of the majority of studies published so far, primarily referring to the use of the multivariate framework and the corresponding quantitative method. Second, to avoid the potential problem of omitted variables, the research applies the Cobb-Douglas production function which includes capital and labour. Thirdly, the sign and size of individual coefficients is evaluated in relation to comparative models in which the relationship between consumption of renewable and non-renewable energy sources and economic growth is investigated.

The remainder of the paper is organized as follows: Section 2 presents a review of the existing literature. The model used in analysis is described in Section 3, followed by the empirical data and analysis in Section 4 and empirical results in Section 5. Finally, conclusion and policy implications are provided in Section 6.

2. Literature review

The relationship between energy consumption and economic growth has been subject of intense research in the last three decades. However, the empirical evidence remains controversial and ambiguous to this date. The existing literature reveals that empirical studies differ substantially and are not conclusive to present policy recommendation that can be applied across countries.

Following the study of Kraft and Kraft (1978), an extensive number of empirical works have assessed the empirical evidence employing Granger causality and cointegration model. Ozturk (2010) and Menegaki (2014) provide an extensive review survey of the studies on the empirical results from causality tests between energy consumption and economic growth.

The energy consumption-economic growth nexus can be analysed under four hypotheses. The growth hypothesis assumes energy as a major source of input into the growth process, and unidirectional causality exists from energy consumption

to economic growth. In this scenario, energy conservation policies will have a negative impact on economic growth. The conservation hypothesis implies that economic growth causes consumption of energy. Under this situation, conservation policy will not affect economic growth. The feedback hypothesis implies a bi-directional relationship between energy consumption and economic growth. This hypothesis suggests any change in energy consumption will affect economic growth with a reverse effect. The neutrality hypothesis indicates that energy consumption and economic growth are independent and do not affect each other. The literature over the past decades has produced varied findings across countries under each of these hypotheses. No consensus has emerged from these studies. Most of them focus on just aggregated energy consumption. In this study we will test the presence of growth hypothesis between renewable and non-renewable energy consumption and economic growth in EU countries.

Increased energy demand, the need to achieve sustainable development goals, and negative effects of non-renewable sources on environment are important reasons that motivate countries to promote renewable energy. According to IRENA (2015) 164 countries have accepted at least one of the goals of increasing renewable energy sources. This fact encourages researchers to integrate the renewable energy variable when looking at the relationship between energy consumption and economic growth. Recently, the literature has started paying more attention to the effect of energy consumption on economic growth in terms of renewable and non-renewable energy sources. However, the magnitude and the direction of this effect is still unclear. According to Tugcu et al. (2012), one of the reasons for focusing on this topic is the vision of sustainable development. Today, a large number of countries have agreed on conserving energy and reducing carbon dioxide (CO₂) emissions. This has increased the attractiveness of energy consumption related studies. However, the key dynamic in those studies is the consumption of renewable energy sources. With the growing importance of sustainable development, researchers are more interested in the effects of renewable energy consumption on economic growth.

Due to a large number of studies, analysis of literature in this area will be focused on the literature relating to the EU countries. Tiwari (2011) revealed that while the growth rate of non-renewable energy consumption has a negative impact, the growth rate of renewable energy consumption has a positive impact on the growth rate of GDP for 14 EU, Norway, Switzerland and Turkey. Similar results were found by Uçan, Aricioglu and Yucel (2014) for EU15 and Ito (2017) for 42 developed countries. Apergis and Payne (2012) found bidirectional causality between renewable and non-renewable energy consumption measures and economic growth in both short and long run for 80 developed and developing countries. The same results were found by Salim et al. (2014) for OECD countries. Tugcu et al. (2012) assessed the long-run and causal relationships between renewable and non-

renewable energy consumption and economic growth for G7. The results, estimated under a classical production function, demonstrate that there is bidirectional causality between non-renewable energy and growth in all G7 countries. Pirlogea and Cicea (2012) found long-term impact of all types of energy on economic growth for the EU-27 and for oil in Spain and Romania. Jebli and Youssef (2015) analysed the causal relationship between renewable and non-renewable energy consumption, economic growth and trade in the 69 countries. They found positive unidirectional causality from renewable and non-renewable energy consumption to real GDP. Menegaki (2011) examined the casual relationship between economic growth and renewable energy for 27 EU countries in a multivariate panel framework over the period from 1997 till 2007. The results indicate the evidence of the neutrality hypothesis.

There are few empirical studies on the relationship between economic growth and energy in the new Member States of the EU. Ozturk and Acaravci (2010) analysed causal relationship between energy and economic growth in Albania, Bulgaria, Hungary and Romania from 1980 to 2006. They found evidence of a long-run relationship between energy use and real GDP and evidence of strong bidirectional Granger causality between these variables only in Hungary, while in Albania, Bulgaria and Romania the results indicate the evidence of the neutrality hypothesis. Sharma (2010) analysed the relationship between energy and economic growth in 66 countries from 1986 to 2005. They found that both electricity and non-electricity type energy variables have strong impacts on economic growth of EU. Bercu et al. (2019) analysed the long-term relationship between energy consumption, economic growth and good governance for 14 Central and Eastern EU (CEE) countries, over the period 1995–2017. They found that there is a causal relationship between electricity consumption and economic growth, underlining the fact that deficiencies in the energy system lead to slowing economic growth. The study also shows that good governance influences electricity and GDP consumption. Some authors concentrated on the analysis of relationship between economic growth and renewable energy. Alper and Oguz (2016) analysed the relationship between these variables in the new EU countries and concluded that there is a statistically significant impact on economic output only for Bulgaria, Estonia, Poland and Slovenia. Koçak and Şarkgüneşi (2017) analysed the group of economies in the Balkans and at the Black Sea, concluding that, in Romania, the hypothesis of the bi-directional causality was validated, while in Greece and Bulgaria only the positive influence of renewable energy consumption on the economic growth was confirmed. Šimelytė and Dudzevičiūtė (2017) analysed 28 EU countries, concluding that renewable energy consumption is boosting economic growth in 12 countries. The neutrality hypothesis has been validated in Luxembourg and Portugal, while the conservation hypothesis has been proven in Czech Republic, Hungary, Latvia, Lithuania, Romania, and Spain. The findings by Furuoka (2017) indicate that there exists a unidirectional causality from economic development to renewable energy consumption in Estonia, Latvia and Lithuania. Marinas et al. (2018)

examined the casual relationship between economic growth and renewable energy for 10 EU member states from CEE in the period 1990–2014. The results indicate a bi-directional causality between renewable energy consumption and economic growth in the long run. In the short run there is no causality in Romania and Bulgaria, while in Hungary, Lithuania and Slovenia results confirm growth hypothesis.

A general conclusion from the studies reviewed in this section is that there is no consensus on existence or direction of causality between energy consumption and economic growth in the literature. Most studies are focused on developed countries, developing countries and the so-called countries with emerging markets. There is a smaller number of studies related to new EU countries or countries that entered EU after 2004. Reforms in the energy sector in the post-transition EU countries are carried out as part of a broader process of transition and structural adjustment. Macroeconomic framework of these reforms varies considerably between developed and post-transition EU countries. Therefore, the present study aims to contribute to the literature by identifying the impact of renewable and non-renewable sources of energy on economic growth in developed and post-transition EU countries.

3. The model

For the analysis of the impact of energy consumption on economic growth, a large number of researches use the non-classical Cobb-Douglas production function to integrate energy consumption with production function (Ozturk, 2010). In addition, several recent studies integrate energy consumption by source (consumption of renewable and non-renewable energy sources) with the production function (Apergis and Payne 2010, 2012; Dogan, 2015; Omri et al., 2015; Salim et al., 2014; Šimelytė and Dudzevičiūtė, 2017). Energy can be classified into two categories; clean energy (renewable) and non-clean energy (non-renewable) and the production procedure uses both resources as sources of energy. In this paper a simple Cobb-Douglas production function was used, along with traditional inputs capital and labour, renewable and non-renewable sources of energy are utilized.

$$GDP_{it} = f(K_{it}; L_{it}; RE_{it}; NRE_{it}) \quad (1)$$

The subscripts i and t denote country and time period respectively. In the above model, GDP is the dependent variable and represents real gross domestic production, K , L , RE , and NRE , are independent variables and stand for capital, labour, renewable, and non-renewable energy consumption, respectively. Eq. (1) can be parameterised as follows:

$$GDP_{it} = K_{it}^{\beta 1i} L_{it}^{\beta 2i} RE_{it}^{\beta 3i} NRE_{it}^{\beta 4i} \quad (2)$$

The transformation of data series into natural logarithm avoids the problems associated with dynamic properties of the data series. The log transformation of the data series is a preferred approach, as each resulting coefficient in a regression equation can be interpreted as elasticities. The empirical equation is developed as follows:

$$\ln GDP_{it} = \beta_{1i} \ln K_{it} + \beta_{2i} \ln L_{it} + \beta_{3i} \ln RE_{it} + \beta_{4i} \ln NRE_{it} + \varphi_{it} \quad (3)$$

where β_{1i} , β_{2i} , β_{3i} and β_{4i} are elasticities of output with respect to gross fixed capital formation, labour, renewable, and non-renewable energy consumption, φ is the error term.

4. Empirical data and analysis

4.1. The data

Annual data for 16 developed EU countries from 1990 to 2018 and 11 post-transition EU countries from 1995 to 2018 were obtained from the World Bank Development Indicators and Eurostat. Malta is excluded from the research due to the lack of all the necessary data. Data for post-transition EU countries begins with year 1995 due to missing data for previous years for all variables needed. The multivariate frame-work includes real GDP (GDP) in constant 2010 US dollars, real gross fixed capital formation (K) in constant 2010 US dollars, labour force (L) in millions, renewable energy consumption (RE) and non-renewable energy consumption (NRE) in thousand tonnes of oil equivalent (TOE). Data for gross inland energy consumption of renewable energy was taken from Eurostat and includes wind power, solar power (thermal, photovoltaic and concentrated), hydroelectric power, tidal power, geothermal energy, biomass and the renewable part of waste. NRE is calculated by summarizing gross inland energy consumption of solid fossil fuels, oil and petroleum products and natural gas. To compare the results between countries, all variables are divided by the average population collected from the Eurostat. All variables are expressed in natural logarithms, so that the coefficients resulting from panel regressions can be interpreted as elasticities. The descriptive statistics is listed in the appendix. The descriptive statistics clearly indicates that there are large differences in data between both group of countries. It is clear that in developed EU countries the average GDP per capita and gross fixed capital formation per capita are three times higher than in post-transition EU countries, while the average consumption of renewable and non-renewable energy per capita is 30% and 60% higher.

EU countries are divided into developed and post-transition EU countries based on the following criteria. First, the 11 post-transition EU economies had similar

trajectories regarding their economic development—the planned allocation of resources in the economy up to 1990 followed by transition towards a market economy, their accession to the EU in 2004 (the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovakia, Slovenia), in 2007 (Bulgaria and Romania) and 2013 (Croatia) as a result of meeting certain common criteria. Secondly, there were some common features of their energy sector— high energy intensity, high dependence on solid fuels, little diversification of supply lines, high dependence on import of oil and gas from Russia, old and obsolete energy facilities, lack of capital for investing in rebuilding energy sector and inadequate institutional resources. The third is the fact that specialized literature neglected to analyse this group of economies despite the fact that the post-transition EU countries enjoy similar economic challenges and context.

The primary objective of the model is to test how renewable and non-renewable energy consumption affects the economic growth in the selected countries. To analyse the long-run and short-run relationship between variables, in the panel of 16 developed and 11 post-transition EU countries, Pooled mean group estimator (PMG) and Mean Group estimator (MG) were applied. We also did a comparison with results obtained until 2014.

The empirical analysis is divided into three steps. In the first step, we perform the panel unit root tests. In the second step we carry out Pedroni cointegration tests on the data. Finally in the third step to analyse the long-run and short-run relationship parameters, PMG and MG method is employed.

4.2. The empirical analysis

The first step in the estimation of dynamic panels was to test if the variables contain unit roots. In this study, five panel unit root tests were tested, namely Levin–Lin–Chu (LLC) test (Levin et al. 2002), Im, Pesaran and Shin (IPS) test (Im et al., 2003), Fisher-type tests using Augmented Dickey–Fuller and Philips-Perron test (Maddala and Wu, 1999) and Breitung test (Breitung, 2001). Table 2 presents the results of the panel unit root tests. It can be seen from Table 1 that each variable was integrated of order one, i.e. $I(1)$.

Table 1: Results of panel unit root tests

Variables	LLC test	IPS test	ADF-Fisher test	PP-Fisher test	Breitung test
Level					
GDP	-1.23361	0.55403	46.9668	43.5777	-2.41698**
K	-2.02472*	-1.64811*	68.8815	46.1880	-4.36935***
L	-2.15487*	-0.25137	79.1568*	52.7193	1.53430
NRE	-2.24844*	0.41873	82.5122*	81.6991*	3.84849
RE	-1.80203**	-1.63175*	78.2217**	128.127***	-0.40291
First difference					
Δ GDP	-8.40361***	-7.75320***	159.868***	314.361***	-7.56591***
Δ K	-7.28852***	-8.74447***	176.074***	486.634***	-6.69363***
Δ L	-6.22900***	-7.91201***	160.314***	318.411***	-7.96059***
Δ NRE	-5.71149***	-10.2379***	206.237***	876.429***	-6.58676***
Δ RE	-10.3998***	-13.1903***	264.908***	1114.08***	-8.61760***

Notes: Deterministic intercept and trend included; ***, ** and * indicate the test statistics are significant at 1%, 5%, and 10% levels, respectively.

Source: Author's calculation

Given that each variable contains a panel unit root, the set of Pedroni's panel cointegration tests (Pedroni, 1999) were carried out to examine whether there was a long-term relationship between the variables used. The results obtained from the tests are presented in Table 2.

Table 2: Pedroni results for panel cointegration tests

Within dimension test statistics		Between dimension test statistics	
Panel v-Statistic	15.16030***	Group rho-Statistic	2.538609
Panel rho-Statistic	1.409332	Group PP-Statistic	-6.607006***
Panel PP-Statistic	-4.214487***	Group ADF-Statistic	-6.983725***
Panel ADF-Statistic	-5.560384***		

Trend assumption: Deterministic intercept and trend. Lag selection: Automatic based on SIC with a max lag of 3. Newey-West automatic bandwidth selection with Bartlett kernel. *** Denote rejection of null hypothesis of no cointegration at 1% significance level

Source: Author's calculation

Out of seven test statistics, five confirm the presence of cointegration among the variables. Therefore, according to the results, real GDP, real gross fixed capital formation, labour force, renewable, and non-renewable energy consumption share a long-run equilibrium relationship.

Since the cointegration relationship was established, the PMG estimator proposed by Pesaran et al. (1999) was used in a panel of autoregressive distributed lag (ARDL) model. When a number of time series is relatively larger than cross sections, as is the case in this analysis, Pesaran and Smith (1995) show that the traditional panel techniques (FE, instrumental variables, GMM estimators) can produce inconsistent, and potentially very misleading estimates of the average values of the parameters in dynamic panel data model. The PMG model is used to identify the short-run and the long-run impact of selected independent variables on the economic growth. The basic assumptions of the PMG estimator are as follows: first, the error terms are serially uncorrelated and are distributed independently of the regressors, that is, the explanatory variables can be treated as exogenous; second, there is a long-run relationship between the dependent and explanatory variables; and third, the long-run parameters are the same across countries (Lee and Wang, 2015). Advantages of PMG model are that it allows intercept, slope coefficient and error variance to vary across countries, and therefore, to identify heterogeneity among countries of the panel. An alternative panel specification would be the MG estimator by Pesaran and Smith (1995) that does not account for the fact that some economic conditions may be the same across countries in the long run (Sulaiman and Abdul-Rahim, 2020)

The efficiency gain of PMG estimator comes from the hypothesis of heterogeneous short-run dynamics and identical long-run coefficient across countries. The PMG estimator allows assessing two types of relationship: a short-run relationship by testing the significance of the coefficients related to the lagged differences of economic and energy variables and a long-run relationship associated to the speed of adjustment coefficient or the error correction term (ECT). The ECT has to be negative to validate long-run equilibrium among the variables. A larger value of ECT implies a greater response of the variable to the deviation from long-run equilibrium while a low value indicates that any deviation from long-run equilibrium needs much longer time to force the variables back to it. A disadvantage of the PMG estimator is that, unless the available time series are long, a degrees of freedom problem is soon reached (Gemmell et al., 2016).

Next, according to the minimum levels of the Akaike criteria, an optimal lag of the ARDL model (1,1,1,1,1) was chosen. Table 3 reports the results helping to choose the best estimation method by comparing the PMG estimates with those obtained by using MG method. The test of difference in these models is performed with the well-known Hausman test.

Table 3: Estimation results of the dynamic panel model.

Variables	16 developed EU countries			11 post-transition EU countries		
	PMG	MG	Results in period 1990-2014	PMG	MG	Results in period 1995-2014
K	-0.019 (0.0289)	-11.734 (-12.0755)	0.416*** (0.1276)	0.501*** (-0.1143)	-0.133 (-0.6778)	0.628*** (0.0472)
L	-11.638*** (-2.3301)	5.678 (-15.0157)	-0.470 (0.5068)	-15.614*** (-5.0578)	3.426 (-5.3346)	0.593* (0.3499)
NRE	0.337** (-0.1361)	-0.208 (-6.354)	0.625*** (0.2091)	-1.101*** (-0.2962)	0.014 (-0.4567)	-0.311** (0.1387)
RE	-1.005*** (-0.2495)	3.207 (-4.4956)	0.266*** (0.0941)	0.689** (-0.3009)	1.578 (-1.5233)	0.096* (0.0559)
Short-run coefficients						
Error correction coefficients	-0.064** (-0.0376)	-0.186** (-0.0743)	-0.215*** (0.0456)	-0.246** (-0.0975)	-0.440*** (-0.0534)	-0.115*** (0.0195)
ΔK	0.016 (-0.2579)	-0.48 (-0.6207)	0.164*** (0.0186)	0.678*** (-0.1658)	0.497*** (-0.1458)	0.139*** (0.0177)
ΔL	-1.345 (-1.5555)	0.88 -2.2241	0.128 (0.0806)	0.246 (-3.1418)	-1.099 (-2.9699)	0.084 (0.1736)
ΔNRE	4.112 (-3.7867)	4.711 (-4.6079)	0.009 (0.0211)	0.206 (-0.1275)	0.173 (-0.1557)	0.124*** (0.0329)
ΔRE	0.189 (-0.2597)	-0.256 (-0.2661)	-0.012 (0.0154)	-0.200 (-0.414)	-0.925 (-0.7503)	0.030 (0.0301)
constant	0.032 (-0.0497)	9.578 -21.557	2.198*** (0.6510)	-2.163** (-0.8738)	-1.166 (-5.8903)	0.432*** (0.0687)
Number of observations	446	446	360	253	253	236
Number of groups	16	16	15	11	11	11
Hausman test	1.75 [0.789]			5.36 [0.620]		

Note: The standard errors are in the parenthesis. The p-value for the Hausman specification test is given in square brackets. The asterisks *, **, ***, indicate significance level of 10%, 5% and 1%, respectively, all variables are expressed in logarithms.

Source: Author's calculation

Given that the Hausman tests points to panel homogeneity, a battery of diagnostic tests were performed, namely on heteroscedasticity, contemporaneous correlation among cross sections and non-correlation of variances across individuals. The results support the acceptance of the null hypothesis of the modified Wald test,

pointing that there is no heteroscedasticity. According to Pesaran test there is no contemporaneous correlation. The Breusch-Pagan test rejects the hypothesis that the residuals are correlated but only for post-transition countries. Results of diagnostic tests is listed in the appendix.

5. Results and discussion

Using a PMG estimator, the results showed that in 16 developed EU countries, changes in consumption of renewable and non-renewable energy sources per capita have an impact on economic growth, but only in the long run. According to the given results, renewable energy consumption has a negative impact on economic growth. Although consumption of renewable energy has been continually growing, especially after the ratification of the Kyoto Protocol, it seems that by increasing consumption of renewable energy, GDP growth will decrease. This might be a result of political decisions carried out in some developed EU countries which decreased or stopped further investments in the renewable sources of energy and encouraged investments in fossil fuels due to lower prices of oil. According to IEA (2018), global investment in renewable energy declined by 7% in 2017, it was the largest fall in over 15 years. It is interesting to notice that when the same variables were analysed in the period 1990 - 2014 renewable energy consumption had a positive and significant impact on economic growth. Between mid-2014 and early 2016, the global economy faced one of the largest oil price declines in modern history. The 70% price drop during that period was one of the three biggest declines since World War II, and the longest lasting since the supply-driven collapse of 1986 (World Bank Group, 2018).

According to the results in 11 post-transition EU countries, the change in the consumption of renewable and non-renewable energy per capita has a statistically significant impact on economic growth. The long-term renewable energy consumption coefficient is statistically significant at the 5% significance level, suggesting that if renewable energy consumption increases by 1%, then GDP will increase by 0.68%. This means that renewable energy could help expand access to energy in post-transition EU countries. When comparing results with analysis conducted until 2014 it is evident that the impact of renewable energy consumption increased dramatically due to high increase of renewable energy in post-transition EU countries. Increasing renewable energy consumption can be a very difficult goal, including uncertainties related to technology revenues and costs, availability of technology, lack of private sector involvement, or restrictions on government policies. The economic policies of individual post-transition EU countries must provide incentives to implement energy-efficient industries and increase investment in new energy capacities while diversifying energy sources in order to reduce energy dependence.

Furthermore, the coefficient for consumption of non-renewable energy in post-transition countries is statistically significant but negative, which can be explained by the continuous decrease of non-renewable energy sources in post-transition EU countries. Same results are confirmed in analysis conducted until 2014. In 2017, in post-transition EU countries, the share of non-renewable energy in total energy consumption was 77%, while in 1990 it was 91%. Coal is still the main source of energy, although in 2017 its share was reduced to 30% compared to 46% in 1990. The share of oil (27%) and gas (19%) did not change significantly, while consumption of renewable energy increased by four times, from 3% in 1990 to 12% in 2017. Hajko (2014) argues that if manufacturing processes, for example in the industrial sector, move away from energy-intensive activities while maintaining production, the innovation potential of such change will be expressed as negative causality. This innovation can be influenced by increased energy efficiency in existing production, but also by the motivation for structural change within the industry. The importance of the sign of causality is often overlooked in the literature. The sign of causality is usually assumed to be positive (Narayan and Popp, 2012). Among the few exceptions that acknowledge the importance of a sign of causality are Narayan and Popp (2012), Bowden and Payne (2009), and Sari and Soytas (2007). The long-run coefficient for capital is statistically significant, suggesting that if capital increases by 1%, then GDP will increase by 0.50% while coefficient for labour is significant but negative in the long run. In the short run only capital significantly affects economic growth.

The results using PMG estimation method suggest that the error correction coefficients are significantly negative in both groups of countries, indicating the existence of a stable and converging long-run relationship between GDP and capital, labour, non-renewable and renewable energy. Therefore, it can be concluded that the deviation between economic activity and the selected set of independent variables from their long-run equilibrium relationship is gradually decreasing.

The results of the econometric analysis carried out on a set of developed and post-transition EU countries confirmed the main hypothesis that renewable and non-renewable energy consumption has a statistically significant impact on economic growth. The presence of relationship from energy consumption to economic growth means that the availability of energy has a direct impact on economic activity and a prerequisite for achieving high growth rates in the region. Therefore, priority should be directed to energy management, manufacturing and distribution in order to avoid harmful effects of lack of energy. However, the results differ between the developed and post-transition EU countries. In developed EU countries renewable energy consumption has a negative impact on economic growth, while non-renewable energy consumption has a positive impact. In post-transition EU countries results are opposite.

The empirical finding that renewable and non-renewable energy consumption has an impact on economic growth does not necessarily imply that energy conservation

will harm economic growth if energy-efficient production technologies are used. In fact, a reduction in energy consumption due to improvements in energy efficiency may raise productivity, which in turn may stimulate economic growth. Thus, a shift from less efficient and more polluting energy sources to more efficient energy options may establish a stimulus rather than an obstacle to economic development (Costantini and Martini, 2010). According to the results this is validated for post-transition EU countries, which evidently had decreased their consumption of non-renewable energy, while increasing consumption of renewable energy.

Although the EU seeks to establish a single energy market and common energy goals for all member states, different energy policies need to be implemented for each group of countries. Energy intensity is still higher in the post-transition EU countries, it would be irresponsible to force a reduction in energy consumption in those Member States. Obtained research results represent a significant challenge for creators of economic and energy policy in the analysed countries. The above results have significant implications for developing economic policy, especially measures relating to state aid, as well as to conduct energy policy, in particular instruments and measures affecting energy savings. It is particularly important for post-transition EU countries to ensure stable energy sources and diversified supply routes in order to reduce vulnerability and increase the security of the energy system, thus providing a basis for long-term stable economic growth.

We highlight some limitations of our model in explaining the economic growth process considering renewables as an energy source. According to Bhattacharya et al. (2016) while the deployment of renewables depends on many factors within and across countries, it is important to take a long-term view of the deployment process considering cost, efficiency, infrastructure, regulatory barriers, and institutional structure of any country. For example, the integration of renewables with the grid is a major challenge as the grids are largely built to cater for fossil fuel generated baseload electricity. There are strong regulation perceptions, acting as a barrier for increase in renewable investment. We do not consider these factors which may directly or indirectly affect economic growth. Further, we could not include disaggregated data within the renewables due to unavailability of data for long period of time.

Comparison with other studies in which the effects of renewable and non-renewable energy consumption on economic growth were simultaneously investigated show that the results obtained here are consistent with those reported by Tiwari (2011) for 14 EU countries, Uçan et al. (2014) for 15 EU countries and Ito (2017) for 42 developed countries. However, the results are different from those by Menegaki (2011) who found no relationship between renewable energy consumption and economic growth and Furuoka (2017) who found that economic growth affects renewable energy consumption. Finding positive and significant relationship between renewable energy consumption and economic growth for post-transition EU countries in the long term is also found by Alper, Oguz (2016) for 7 new EU

countries, Koçak and Şarkgüneşi (2017) for Bulgaria and Greece, Šimelytė and Dudzevičiūtė (2017) for 12 EU countries and Marinaş et al. (2018) for Hungary, Lithuania and Slovenia.

5. Conclusion

This article investigated the short and long-run impact of non-renewable and renewable energy consumption on economic growth in EU countries. The main aim of this study was to analyse whether energy sources contribute equally to economic growth and what is the difference in the use of individual energy sources in developed compared to post-transition EU countries. Using PMG estimator the results have confirmed the main hypothesis that in developed and post-transition EU countries, the change in the consumption of renewable and non-renewable energy per capita has a statistically significant impact on economic growth per capita. However, the impact of the consumption of non-renewable energy in post-transition EU countries is negative in the long run. It seems that post-transition EU countries managed to shift from less efficient and more polluting energy sources to more efficient energy options which became stimulus to economic growth. On the other hand in developed countries renewable energy consumption has a negative impact on economic growth. This might be a result of political decisions carried out in some developed EU countries which decreased or stopped further investments in the renewable sources of energy and encouraged investments in fossil fuels due to lower prices of oil.

In order to meet goals defined by the Kyoto Protocol and the Paris agreement, the EU has set different target values to be achieved by 2020 and 2030 among which are specific target values for increasing renewable energy production and energy efficiency. In December 2019 European Commission proposed The EU's Green Deal, which is a roadmap for how to reach the newly set climate goal of a 50-55 per cent emission reduction in emissions by 2030, as well as a net-zero emission economy by 2050. It outlines policies and measures, including financial support, which should help enable the EU and its member states, in a collective effort, to reduce emissions sufficiently. To achieve these goals represents a particular challenge for the post-transition EU countries. Although energy intensity is still higher in the new Member States, it would be irresponsible to impose a reduction in energy consumption in those countries.

Given that consumption of renewable energy has positive impact on economic growth in post-transition EU countries, an active role of energy policy-makers in promoting and implementing such energy will have positive effects on the economy. Since infrastructure in post-transition EU countries is old and out-dated, there are essential investments in the development of renewable energy sector. Furthermore,

financial and technical support from developed countries is necessary in order to accomplish goals set by Kyoto protocol and Paris agreement. Also, energy policies intended to increase the production and use of renewable energy will lower the current energy dependence of post-transition countries on energy-supplying states. Although the EU seeks to establish a single energy market and common energy targets for all Member States, energy policies have to be adjusted for the needs of post-transition EU countries. The government should choose the most appropriate incentive policies based on their relevant objectives in terms of renewable energy, the availability of renewable energy technology and the budget constraints in order to promote optimally the exploitation of renewable energy. To ease this “trade-off” between energy consumption and economic growth, policy makers should implement energy policies and provide incentives that emphasise the structural changes towards more energy-efficient industries. New technology-intensive and energy-efficient industries complementary to developed service sector, could trigger sustainable economic growth.

Furthermore, economic growth should be decoupled from energy consumption to avoid negative impacts on economic activities resulting from EU directives enforcing reductions in energy use. Far from being conclusive, this study allows us to open new research directions in the field of multivariate causality among energy consumption, economic activity and CO₂ emissions on disaggregated level and to assess public policies in the energy sector. Also it seems as a good practice to consider the different behavior of different sectors in both energy consumption analyses and in the energy conservation policy design.

References

- Apergis, N., Payne, J. E. (2011) “Renewable and non-renewable electricity consumption–growth nexus: evidence from emerging market economies”, *Applied Energy*, Vol. 88, No. 12, pp. 5226–5230, <https://doi:10.1016/j.apenergy.2011.06.041>.
- Apergis N., Payne J.E. (2012) “Renewable and non-renewable energy consumption–growth nexus: Evidence from a panel error correction model”, *Energy Economics*, Vol. 34, No. 3, pp. 733–738, <https://doi.org/10.1016/j.eneco.2011.04.007>.
- Alper, A.,Oguz, O. (2016) “The role of renewable energy consumption in economic growth: Evidence from asymmetric causality”, *Renewable and Sustainable Energy Reviews*, Vol. 60, pp. 953–959, <http://dx.doi.org/10.1016/j.rser.2016.01.123>.
- Bercu, A. M., Paraschiv, G., Lupu, D. (2019) “Investigating the energy–economic growth–governance nexus: Evidence from Central and Eastern European

- countries”, *Sustainability*, Vol. 11, No. 12, p. 3355, <https://doi.org/10.3390/su11123355>.
- Bhattacharya, M., Paramati, S.R., Ozturk I., Bhattacharya S. (2016) “The effect of renewable energy consumption on economic growth: Evidence from top 38 countries”, *Applied Energy*, Vol. 162, pp. 733–741, <http://dx.doi.org/10.1016/j.apenergy.2015.10.104>.
- Bowden, N., Payne, J.E. (2009) “The causal relationship between U.S. energy consumption and real output: A disaggregated analysis”, *Journal of Policy Modeling*, Vol. 31, pp. 180–188, <https://doi.org/10.1016/j.jpolmod.2008.09.001>
- Breitung J. (2001) “The Local Power of Some Unit Root Tests for Panel Data In Nonstationary Panels, Panel Cointegration, and Dynamic Panels”, *Advances in Econometrics*, Baltagi B. (ed.), Amsterdam, Vol. 31, pp.161–178, [https://doi.org/10.1016/S0731-9053\(00\)15006-6](https://doi.org/10.1016/S0731-9053(00)15006-6).
- Costantini, V., Martini, C. (2010) “The causality between energy consumption and economic growth: A multi-sectoral analysis using non-stationary cointegrated panel data”, *Energy Economics*, Vol. 32, No. 3, pp. 591–603, <https://doi.org/10.1016/j.eneco.2009.09.013>.
- Dobnik, F. (2011) “Energy consumption and economic growth revisited: structural breaks and cross-section dependence”, Available at SSRN 1981869, <https://dx.doi.org/10.2139/ssrn.1981869>.
- European Commission (2019) The European Green Deal, EU Commission: Brussels, Belgium https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF [Accessed: 15.10.2020].
- European Council (2015) Energy Union: secure, sustainable, competitive, affordable energy for every European, https://ec.europa.eu/commission/presscorner/detail/en/IP_15_4497 [Accessed: 15.01.2020].
- Eurostat (2020) Supply, transformation and consumption of energy, by source, https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_cb_sff&lang=en [Accessed: 15.01.2020].
- Eurostat (2020) “The EU in the World”, Eurostat Statistical Books. <https://ec.europa.eu/eurostat/documents/3217494/10934584/KS-EX-20-001-EN-N.pdf/8ac3b640-0c7e-65e2-9f79-d03f00169e17> (11.12.2020.) [Accessed: 15.01.2020].
- Farfan Orozco, F. (2017) “Aging of European power plant infrastructure as an opportunity to evolve towards sustainability”, *International Journal of Hydrogen Energy*, Vol. 42, pp. 18081–18091, <https://doi.org/10.1016/j.ijhydene.2016.12.138>.
- Gemmell, N., Kneller, R., Sanz, I. (2016) “Does the Composition of Government Expenditure Matter for Long-Run GDP Levels?” *Oxford Bulletin of Economics and Statistics*, Vol. 78, No. 4, pp. 522–547, <https://doi.org/10.1111/obes.12121>.

- Hajko, V. (2014) “The Energy-GDP Nexus in EU Countries”, *Energy Studies Review*, Vol. 20, No. 2, pp. 1–23, <https://energystudiesreview.ca/esr/article/view/546/524>.
- Ito, K. (2017) “CO₂ emissions, renewable and non-renewable energy consumption, and economic growth: evidence from panel data for developing countries”, *International Economics*, CEPII research center, No. 151, pp. 1–6, <https://doi.org/10.1016/j.inteco.2017.02.001>.
- Im KS, Pesaran MH, Shin Y. (2003) “Testing for unit roots in heterogeneous panels”, *Journal of Econometrics*, Vol. 115, Issue 1, pp. 53–74, [https://doi.org/10.1016/S0304-4076\(03\)00092-7](https://doi.org/10.1016/S0304-4076(03)00092-7).
- IEA (2018) World Energy Investment 2018, <https://www.iea.org/reports/world-energy-investment-2018> [Accessed: 15.04.2020].
- IRENA (2015) Renewable Energy Target Setting, http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Target_Setting_2015.pdf [Accessed: 15.01.2020].
- Jebli, M. B., Youssef, S. B. (2015) “Output, renewable and non-renewable energy consumption and international trade: Evidence from a panel of 69 countries”, *Renewable Energy*, Vol. 83, pp. 799–808, <https://doi.org/10.1016/j.renene.2015.04.061>.
- Koçak, E., Şarkgüneşi, A. (2017) “The renewable energy and economic growth nexus in Black Sea and Balkan countries,” *Energy Policy*, Vol. 100, pp. 51–57, <https://doi.org/10.1016/j.enpol.2016.10.007>.
- Kraft, J., Kraft, A. (1978) On the relationship between energy and GNP, *Journal of Energy and Development*, Vol. 3, No. 2, pp. 401–403, <https://www.jstor.org/stable/24806805?seq=1>.
- Lee, Y. M., Wang, K. M. (2015), “Dynamic heterogeneous panel analysis of the correlation between stock prices and exchange rates”, *Economic research-ekonomska istraživanja*, Vol. 28, No. 1, pp. 749–772, <https://doi.org/10.1080/1331677X.2015.1084889>.
- Levin A, Lin F, Chu C. “Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties”, *Journal of Econometrics* 2002, Vol. 108, No. 1, pp. 1–24, [https://doi.org/10.1016/S0304-4076\(01\)00098-7](https://doi.org/10.1016/S0304-4076(01)00098-7).
- Maddala GS, Wu SA. (1999) “Comparative Study of Unit Root Tests with Panel Data and a New Simple Test”, *Oxford Bulletin of Economics and Statistics*, Vol. 61, pp. 631–652, <https://doi.org/10.1111/1468-0084.0610s1631>.
- Marinaş, M. C., Dinu, M., Socol, A. G., Socol, C. (2018), “Renewable energy consumption and economic growth. Causality relationship in Central and Eastern European countries” *PloS one*, Vol. 13, No. 10, e0202951 <https://doi.org/10.1371/journal.pone.0202951>.
- Menegaki, A. N. (2011) “Growth and renewable energy in Europe: A random effect model with evidence for neutrality hypothesis”, *Energy Economics*, Vol. 33, No. 2, pp. 257–263, <https://doi.org/10.1016/j.eneco.2010.10.004>.

- Menegaki, A. N. (2014) “On energy consumption and GDP studies; A meta-analysis of the last two decades”, *Renewable and Sustainable Energy Reviews*, Vol. 29, pp. 31–36, <https://doi.org/10.1016/j.rser.2013.08.081>.
- Narayan, P.K., Popp, S. (2012) “The energy consumption-real GDP nexus revisited: Empirical evidence from 93 countries”, *Economic Modelling*, Vol. 29, No. 2, pp. 303–308, <https://doi.org/10.1016/j.econmod.2011.10.016>.
- Ozturk, I. (2010) A literature survey on energy-growth nexus, *Energy Policy*, Vol. 38, No. 1, pp. 340–349, <https://doi.org/10.1016/j.enpol.2009.09.024>.
- Ozturk, I.; Acaravci, A. (2010) “The causal relationship between energy consumption and GDP in Albania, Bulgaria, Hungary and Romania: Evidence from ARDL bound testing approach”, *Applied Energy*, Vol. 87, No. 6, pp. 1938–1943, <https://doi.org/10.1016/j.apenergy.2009.10.010>.
- Papież M., Smiech, S., (2013) “Economic Growth and Energy Consumption in Post-Communist Countries: a Bootstrap Panel Granger Causality Analysis”, *Dynamic Econometric Models*, Uniwersytet Mikolaja Kopernika, Vol. 13, pp. 51–68, <http://dx.doi.org/10.12775/DEM.2013.003>.
- Pedroni, P. (1999) “Critical values for cointegration tests in heterogeneous panels with multiple regressors”, *Oxford Bulletin of Economics and statistics*, Vol. 61, No.1, pp. 653–670, <https://econpapers.repec.org/scripts/redir.pf?u=https%3A%2F%2Fweb.williams.edu%2FEconomics%2Fwp%2Fpedronicriticalvalues.pdf;h=repec:wil:wileco:2000-02>.
- Pesaran HM, Shin Y, Smith RP (1999) “Pooled mean group estimation of dynamic heterogeneous panels”, *Journal of the American Statistical Association*, Vol. 94, pp. 621–634, https://econpapers.repec.org/scripts/redir.pf?u=http%3A%2F%2Fwww.econ.ed.ac.uk%2Fpapers%2Ffid16_esedps.pdf;h=repec:edn:esedps:16.
- Pesaran, M. H., Smith, R. (1995) “Estimating long-run relationships from dynamic heterogeneous panels”, *Journal of econometrics*, Vol. 68, No. 1, pp. 79–113, [https://doi.org/10.1016/0304-4076\(94\)01644-F](https://doi.org/10.1016/0304-4076(94)01644-F).
- Pirlogea, C., Cicea, C. (2012) “Econometric perspective of the energy consumption and economic growth relation in European Union,” *Renewable and Sustainable Energy Reviews*, Vol. 16, No. 8, pp. 5718–5726, <https://doi.org/10.1016/j.rser.2012.06.010>.
- Salim, R. A., Hassan, K., Shafiei, S. (2014) “Renewable and non-renewable energy consumption and economic activities: Further evidence from OECD countries”, *Energy Economics*, Vol. 44, pp. 350–360, <https://doi.org/10.1016/j.eneco.2014.05.001>.
- Sari, R., Soytas, U., (2007) “The growth of income and energy consumption in six developing countries”, *Energy Policy*, Vol. 35, pp. 889–898, <https://doi.org/10.1016/j.enpol.2006.01.021>.
- Sharma, S. S. (2010) “The relationship between energy and economic growth: Empirical evidence from 66 countries” *Applied energy*, Vol. 87, No. 11, pp. 3565–3574, <https://doi.org/10.1016/j.apenergy.2010.06.015>.

- Sulaiman, C., Abdul-Rahim, A. S. (2020) “The Impact of Wood Fuel Energy on Economic Growth in Sub-Saharan Africa: Dynamic Macro-Panel Approach” *Sustainability*, Vol. 12, No. 8, p. 3280, <https://doi.org/10.3390/su12083280>.
- Šimelytė, A., Dudzevičiūtė, G. (2017) “Consumption of renewable energy and economic growth” In Contemporary issues in business, management and education’2017: 5th international scientific conference, 11-12 May 2017, Vilnius Gediminas Technical University: conference proceedings (1-10). VGTU Press, <https://doi.org/10.3846/cbme.2017.048>.
- Tiwari A.K., (2011) Comparative performance of renewable and non-renewable energy source on economic growth and CO₂ emissions of Europe and Eurasian countries: A PVAR approach”, *Economics Bulletin*, Vol. 31, No. 3, pp. 2356-2372, <https://econpapers.repec.org/scripts/redir.pf?u=http%3A%2F%2Fwww.accessecon.com%2FPubs%2FEB%2F2011%2FVolume31%2FEB-11-V31-I3-P212.pdf;h=repec:ebl:ecbull:eb-11-00479>.
- Tugcu, C.T., Ozturk, I., Aslan, A. (2012) “Renewable and non-renewable energy consumption and economic growth relationship: Evidence from G7 countries”, *Energy Economics*, Vol. 34, No. 6, pp. 1942–1950, <https://doi.org/10.1016/j.eneco.2012.08.021>.
- Uçan, O., Aricioglu, E., Yucel, F. (2014) Energy Consumption and Economic Growth Nexus: Evidence from Developed Countries in Europe, *International Journal of Energy Economics and Policy*, Vol. 4, No. 3, pp. 411–419, <http://www.econjournals.com/index.php/ijeep/article/download/848/476>.
- Vlahinić-Dizdarević, N. (2011) Restrukturiranje i liberalizacija tržišta električne energije: Gdje je Hrvatska. *Računovodstvo i financije*, God. 57, pp. 99–104, https://bib.irb.hr/datoteka/522647.vlahinic_dizdarevic-rif.pdf.
- World Bank Group (2018) Global Economic Prospects, Broad-based upturn, but for how long, <https://openknowledge.worldbank.org/bitstream/handle/10986/28932/9781464811630.pdf> [Accessed: 15.04.2020].

Utjecaj potrošnje energije na ekonomski rast u razvijenim i post-tranzicijskim zemljama Europske unije

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Sažetak

Cilj ovog istraživanja bio je empirijski istražiti utjecaj potrošnje obnovljivih i neobnovljivih izvora energije na ekonomski rast. Analiza je provedena na podacima za 16 razvijenih EU država u razdoblju od 1990. do 2018. te za 11 post-tranzicijskih EU država u razdoblju od 1995. do 2018. Dobiveni rezultati uspoređeni su s rezultatima dobivenim za razdoblje do 2014. godine. Za kvantificiranje kratkoročnog i dugoročnog utjecaja, primijenjen je združeni procjenitelj aritmetičke sredine grupe (PMG). Prema empirijskim rezultatima potrošnja oba izvora energije u dugom roku značajno utječe na ekonomski rast u obje skupine zemalja. Međutim, rezultati se razlikuju između razvijenih i post-tranzicijskih EU zemalja. U razvijenim EU zemljama potrošnja obnovljivih izvora energije ima negativan utjecaj na ekonomski rast, dok potrošnja neobnovljivih izvora energije ima pozitivan utjecaj. U post-tranzicijskim EU zemljama rezultati su suprotni, što znači da u tim zemljama postoji tendencija prelaska s manje učinkovitih i onečišćujućih izvora energije na učinkovitije energetske opcije koje mogu biti poticaj ekonomskom rastu.

Ključne riječi: *potrošnja obnovljivih i neobnovljivih izvora energije, ekonomski rast, razvijene i post-tranzicijske EU zemlje*

JEL klasifikacija: *Q43, O44, C33*

Appendices

Table 1A: Descriptive statistics

	Variable	Obs	Mean	Std. Dev.	Min	Max
	EU16	GDP	459	41166.48	18299.13	6539.951
GFCF		464	8576.565	3686.422	2564.02	24856
LABOR		464	0.481102	0.039781	0.396179	0.558528
NRE		459	3.129299	1.436152	1.371544	9.491975
RE		459	0.432392	0.498048	0.006681	2.137595
	Variable	Obs	Mean	Std. Dev.	Min	Max
	EU11	GDP	253	12895.12	5148.539	3756.751
GFCF		253	2977.71	1413.214	127.49	7445.37
LABOR		253	0.477273	0.030342	0.389806	0.533005
NRE		251	1.924885	0.670702	0.476456	3.755915
RE		251	0.324599	0.188089	0.05702	0.99635

Table 2A: Diagnostic tests

	EU16	EU11
Modified Wald test	-1.5846	-0.78768
Breusch-Pagan test	213.1929	90.71792
Pesaran LM Normal	2.807478***	1.009105

Note: *** denote significant at 1%; results for H0 of Modified Wald test: $\sigma(i)^2 = \sigma^2$ for all i ; results for H0 of Pesaran and Breusch-Pagan LM tests: residuals are not correlated

Source: Author's calculation

Income convergence between Southeast Europe and the European Union*

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Abstract

This paper investigates the average gross per capita income convergence of eight Southeast European economies towards the EU average. Our goal is to analyse which factors have driven that convergence in the SEE region and describe convergence paths in the 2000-2018 period, concerning two sub-periods, before and after the economic crisis. We use a combination of parametric and nonparametric methods and a fixed effects linear panel regression with robust standard errors. Results suggest that the EU integration process drove convergence, education level, investment (FDI, private domestic and public investments), and private sector lending, as well as by government expenditures. Economic crisis, unemployment, and inflation were the main factors which have influenced the divergence process. We also concluded that the post-transition growth model dominant in the SEE region, based on an FDI inflow, has not sufficient for income convergence in this region. Private domestic investments are a critical missing factor for faster income convergence.

Key words: Gross income convergence, Southeast Europe, economic growth, EU integration, panel data analysis

JEL classification: F43, O11, O47

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1. Introduction

Southeast Europe (SEE)⁵ entered the 21st century as one of the most underdeveloped parts of Europe, with an average gross domestic product (GDP) per capita almost ten times lower than the European Union (EU) average. A deep recession in the early 1990s influenced by the wars in the former Yugoslavia, international sanctions, delay in structural reforms, political instability, lack of investment, and many other factors, negatively affected the economic development of the region at the beginning of the transition process (Bartlett, 2009; Uvalic, 2010).

The region has been recovering since 2000. Some of the reasons for the relatively high growth rates during the 2000-2008 period were the low starting position, significant donor assistance (primarily from the EU), and significant FDI inflow due to the stabilization of the political environment (except for North Macedonia, which was affected by the conflict in 2001). FDI has steadily increased, particularly after 2006, including some significant privatization deals in the telecommunications and banking sector across the region (Uvalic, 2010: 11). Simultaneously, close to €7 billion of international assistance, both in the form of grants and loans, entered SEE countries in the 2001-2002 period (European Commission, 2003: 5). However, not all countries had the same pace of development, nor did they rebuild their economies with the same success. Romania, Bulgaria and Croatia, for example, have become part of the EU, which has greatly affected their economic development. Despite the significant growth in the previous period, the SEE region is still the least developed region in Europe. That implies that the convergence process was slow and inadequate, which is a starting point for our analysis.

The main goal of this paper is to examine the process of the income convergence between SEE and the EU during the 2000-2018 period. The main hypothesis is that income convergence in SEE countries was slow and inadequate during that period. We will also test the logical assumption that the dynamics of income convergence is faster in the period before the economic crisis and slower in the period after the crisis. The purpose of this paper is also to examine the gross income convergence and divergence factors in the case of the analysed SEE economies. We use gross income as a convergence indicator (although GDP per capita is more predominantly used) because we focus on living standards rather than just on economic growth. At the same time, GDP per capita might substantially decrease or increase within a decade due to migrations or demographic trends without any effects on the convergence of citizens' living standard. Finally, GDP per capita provides data on the productivity of the economy and does not provide enough information on the living standard. Therefore, it is possible that GDP per capita steadily grows and

⁵ In our analysis we use the IMF and WB definition of SEE which includes Albania, Bosnia-Herzegovina, Bulgaria, Croatia, North Macedonia, Montenegro, Romania and Serbia.

converges and that gross income remains unchanged in case large proportions of gross added value is not reinvested or spent in the country.

After a detailed literature review in part two, we explain the research methodology and define the model and variables in part three. Empirical data and analysis are presented in the fourth section, including Kernel distribution dynamics and regression results. We use a combination of parametric and nonparametric methods to study the dynamics of real per-capita income for eighth SEE countries relative to the EU average over the period 2000-2018. First, we estimated the probability density function of per capita income using a kernel estimator and analysed the evolution in their shape to follow convergence tendencies in the SEE countries. Second, using regression analysis we identified the various factors that contribute to or reduce convergence over the selected period. A discussion of the results is given in part five, followed with conclusions in part six.

2. Literature review

Gross income convergence has been investigated far less in economic literature than the GDP convergence. The rationale relies on the theoretical concepts that higher GDP growth rates in less developed countries will lead to higher income, and therefore, income convergence will follow economic convergence. Theoretical aspects of growth convergence (Rassekh et al., 2001; Ben-David, 1996; Greasley and Oxley, 1997) provided essential insights into the structure of the convergence process. Growth convergence among regions inside a country and a specific group of countries have also been studied (Linden, 2002; Carlino and Mills, 1996; Zhang et al., 2001; Dobson and Ramlogan, 2002). The analysis of the economic convergence of the U.S. states between 1840 and 1988 proved the existence of β -convergence – economies further below steady-state position grow faster (Barro and Sala-i-Martin, 1990). Most research papers analysed and measured convergence by using beta and sigma convergence across countries. Beta convergence implies catching up while sigma convergence implies a reduction in disparities (Grela et al. 2017). Beta convergence generates sigma convergence and is a necessary, but not sufficient, condition of sigma convergence. Countries cannot become similar in terms of GDP if poorer ones do not grow faster (Grela et al. 2017). Apart from beta and sigma convergence, literature recognized nominal and real convergence where nominal convergence represents higher uniformity of nominal variables, while real convergence refers to an approximation of economy welfare levels proxied by GDP per capita (Martin et al., 2001: 3).

In the EU, regional linkages have a significant role in the formation of convergence clubs (Borsi and Metiu, 2015). Assessment of 102 EU regions over the period 1995–2000 (Tselios, 2009) proved the presence of conditional

convergence in income per capita after controlling for educational attainment, unemployment, sectoral composition, spatially lagged growth of income per capita, and regional fixed effects, and that of unconditional convergence in income inequality. The effects of the European integration on regional convergence of 188 regions between 1991 and 2004 have been thoroughly assessed, and conclusions on growth convergence were not unambiguous (De Dominicis, 2014). Research on the existence of convergence of 10 European countries, which accessed the European Union in 2004 (Vojinovic et al. 2009), provided clear conclusions that convergence took place during the examined period 1995-2006. On the other hand, Simionescu (2015: 74) reject the hypothesis of overall convergence in EU-28 over 1995-2012. There is also a study showing that economic, socio-political, and policy differences among EU member states reduce the rate of convergence in the EU (Yin et al., 2003: 210). In some countries, growth rates are varying among regions. According to Eckey and Türck (2005: 18) most studies find a low convergence rate of all or some European regions. The result of EU-25 regional income analyses shows regional disparities in both EU-15 and new member states (Paas and Schlitte, 2006: 23). In Croatia, for example, there is a lack of regional convergence and regions with a higher level of public investments had higher growth rates and short and long-term increases in wages and employment (Drezgić, 2011: 55).

Discussion so far draws that there is little empirical reason for the uncertainty that European integration would cause economies to diverge, and real convergence would seem to depend on a country's capacity to international technological spillovers mainly through FDIs (Martin et al., 2001: 1). Therefore, an important group of convergence factors includes the relevance and impact of FDI and trade and financial openness. The level and growth of per capita income did converge as bilateral FDI flow increased between the two countries. This implies that FDI flow is critical in human capital spillover and thus convergence (Choi, 2004). In the case of 8 CEE countries (Kutan and Yigit, 2009: 136), technology transfer facilitates catching up by this group of countries towards EU15 productivity. Scholars also state the dependence of new member states' convergence speed and speed of capital accumulation (Alho et al., 2004: 19). In the case of 35 OECD countries (D'Elia and De Santis, 2019), low- and middle-income countries benefit more from international trade and trade and financial openness. They further reduce the growth gaps across the countries, but not income inequality. There is also a statement that greater financial integration leading to the transfer of capital from rich to poor, but with higher incomes, financial integration plays fewer roles in attracting foreign capital and reducing this growth impulse (Abiad et al., 2007: 26).

Simionescu (2015: 68) pointed out that convergence is an important problem for new EU member states. Niebhur and Schlitte (2004: 175) also state that

convergence speed has declined since the early period of European integration ... and catching up to the EU average will be a long-term process for the new member states. Important findings on the economic cycles impact on the Eurozone inequality dynamics show country-level differentiability regarding the utilisation of cyclical advantages (Rubinic and Tajnikar, 2020) which creates serious adverse effects on inequality due to the unequal exchange of labour in the Eurozone (Rubinic and Tajnikar, 2019). The focus on the WB region shows that the absolute convergence of the WB countries was much stronger up to 2008 due to lower initial growth at the earlier stage of transition and global economic expansion before the crisis (Krestovska, 2018: 198). In general, the WB region converges to the EU, but real convergence to the EU average is relatively slow (Krestovska, 2018: 200). According to Sanfey and Milatovic (2018: 2) the WB region will need decades to catch up with EU average standards of living, and full convergence will require productivity and investment on a higher level. According to this report, productivity is a fundamental problem of WB region, reflected in under-investments, undeveloped institutions and the business environment (Sanfey and Milatovic, 2018: 2). Starting with the literature review, our analysis is focused on income convergence, while most of the published literature on the issue is based on GDP per capita convergence. We believe that this innovative approach, rarely used in economic literature in the region, will put a new light on key factors influencing living standard in the SEE. Second, we will not use standard first (β -convergence) and second (σ -convergence) moments of the income distribution, which fail to characterize the evolution of the entire income distribution over time. Because of the heterogeneity across SEE countries, we will implement a methodology that uses kernel density estimates to examine the shape of the income distribution and distributional dynamics (Nenovsky and Tochkov, 2014). Last but not least, we want to explore one of the main expectations in transition economies that the process of EU integration leads to an increase in the living standard and catching up with income per capita in the EU.

3. Methodology

In order to analyse what are the long-run tendencies of incomes, we will start from Quah (1993, 1996a, 1996b and 1997). The nonparametric part of the analysis starts with estimating the probability density function of relative per capita income using a kernel function. Let X_1, \dots, X_n be a sample of n identically distributed observations on a random variable X . The density value $f(x)$ at a given point x is estimated by the following kernel density estimator

$$\hat{f}(x) = \frac{1}{nh} \sum_{i=1}^n K\left(\frac{x-X_i}{h}\right) \quad (1)$$

where h denotes the bandwidth of the interval around x and K is the kernel function.⁶ (Li and Racine, 2007). The kernel estimator assigns a weight to each observation in the interval around x , with the weight being inversely proportional to the distance between the observation and x . The density estimate consists of the vertical sum of frequencies at each observation. The resulting smooth curve allows us to visualize the shape of the distribution of relative per-capita income and detect the presence of “convergence clubs” represented by modes.

Second, we attempt to identify the determinants of relative per capita income growth via regression analysis. For this purpose, we estimate the following model:

$$\begin{aligned} \Delta \ln \left(\frac{y_{it}^{SEE}}{y_t^{EU}} \right) = & \alpha_i + \beta_1 UNEMPL_{it} + \beta_2 SCH_{it} + \beta_3 FTR_{it} + \\ & \beta_4 FDI_{it} + \beta_5 GOVEXP_{it} + \beta_6 DEBT_{it} + \beta_7 INVG_{it} + \beta_8 INVD_{it} + \\ & \beta_9 CPI_{it} + \beta_{10} LOAN_{it} + \beta_{11} EU_{it} + \beta_{12} CRIS_{it} + \\ & \beta_{13} \left(\frac{y_{i(t-1)}^{SEE}}{y_{(t-1)}^{EU}} \right) \end{aligned} \quad (2)$$

The dependent variable is the adjusted gross disposable income of households per capita SEE country i ($i=1, \dots, 8$) in year t as a percentage of the EU average. For robustness purposes and to control for short-run fluctuations, we also estimate the model for average gross disposable income over 3-year periods as the dependent variable. The regression employs country-fixed effects (α_i) to control for the effects of unobserved confounding variables that vary across countries and years. Regressors in the model are chosen based on the standard growth literature. (Sala-i-Martin, 1997; Durlauf and Quah, 1999; Temple, 1999). Our dependent variable measures income convergence per capita towards the EU benchmark over time.

As independent variables, we used different factors which can increase or decrease the rate of convergence. Human capital is represented by average years of total schooling (SCH) for individuals aged 15 years and above (see, i.e. Barro and Lee, 2013) and unemployment level (UNEMPL). We suppose that SCH positively influences income convergence, while it is opposite for unemployment. Fiscal policy is approximated by government expenditures as the percentage of GDP (GOVEXP) and public debt (DEBT). We believe that GOVEXP stimulates income convergence, while public debt generates income divergence. External forces are represented by the level of foreign trade (FTR), calculated as the sum of exports and imports, and by net inflow of the foreign direct investment (FDI). Investments are separated into public (INVG) and domestic private investments

⁶ We use data-driven bandwidth selection and an Epanechnikov kernel function.

(INVD). We assume that investments and FTR are influencing positively income convergence. Monetary policy is approximated by price instability and measured as the annual rate of the consumer prices index (CPI), and we expect that impact on income convergence is negative. The financial sector and financial depending are approximated by the level of credits to the private sector (LOAN), which can positively influence income convergence. All investments and credits, as well as fiscal variables and foreign trade, are expressed as a percentage of GDP.

Finally, we include dummy variables for the years in which a SEE country was a member of the EU (EU) and for the years of the global crises (CRIS). Membership in the EU takes the value of 1 if a SEE country is an EU member in that year, and 0 otherwise. The “years of the global crises” takes the value of 1 during the 2009-2010 period and 0 otherwise. Finally, we included lagged values of the dependent variable in order to conclude about the persistency of the convergence process.

4. Empirical data and analysis

The sample covers eight countries in SEE during the period 2000-2018. The adjusted gross disposable income of households per capita reflects the purchasing power of households and their ability to invest in goods and services or save for the future. It is calculated as the adjusted gross disposable income of households divided by the purchasing power parities (PPP) of the actual individual consumption of households and by the total resident population. The index is calculated with the European Union average set to equal 100. If the index of a country is higher than 100, this country’s level of adjusted gross disposable income of households per person is higher than the EU average and vice versa. Variables were collected from the World Bank’s World Development Indicators database and Eurostat.⁷ Data sets are analysed using STATA software. The descriptive statistics for all variables are shown in Table 1.

⁷ Source for dependent variable is EUROSTAT, online data code SDG_10_20.

Table 1: Descriptive statistics⁸

	2000-2018	2000-2008	2009-2018
Average income per capita (% of EU average)	37.62 (11.96)	32.28 (10.83)	42.44 (10.89)
Average income per capita (% of EU average), t-1	37.18 (11.80)	31.27 (10.29)	41.92 (10.80)
Unemployment rate (in %)	17.84 (8.56)	19.16 (9.53)	16.66 (7.46)
FDI (% of GDP)	5.89 (4.36)	6.89 (4.76)	4.99 (3.78)
Foreign trade (sum import and export in % of GDP)	89.75 (18.62)	84.18 (18.17)	94.77 (17.66)
Public debt (% of GDP)	45.70 (23.94)	42.67 (28.48)	48.34 (18.89)
Domestic private investments (% of GDP)	16.97 (5.37)	16.81 (5.42)	17.11 (5.37)
Public investments (% of GDP)	4.65 (1.67)	4.72 (1.57)	4.59 (1.77)
CPI (in %)	5.67 (11.17)	9.63 (15.14)	2.11 (2.34)
Government expenditures (% of GDP)	18.11 (3.86)	18.82 (4.23)	17.47 (3.40)
Credits to private sector (% of GDP)	40.76 (18.69)	30.09 (18.95)	50.36 (12.16)
Average years of schooling	13.64 (1.15)	12.83 (1.00)	14.34 (0.71)

Source: Author's calculation according to data obtained from WB and Eurostat

The average per-capita income in SEE was 37% of the EU average. Five variables – unemployment rate, FDI, public investment, inflation and government expenditures – decreased between the first and second sample periods. The average gross income in SEE was in the period 2000-2008 around 10 percentage points lower than in the second period. Parallel to that, the unemployment rate was lower, as well as the level of foreign trade. The price liberalization caused relatively high levels of inflation in the 2000s during that phase of transition in SEE. Moderate public spending in the second period (government expenditures and public investment), lower foreign direct investments, and a higher level of public debt was most probably the result of the global financial crisis in Europe in the 2009-2010 period.

⁸ The reported numbers are averages across all countries and years. Standard deviations are in parenthesis.

To choose a regression technique, we first tested autocorrelation in panel data using the Wooldridge test (Wooldridge, 2002). Results show that first-order autocorrelation is present (Prob>F=0.002 for 2000-2018 period; Prob>F=0.010 for 2000-2008 period; Prob>F=0.0014 for 2009-2018 period;). Modified Wald test for groupwise heteroskedasticity in fixed effects (FE) regression model shows that heteroskedasticity is present for all dependent variables. Finally, taking into consideration that in our panel, N is bigger than T (N=1,216; T=10), we tested cross-sectional dependence using the test of Pesaran (2004). Results show no presence of cross-sectional dependence in our panel.

Table 2: Heteroskedasticity tests results

Variables	Modified Wild Test
Average income per capita (% of EU average), 2000-2018	1,594.16 (0.000)
Average income per capita (% of EU average), 2000-2008	85.16 (0.000)
Average income per capita (% of EU average), 2009-2018	283.98 (0.000)

Source: Author's calculation according to data obtained from WB and Eurostat

Recent literature dealing with the estimation of heterogeneous panels (Baltagi et al., 2006; Baltagi et al., 2010) suggests that, if heteroskedasticity is present, the choice of a relevant model is sensitive to specifying the correct source of heteroskedasticity. Starting from that, and also taking into consideration that first-order autocorrelation is present, based on the conclusions of Hoechle (2007), we will use in our analysis fixed effects linear panel regression with robust standard error.⁹

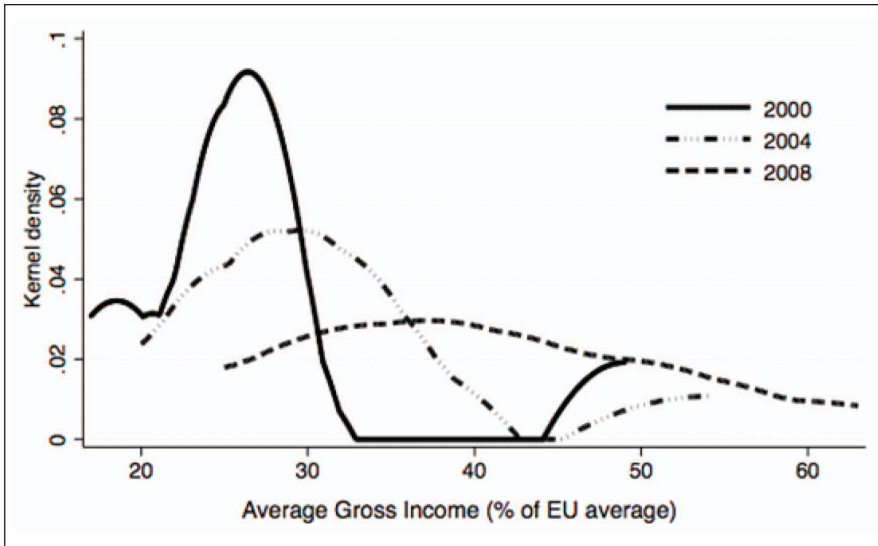
4.1. Distribution dynamics

The density distributions of average gross income per capita as % of the EU average for the pre-crisis period (years 2000, 2004 and 2008) are presented in Figure 1. At the start of the observed period in 2000, the density distribution was almost unimodal, with most of the probability mass concentrated in the range between 20% and 30% of the EU average, with a minor mode emerging at the 50% level. Over the following eight years, there is a clear shift of the distribution to the

⁹ It is also possible to use FGLS regression, but that method is infeasible if the panel's time dimension T is smaller than its cross-sectional dimension N (Hoechle, 2007), which it is in our case.

right, signifying convergence to the benchmark. Also, an increase in the dispersion of average income per capita produces a new range at around 30-45% of the EU average. Simultaneously, a minor mode emerges at the 60% level suggesting some level of convergence between SEE countries.

Figure 1: Kernel density distributions of average gross income per capita (% of EU average), 2000-2008

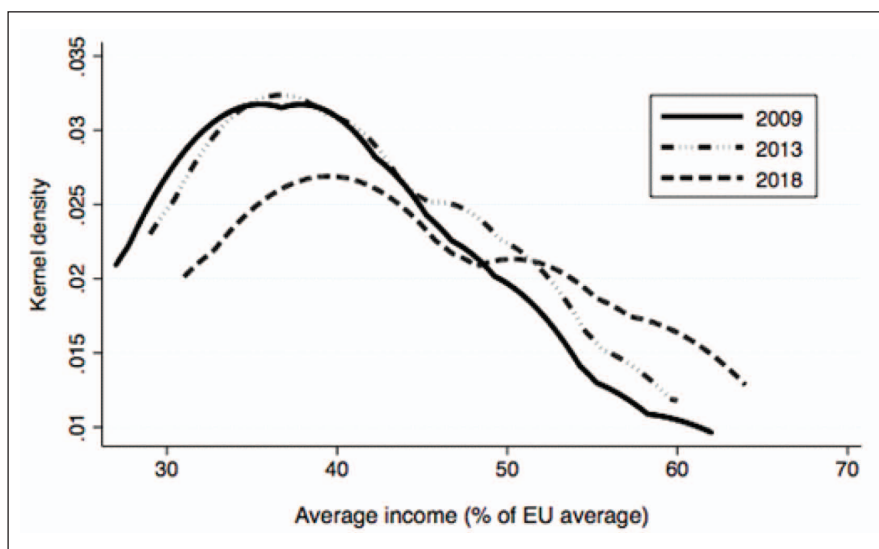


Source: Author's calculation according to data obtained from WB and Eurostat

The observed convergence over the first decade of the 2000s correlates with the most dynamic period of the transition in SEE, when many economies in the region experienced high growth rates and significant investments, especially FDIs. The strong convergence tendency of the late 2000s reflects the success of political reforms in generating growth that allowed SEE countries to catch up with the EU. At the end of this period, two countries (Romania and Bulgaria) became members of the EU.

The distributional dynamics in the period after 2009 present a slightly different picture. The density distributions of average gross income per capita as % of the EU average for the crisis and post-crisis period (years 2009, 2013 and 2018) are presented in Figure 2.

Figure 2: Kernel density distributions of average gross income per capita (% of EU average), 2009-2018



Source: Author's calculation according to data obtained from WB and Eurostat

This period started with an economic crisis that heated the whole of Europe. A continuous shift of the distribution to the right, started in the previous period, was slowed, discontinuing the convergence between SEE and the EU benchmark. In the next five years, distribution remains similar, between 30-45% of the EU benchmark. In the last five years of the observed period, we can see significant convergence again. In that period, distribution was shifted to the right again, with most of the probability mass concentrated around 40% of the EU average. At the same time, we see some modes around 50%, and minor modes around 60%. These include mostly EU member countries in the SEE, such as Romania, Bulgaria and Croatia, as well as Montenegro. Although they experienced an increase in income per capita, the speed of convergence was moderate compared to the first period when most of the SEE countries doubled average gross income per capita measured in % of EU average. For instance, in the first observed period, countries like Bulgaria achieved a 55% increase in its relative standing while Montenegro reached a 62% increase. Also, not all countries experienced the same dynamics in the second period. Serbia recorded a 2.6% increase in its relative standing over the period 2009-2018, better than Croatia (1.6%) similar with Bosnia-Herzegovina (3.3%), but far behind North Macedonia (11.8%), Albania (14.8%), Bulgaria (16.3%), Montenegro (17.5%) or Romania (23.1%).

4.2. Regression results

Regression analysis results are in line with the previous findings. The results for model specification of the fixed-effects over the entire sample period and two sub-periods are shown in Table 3. We should note again that the dependent variable measures income convergence (or divergence) between SEE and the EU over time.

Table 3: Regression results for average gross income per capita GDP in % of EU average

	2000-2018	2000-2008	2009-2018
Average Income (t-1)	1.007* (0.014)	0.951* (0.107)	0.959* (0.017)
Unemployment rate (UNEMPL)	-0.019 (0.022)	-0.039** (0.199)	-0.0097* (0.032)
FDI	0.084* (0.022)	0.015 (0.038)	0.081** (0.054)
Foreign trade (FTR)	-0.023* (0.009)	0.003 (0.008)	-0.008 (0.010)
Public debt (DEBT)	-0.029* (0.008)	-0.003 (0.009)	-0.003 (0.008)
Domestic private investments (INVD)	0.347* (0.027)	0.321** (0.018)	0.425** (0.029)
Public investments (INVG)	0.083 (0.076)	0.285* (0.076)	0.016 (0.064)
CPI	-0.018** (0.009)	-0.004 (0.003)	-0.062** (0.034)
Government expenditures (GOVEXP)	0.001 (0.039)	-0.212* (0.027)	0.225* (0.099)
Credits to private sector (LOAN)	0.001 (0.006)	0.025* (0.008)	-0.041* (0.025)
Average years of schooling (SCH)	0.171* (0.021)	1.974* (0.351)	-0.873* (0.181)
EU Membership (EU)	0.273* (0.032)	0.389 (0.479)	1.198* (0.529)
Economic Crisis (CRIS)	-1.533* (0.285)		-0.996* (0.393)
Const.	2.836 (2.332)	-19.420* (5.171)	14.020* (3.108)
No of Observation	141	62	79

* 5% significance level; ** 10% significance level

Source: Author's calculation according to data obtained from WB and Eurostat

5. Results and discussion

The regression analysis shows that progress in EU integration, education (average years of schooling) and investments (FDI and public investment) were the key determinants of convergence over the entire sample period while divergence was mainly driven by the economic crisis and by the unemployment rate growth after the economic crisis 2009-2010.

Membership in the EU contributes to the accelerated economic growth and faster convergence (Ryszard and Mariusz, 2019; Alcidi, 2019; Cuaresma et al., 2008). In the case of SEE countries, that is most evident for Romania, Bulgaria, and Croatia. At the same time, average years of schooling promotes not only economic growth but also convergence towards the EU average per capita income (Henderson and Russell, 2005). Based on the comparative analysis of the education quality significance to economic growth (Hanushek and Woessmann, 2010) it is logical to assume that the education quality has improved alongside increased years of schooling in SEE. The educated workforce helped SEE to grow more rapidly than the EU benchmark. Many factors might be responsible for this, including the historical quality of education in SEE as well as enhanced opportunities for higher income in the booming private sector (2001-2008) in comparison to the salaries in the public sector. However, this effect seems to be limited to the first period of transition, while in the second period, with higher levels of development, some other factors become more important. That is also influenced by the massive brain drain from SEE, especially in the period after the crisis.

The impact of FDI on convergence in the whole observed period is positive. In economic literature, there is a clear consensus that FDI contributes to living standards (OECD, 2008). Hence, some analysis shows that the result depends “positively on levels of freedom from government intervention and freedom from business regulation, and negatively on FDI volatility and natural resource dependence” (Herzer, 2012). We assume that FDI flow in the SEE region is mostly driven by a cheap labour force, while markets are unstable and highly dependent on government intervention. In such an environment, FDI contributes to the average income growth, but much less than expected. At the same time, the contribution of private domestic investment is significant, especially in the second period. Most of the literature points out this factor as critical for growth and convergence toward the EU standard (Grela et al., 2017).

A positive sign for the coefficient of financial depending (LOAN) is not unexpected, taking in consideration previous studies for this region (Kiss et al. 2006; Stojanović and Stojanović, 2015). Between 2000 and 2008, most of the SEE countries experienced an unprecedented credit boom with double-digit increases in private lending as a share of GDP. Credit growth was fuelled by large inflows resulting from the high liquidity on global markets that was channelled into SEE via foreign-

owned banks that dominate the financial sector in many countries in the region (IMF, 2015; IMF, 2017). Presence of foreign banks made it possible to increase the availability of funds to the private sector in these countries. The credit boom disappeared as soon as the global crisis hit the region in 2009-2010. SEE countries, which had experienced massive private credit growth in the years 2000-2008, in the second period faced a drop or a slowdown in the convergence of their per-capita income compared to the EU average.

In the period after the crisis, most of the countries established expansive fiscal policies to fasten economic growth and fight economic crisis. On the other side, significant level of government expenditures is followed by high public debt. Although the literature on the relationship between government debt and economic growth in the period of crisis and after crisis (Darvas, 2010; Checherita-Westphal and Rother, 2011), shows a certain positive correlation between fiscal expenditures, public debt, and growth, that is true until a certain threshold is reached. All countries (except Bulgaria) experience high levels of public debt, which hampered the income convergence of the region.

Our results also show that the global economic crisis has slowed down the convergence of the SEE region. That result is in line with economic literature (Matkowski et al. 2016; Stanisic, 2012). During the crisis, most of the convergence drivers (investments, EU integration process, credit to the private sector) dramatically slowed, creating increased income differences between SEE and EU countries. Moreover, the scope and duration of this effect have affected the medium-term convergence path, as we can see from the results in the second period (Table 3). Although the temporary nature of the crises is evident, this conclusion is in line with our finding in the nonparametric part of the analysis that showed convergence to be generally affected by the crises.

At the same time, unemployment played an important role in income divergence in the SEE region over time as well as inflation. In particular, increases in inflation cause average per capita income in SEE to diverge from the EU average. Inflation is more generally a sign of macroeconomic instability, especially in SEE, where hyperinflation has resulted from price liberalisation in the early stages of the first period as well as from banking and financial crises due to the expansionary monetary policy. Therefore, it is not unexpected that this instability hampers the reduction of disparities between SEE and the EU.

The results indicate faster income convergence to the EU average in the early years of transition (2000-2008). During this period, SEE countries, on average, doubled their average per-capita income comparing the benchmark. Some countries, like Romania and Bulgaria, entered the EU at the end of this period, which highly influenced their income level. Simultaneously, the relative income distribution over this period evolved from a multimodal to a unimodal one, hiding a disparity among

the countries in the sample. Over the years 2009-2010, SEE countries experienced economic crises, which slowed down the convergence. Our analysis shows that in the 2009-2018 period, SEE countries did not retrieve convergence dynamics from the previous period. At the same time, the global crises influenced convergence tendencies but also increased relative income heterogeneity across the region, especially between EU and non-EU countries.

6. Conclusions

Our analysis shows that income convergence in SEE countries was inadequate in the 2000-2018 period. At the same time, over the first eight years (2000-2008), there was a clear and dynamic convergence to the EU benchmark. That convergence process was interrupted by an economic crisis in 2009, discontinuing the convergence between SEE and the EU benchmark after 2010. EU integration has been one of the primary goals in SEE over the past two decades and tends to remain the main priority in the future. Several countries in the region have succeeded in joining the EU (Romania, Bulgaria, and Croatia), while others are candidates and should become members in the future. However, SEE countries still rank at the bottom in per capita income terms. It seems that the growth model dominant in the SEE region in the period before the crisis, based on a large inflow of FDI, has reached its limits. This leads us to the SEE countries' economic policies' need to focus more on promoting domestic private investments as one of the crucial factors for income convergence in the coming years. Apart from that, growth and convergence need to be driven by other factors affecting structural competitiveness, such as innovation, institutional environment and policies, and demographic developments important for the labour market outcomes. Finally, to better understand individual countries, analysis of the specific countries' income convergence drivers should be further explored.

References

- Abiad, A., Leigh, D., Mody, A. (2007) "International Finance and Income Convergence: Europe is Different", IMF Working Paper, European Department, Available at: <https://www.imf.org/external/pubs/ft/wp/2007/wp0764.pdf>.
- Alcidi, C. (2019) "Economic Integration and Income Convergence in the EU", *Intereconomics*, Vol. 54, No. 1, pp. 5–11, <https://doi.org/10.1007/s10272-019-0783-6>.
- Alho, K. E. O., Kaitila, V., Widgrén, M. (2004) "Speed of convergence and relocation: New EU member countries catching up with the old", ETLA Discussion Papers, No. 963, The Research Institute of the Finnish Economy (ETLA), Helsinki, <http://hdl.handle.net/10419/63930>.

- Baltagi, B.H., Bresson, G., Pirotte, A. (2006) “Joint LM test for homoscedasticity in a one-way error component model”, *Journal of Econometrics*, Vol. 134, pp. 401–417, <https://doi.org/10.1016/j.jeconom.2005.06.029>.
- Baltagi, B.H., Jung, B.C., Song, S.H. (2010) “Testing for heteroskedasticity and serial correlation in a random effects panel data model”, *Journal of Econometrics*, Vol. 154, No. 2, pp. 122–124, <https://doi.org/10.1016/j.jeconom.2009.04.009>.
- Barro, R. J., Sala-i-Martin, X. (1990) *Economic growth and convergence across the United States*, No. w3419, National Bureau of Economic Research, <https://doi.org/10.3386/w3419>.
- Barro, R., Lee, J. (2013) “A new data set of educational attainment in the world, 1950–2010”, *Journal of Development Economics*, Vol. 104, pp. 184–198, <https://doi.org/10.1016/j.jdeveco.2012.10.001>.
- Bartlett W. (2009) “Economic development in the Europeans upper-periphery: evidence from the Western Balkans“, *Economic Annals*, Vol. 54, No. 181, pp. 21–44, <https://doi.org/10.2307/2595100>.
- Ben-David, D. (1996) “Trade and convergence among countries”, *Journal of International Economics*, Vol. 40, pp. 279–298, [https://doi.org/10.1016/0022-1996\(95\)01405-5](https://doi.org/10.1016/0022-1996(95)01405-5).
- Borsi, M. T., Metiu, N. (2015) “The evolution of economic convergence in the European Union”, *Empirical Economics*, Vol. 48, No. 2, pp. 657–681, <https://doi.org/10.1007/s00181-014-0801-2>.
- Carlino, A. G., Mills, L. (1996) “Testing neoclassical convergence in regional incomes and earnings”, *Regional Science and Urban Economics*, Vol. 26, pp. 565–590, [https://doi.org/10.1016/S0166-0462\(96\)02137-0](https://doi.org/10.1016/S0166-0462(96)02137-0).
- Checherita-Westphal, C., Rother. P. (2011) “The Impact of Government Debt on Growth. An Empirical Investigation for the Euro Area”, *Revue économique*, Vol. 62, No. 6, pp. 1015–1029, <https://www.jstor.org/stable/41307971>.
- Choi, C. (2004) “Foreign direct investment and income convergence”, *Applied Economics*, Vol. 36, No. 10, pp. 1045–1049, <https://doi.org/10.1080/0003684042000246759>.
- Cuaresma, J.C., Ritzberger-Grunwald, D., Silgoner M.A. (2008) “Growth, Convergence and EU Membership”, *Applied Economics*, Vol. 40, No. 5, pp. 643–656, <https://doi.org/10.1080/00036840600749524>.
- D’Elia, E., De Santis, R. (2019) “Growth divergence and income inequality in OECD countries: the role of trade and financial openness”, *LEQS Paper*, Vol. 148, <http://aei.pitt.edu/id/eprint/102415>.
- Darvas, Z. (2010) “The Impact of the Crisis on Budget Policy in Central and Eastern Europe”, *OECD Journal on Budgeting*, Vol. 10, No. 1, pp. 39–80, <https://doi.org/10.1787/budget-10-5km7s5m3nlvd>.

- De Dominicis, L. (2014) “Inequality and growth in European regions: Towards a place-based approach”, *Spatial Economic Analysis*, Vol. 9, No. 2, pp. 120–141, <https://doi.org/10.1080/17421772.2014.891157>.
- Dobson, S., Ramlogan, C. (2002) “Convergence and divergence in Latin America, 1970–1998”, *Applied Economics*, Vol. 34, pp. 465–470, <https://doi.org/10.1080/00036840600606278>.
- Drezgić, S. (2011) “Public investments and regional income convergence: empirical analysis of Croatian regions”, *Social Research*, No. 3 (24), pp. 43–55, Available at: http://www.su.lt/bylos/mokslo_leidiniai/soc_tyrimai/2011_24/drezgic.pdf.
- Durlauf, S. N., Quah, D. (1999) “The New Empirics of Economic Growth”, in: Taylor, J.B. and Woodford, M. (Eds.), *Handbook of Macroeconomics*, Vol. 1A, North Holland, Amsterdam, pp. 235–308, <https://doi.org/10.3386/w6422>.
- Eckey, H., Türck, M. (2005) “Convergence of EU regions: A literature report”, *Volkswirtschaftliche Diskussionsbeiträge*, No. 80, Universität Kassel, Fachbereich Wirtschaftswissenschaften, Kassel, <http://hdl.handle.net/10419/32143>.
- European Commission (2003) *Western Balkans in Transition*, European Commission’s Directorate General for Economic and Financial Affairs, Brussels, Available at: https://ec.europa.eu/economy_finance/publications/pages/publication15155_en.pdf.
- Greasley, D. and Oxley, L. (1997) “Time-series based tests of the convergence hypothesis: some positive results”, *Economics Letters*, Vol. 56, pp. 143–147, [https://doi.org/10.1016/S0165-1765\(97\)81892-7](https://doi.org/10.1016/S0165-1765(97)81892-7).
- Grela, M. et al. (2017) “Is Central and Eastern Europe converging towards the EU-15?”, NBP Working Paper No. 264, National Bank of Poland, Available at: https://www.nbp.pl/Publikacje/Materialy_I_Studia/264_En.Pdf.
- Hanushek E. A. and Wößmann L. (2010) “Education and Economic Growth”, In: Penelope Peterson, Eva Baker, Barry McGaw (Editors), *International Encyclopedia of Education*, Volume 2, pp. 245-252, Oxford: Elsevier, Available at: <http://hanushek.stanford.edu/sites/default/files/publications/Hanushek%2BWoesmann%202010%20IntEncEduc%202.pdf>.
- Henderson D., Russell R. (2005) “Human capital and convergence: A production-frontier approach”, *International Economic Review*, Vol. 46, No. 4, pp. 1167–1205, <https://www.jstor.org/stable/3663664>.
- Herzer, D. (2012) “How does foreign direct investment really affect developing countries’ growth?”, *Review of International Economics*, Volume 20, Issue 2, pp. 396–414, <https://doi.org/10.1111/j.1467-9396.2012.01029.x>.
- Hoechle, D. (2007) “Robust standard errors for panel regressions with cross-sectional dependence”, *The Stata Journal*, Vol. 7, No. 3, pp. 281–312, <https://doi.org/10.1177/1536867X0700700301>.
- IMF (2015) *The Western Balkans: 15 years of economic transition*, Regional Economic Issues, Special Report, International Monetary Fund, Washington,

- DC, Available at: <https://www.imf.org/external/pubs/ft/reo/2015/eur/eng/erei0315.htm>.
- IMF (2017) *A broadening recovery, Central, Eastern, and Southeastern Europe*, Regional Economic Issues, International Monetary Fund, Washington, DC, Available at: <https://www.imf.org/en/Publications/REO/EU/Issues/2017/05/10/a-broadening-recovery>.
- Krestovska, A. (2018) “Real Convergence of Western Balkan Countries to European Union in view of Macroeconomic Policy Mix”, *Journal of Central Banking Theory and Practice*, pp.187–202, <https://doi.org/10.2478/jcbtp-2018-0018>.
- Kiss, G., Márton N., Balázs V. (2006) “Credit Growth in Central and Eastern Europe: Convergence or Boom?,” MNB Working Papers 2006/10, Magyar Nemzeti Bank – Central Bank of Hungary, Available at: <http://hdl.handle.net/10419/83593>.
- Kutan, A. M., Yigit, T. M. (2009) “European integration, productivity growth and real convergence: Evidence from the new member states”, *Economic Systems*, Vol. 33, No. 2, pp. 127–137, <https://doi.org/10.1016/j.ecosys.2009.03.002>.
- Li, Q., Racine, J. S. (2007) *Nonparametric Econometrics: Theory and Practice*, Princeton University Press.
- Linden, M. (2002) “Trend model testing of growth convergence in 15 OECD countries, 1946–1997”, *Applied Economics*, Vol. 34, pp. 133–142, <https://doi.org/10.1080/00036840010025119>.
- Martin, C., Valazquez, F. J., Bernard, F. (2001) “European Integration and income convergence Lessons for Central and Eastern European Countries”, World Bank Technical Paper No. 514, European and Central Asia Poverty Reduction and Economic Management Series, <https://doi.org/10.1596/978-0-8213-4994-6>.
- Matkowski, Z., Prochniak, M., Rapacki, R. (2016) “Real Income Convergence between Central Eastern and Western Europe: Past, Present, and Prospects”, 33rd CIRET Conference on Economic Tendency Surveys and Economic Policy Copenhagen, Denmark, <http://hdl.handle.net/10419/146992>.
- Nenovsky, N., Tochkov, K. (2014) “Transition, Integration and Catching Up: Income Convergence between Central and Eastern Europe and the European Union”, *Mondes en développement*, Vol. 167, pp. 73–92, <https://doi.org/10.3917/med.167.0073>.
- Niebuhr, A., Schlitte, F. (2004) “Convergence, trade and factor mobility in the European Union: Implications for enlargement and regional policy”, *Intereconomics*, ISSN 0020-5346, Springer, Heidelberg, Vol. 39, No. 3, pp. 167–176, <https://doi.org/10.1007/BF02933584>.
- OECD (2008) “The impact of foreign direct investment on wages and working conditions”, OECD-ILO conference on corporate social responsibility, Paris, France, <https://doi.org/10.1787/230184240223>.

- Paas, T., Schlitte, F. (2006) “Regional Income Inequality and Convergence Processes in the EU-25”, HWWA Discussion Paper, No. 355, Hamburg Institute of International Economics, https://www.researchgate.net/publication/23731981_Regional_Income_Inequality_and_Convergence_Processes_in_the_EU-25.
- Pesaran, M. H. (2004) “General diagnostic tests for cross section dependence in panels”, Working Papers in Economics No. 0435, Cambridge: University of Cambridge, Faculty of Economics, <https://doi.org/10.1007/s00181-020-01875-7>.
- Quah, D. (1993) “Empirical cross-section dynamics in economic growth”, *European Economics Review*, Vol. 37, pp. 426–434, [https://doi.org/10.1016/0014-2921\(93\)90031-5](https://doi.org/10.1016/0014-2921(93)90031-5).
- Quah, D. (1996a) “Empirics for economic growth and convergence”, *European Economic Review*, Vol. 40, pp.1353–1375, [https://doi.org/10.1016/0014-2921\(95\)00051-8](https://doi.org/10.1016/0014-2921(95)00051-8).
- Quah, D. (1996b) “Twin Peaks: growth and convergence in models of distribution dynamics”, *Economic Journal*, Vol. 106, pp. 1045–1055, <https://doi.org/10.2307/2235377>.
- Quah, D. (1997) “Empirics for growth and distribution: stratification, polarization and convergence clubs”, *Journal of Economic Growth*, Vol. 2, pp. 27–59, <https://doi.org/10.1023/A:1009781613339>.
- Rassekh, F., Panik, M. J., Kolluri, B. R. (2001) “A test of convergence hypothesis: the OECD experience, 1950–1990”, *International Review of Economics and Finance*, Vol. 10, pp. 147–157, [https://doi.org/10.1016/S1059-0560\(01\)00079-X](https://doi.org/10.1016/S1059-0560(01)00079-X).
- Rubinic, I., Tajnikar, M. (2019) “Labour Force Exploitation and Unequal Labour Exchange as the Root Cause of the Eurozone’s Inequality”, *Društvena istraživanja*, Vol. 28, No. 2, pp. 207–228, <https://www.ceeol.com/search/article-detail?id=799967>.
- Rubinic, I., Tajnikar, M. (2020) “The influence of the economic cycle on Eurozone cross- country inequality dynamics”, *South-Eastern Europe Journal of Economics*, Association of Economic Universities of South and Eastern Europe and the Black Sea Region, Vol. 17, No. 2, pp. 267–290, <https://ojs.lib.uom.gr/index.php/seeje/article/view/9644>.
- Ryszard, R., Mariusz, P. (2019) “EU membership and economic growth: empirical evidence for the CEE countries”, *European Journal of Comparative Economics*, Cattaneo University, Vol. 16, No. 1, pp. 3–40, <http://ejce.liuc.it/18242979201901/182429792019160101.pdf>.
- Sala-i-Martin, X. (1997) “I just ran two million regression”, *American Economic Review*, Vol. 87, pp. 178–183, <https://www.jstor.org/stable/2950909>.
- Sanfey, P., Milatovic, J. (2018) “The Western Balkans in transition: diagnosing the constraints on the path to a sustainable market economy”, Background paper for the Western Balkans Investment Summit, hosted by the EBRD, 26 February

- 2018, <https://www.ebrd.com/documents/eapa/western-balkans-summit-2018-diagnostic-paper.pdf>.
- Simionescu, M. (2015) "About regional convergence clubs in the European Union", *Zbornik radova Ekonomskog fakulteta Rijeka*, Vol. 33, No. 1, pp. 67–80, <https://hrcak.srce.hr/139926>.
- Stanisic, N.M. (2012) "The effects of the economic crisis on income convergence in the European Union", *Acta Oeconomica*, Vol. 62, No. 2, pp. 161–182, <https://doi.org/10.1556/aoecon.62.2012.2.2>.
- Stojanović, D., Stojanović, D. (2015) "Excessive credit growth or the catching up process: the case of Central, Eastern, and South-eastern European countries", *Economic annals*, Vol. 60, No. 208, pp. 7–44, <https://doi.org/10.2298/EKA1506007S>.
- Temple, J. (1999) "The new growth evidence", *Journal of Economic Literature*, Vol. 37, pp. 112–156, <https://doi.org/10.1257/jel.37.1.112>.
- Tselios, V. (2009) "Growth and convergence in income per capita and income inequality in the regions of the EU", *Spatial Economic Analysis*, Vol. 4, No. 3, pp. 343–370, <https://doi.org/10.1080/17421770903114711>.
- Uvalic, M (2010) "Transition in Southeast Europe: Understanding economic development and institutional change", WIDER Working Paper, No. 2010/41, https://doi.org/10.1057/9780230361836_15.
- Vojinovic, B., Acharya, S., Prochniak, M. (2009) "Convergence analysis among the ten European transition economies", *Hitotsubashi Journal of Economics*, Vol. 50, No. 2, pp. 17–35, <https://www.jstor.org/stable/43296221>.
- Wooldridge, J. M. (2002) *Econometric Analysis of Cross Section and Panel Data*, Cambridge, MA: MIT Press.
- Yin, L, Zestos, G. K., Michelis, L. (2003) "Economic Convergence in the European Union", *Journal of Economic Integration*, Vol. 18, No. 1, pp. 188–213, <https://www.jstor.org/stable/23000737>.
- Zhang, Z., Liu, A., Yao, S. (2001) "Convergence of China's regional incomes 1952–1997", *China Economic Review*, Vol. 12, pp. 243–258, [https://doi.org/10.1016/S1043-951X\(01\)00053-0](https://doi.org/10.1016/S1043-951X(01)00053-0).

Dohodovna konvergencija Jugoistočne Europe i Europske unije

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Sažetak

Ovaj rad analizira prosječnu bruto per capita dohodovnu konvergenciju osam zemalja Jugoistočne Evrope (JIE) prema prosjeku EU-a. Cilj je utvrditi koji faktori doprinose konvergenciji zemalja JIE regije kao i opisati kretanje konvergencije u periodu 2000.-2018. godine, s posebnom pozornošću na dva pod perioda, prije i nakon Svjetske ekonomke krize. Koristimo pri tome kombinaciju parametarskih i neparametarskih metoda i linearne panel regresije fiksnih efekata s robusnim standardnim greškama. Rezultati sugeriraju da je konvergencija bila podstaknuta procesom EU integracija, obrazovnim nivoom stanovništva, investicijama (stranim, domaćim i javnim), kreditnom ekspanzijom u privatnom sektoru, kao i rastom javnih rashoda. S druge strane, ekonomska kriza, nezaposlenost i inflacija bili su glavni faktori koji su utjecali na divergenciju procesa. Zaključujemo na kraju i da je post-tranzicijski model rasta dominantan u regiji SEE, temeljen na stranim direktnim investicijama, nedovoljan, i da su domaće privatne investicije kritično-nedostajući faktor brže dohodovne konvergencije.

Ključne riječi: bruto dohodovna konvergencija, Jugoistočna Europa, ekonomski rast, EU integracije, analiza panela

JEL klasifikacija: F43, O11, O47

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Impact of board size and ownership concentration on agency costs: evidence for Croatian companies*

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Abstract

The main objective of this research paper is to examine the impact of board size and ownership concentration, representing corporate governance mechanisms, on agency costs in large Croatian companies. Furthermore, debt financing and firm growth are examined because those variables also have impact on agency costs. Agency theory defines a framework for the potential issue of the separation of ownership and management as well as for the conflict between stakeholders (principals) and managers (agents). The most significant principal-agent problems are agency costs, but they do not have a directly quantifiable value; hence, in this research paper, the asset turnover ratio is used as the approximation. Therefore, this research will empirically test the significance of the impact of board size, ownership concentration, debt financing and firm growth on agency cost in the observed period from 2014 to 2018 using panel data analysis. This research was conducted with large Croatian companies using data and information from official annual accounts primarily to ensure objectivity, standardization and comparability. Specifically, the analysis was conducted on 219 companies operating in two main categories of economic activity: Manufacturing (C) and Wholesale and retail trade (G). The results indicate that board size has a significant but negative impact on agency costs. The results also indicate that debt and growth have a significant and negative impact on agency costs. Ownership concentration was not found to have significant impact.

Key words: agency costs, corporate governance, board size, ownership concentration, panel data analysis

JEL classification: G30, G32, K22

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1. Introduction

Aziz et al. (2015) claim that corporate governance explains processes and structures that are used for management within the company and that the aim of these practices is to increase the wealth of shareholders. According to this definition, corporate governance mechanisms aim to resolve agency problems and to protect the wealth of shareholders. Panda and Leepsa (2017) state that the agency problem began with the development of joint-stock companies but that organizations suffer from this problem in different forms. La Porta et al. (2000: 3) state that the agency problem is a situation in which *“the insiders who control corporate assets can use these assets for a range of purposes that are detrimental to the interests of the outside investors”*. Bhojraj and Sengupta (2003: 456) state that the agency problem is *“a risk that management acting in its self-interest would take actions that deviate from firm value maximization, as well as the risk that the manager is incompetent”*. Jensen and Meckling (1976) define a principal-agent relationship as a contract between the principal and the agent under which the principal engages the agent to perform services on their behalf. Jensen and Meckling (1976) argue that it is impossible with zero agency costs to ensure that the agent will make optimal decisions for the principal.

Eisenhardt (1989) states that the domain of agency theory is the relationship of the principal and the agent who are engaged in a principal-agent contract and who have different goals and attitudes towards risk. According to Florackis (2008), agency theory provides a unique, realistic, and empirically testable perspective on problems between the principal and the agent. Consequently, agency costs associated with the agency problem cannot be avoided if a principal hires an agent to manage companies. Bendickson et al. (2016) define two perspectives in agency theory: principal-agent research and positivist agency theory. Eisenhardt (1989: 59) states that these two perspectives *“share a common unit of analysis: the contract between the principal and the agent”* as well as assumptions about people, organizations, and information. According to Bendickson et al. (2016) the first perspective, principal-agent research identifies two possible agency problems: risk-sharing and agent monitoring. Eisenhardt (1989) claims that positivist agency theory is focused on identifying situations in which the principal and the agent have different goals and describes the governance mechanisms that limit the agent's self-serving behaviour. Cerović et al. (2011) state that agency costs are all of those tangible and intangible assets which the principal uses in the control of agent to ensure optimal capital exploitation. The main idea of this paper is to analyse the efficiency of the governance mechanisms that limit those agent behaviours which are in conflict with the principal's interest. Based on literature review and results of past studies the paper's hypotheses are as follows:

H1: Agency costs will be lower when companies have boards that are small in size.

H2: When the ownership concentration is greater, agency costs will be lower.

The basis of this research paper is the theoretical and empirical literature in agency theory. The primary research questions are (1) what is the relationship between the size of the supervisory board and the asset turnover ratio (level of agency costs) and (2) what is the relationship between ownership concentration and the asset turnover ratio (level of agency costs) in the Croatian capital market?

The paper is structured as follows. Section 2 is the literature review on theories and studies in the field of corporate governance mechanism. Section 3 is description of methodology of analysis. Econometric model is establishment in section 4. Section 5 discusses the empirical results. Section 6 summarizes conclusion, study limitation and recommendations for future research.

2. Literature review

Agency costs, as the most significant principal-agent problem, do not have a directly quantifiable value. Several authors in their empirical studies define measures for the approximation of agency costs. Cerović et al. (2011), Florackis (2008), Junwei et al. (2011), Fauzi and Locke (2012), Ang et al. (2000), Singh and Davidson (2003), Gul et al. (2012), Rashid (2016), Garanina and Kaikova (2016), McKnight and Weir (2009) and Aziz et al. (2015) define total asset turnover as a proxy for agency costs. According to Junwei et al. (2011), McKnight and Weir (2009) and Ang et al. (2000), lower total assets turnover indicates a higher level of agency costs because of inefficient asset utilization. Inefficient asset utilization decreases the wealth of shareholders. Panda and Leepsa (2017) state that total assets turnover explains the efficiency with which the assets are utilized by management and that better utilization indicates lower agency cost. Aziz et al. (2015) claim that increased firm performance decreases agency costs. Junwei et al. (2011) and Aziz et al. (2015) define several governance mechanisms for controlling agency costs: board size, debt financing, and ownership concentration.

2.1. Board size

Junwei et al. (2011), Fauzi and Locke (2012) and Florackis (2008) state that a large board is usually more powerful than a small board and obtains better results or that, when board size is larger, agency costs are lower. Fauzi and Locke (2012) also claim that larger companies tend to have larger agency costs and that larger board sizes can reduce agency costs. In contrast, empirical evidence of Junwei et al. (2011) indicates that board size is indistinctively correlated with asset turnover; moreover, they claim that companies with larger board sizes are less efficient in their asset utilization, or that they have higher agency costs. Furthermore, Aziz et al. (2015) and Garanina and Kaikova (2016) state that companies with smaller boards have lower agency costs. Huyghebaert and Wang (2012) claim that, when

the size of the board increases, the board loses some ability to exert control over key business decisions and the power to ensure that the interests of all investors are realized. Gul et al. (2012) indicate a negative association between board size and the asset utilization ratio; therefore, they indicate that companies with smaller board sizes have lower agency costs. Singh and Davidson (2003) state that board size is negatively related to asset turnover and claim that a larger board size is associated with efficiency losses. Florackis and Ozkan (2004) state that the size of the board has a negative influence on agency costs in terms of asset turnover, which means that, when the board size is larger, agency costs will be higher. Research results conducted by Aziz et al. (2015) on Pakistani companies show a significantly negative relationship with asset turnover because of less effective boards. Garanina and Kaikova (2016) indicate in research conducted on Norwegian, Russian and US companies—that larger boards are associated with higher agency costs in companies. Guney et al. (2020) indicate that a larger board size has an adverse impact on the operational performance of companies. Huu Nguyen et al. (2020) claim that the majority of studies in UK and US indicated a negative relation between board size and firm performance, which imply the higher level of agency costs in companies with larger boards. Previous empirical studies indicated the negative impact of board size on agency costs, so this was the background for our first hypothesis. We are expecting a negative impact of board size on agency costs in Croatian companies.

2.2. Ownership concentration

According to Florackis (2008), shareholders with substantial stakes have a greater incentive to supervise management and can do so more effectively than those without substantial stakes, which indicates that higher ownership concentration results in lower agency costs. Aziz et al. (2015) claim that, when the ownership concentration is greater, agency costs are lower. Additionally, Moez (2018) claims that ownership concentration has a negative impact on agency costs. Junwei et al. (2011) state that, when the sum of the stakes of the top ten shareholders is larger, agency costs are lower. Sanda et al. (2010) claim that the effect of ownership concentration is positive on firm performance (return on asset). The results of a study performed by Ang et al. (2000) indicate that agency costs are higher when an agent (outsider) manages the company and that agency costs decrease when the ownership is more concentrated. In contrast, Junwei et al. (2011) indicate a not significant relationship between the sum of the stakes of the top ten shareholders and asset turnover. Aziz et al. (2015) indicate a negative but also insignificant relationship between asset turnover and ownership concentration. Shan and McIver (2011) claim that high levels of ownership concentration will have a negative impact on firm performance because of a conflict between majority and minority shareholders and show research results in support of this conclusion. Moez (2018) ownership concentration has a negative impact on agency costs.

2.3. Debt financing

Jensen and Meckling (1976) explain that debt financing decreases agency costs and increases company value. Florackis (2008: 40) argues that “*bank debt has an advantage in comparison to publicly traded debt in monitoring a firm’s activities and in collecting and processing information*”. In addition, Garanina and Kaikova (2016) state that companies with a higher level of debt are better monitored by creditors, resulting in lower agency costs. Junwei et al. (2011), McKnight and Weir (2009) and Fauzi and Locke (2012) state that, when the ratio of total debt to total assets is greater, agency costs are lower. According to Rashid (2016), when a firm relies on debt financing, the interest payment obligation may reduce agency costs. Junwei et al. (2011) claim that the ratio of total debt to total assets is positive. Empirical evidence found by Zhang and Li (2008) supports the thesis that higher leverage can reduce agency costs. McKnight and Weir (2009) indicate that debt is positive and statistically significant, suggesting that companies with more debt tend to have lower agency costs. Ang et al. (2000) state that additional debt decreases agency costs. In contrast, Singh and Davidson (2003) state that leverage is negatively related to the asset turnover ratio. Garanina and Kaikova (2016) indicate that, in US companies, higher debt is associated with lower agency costs, but, in Norwegian companies, higher debt increases agency costs. These results clearly show the different impact which some corporate governance mechanisms have on agency costs depending on market characteristics.

2.4. Firm growth

Mendoza and Yelpo (2016) claim that companies with low growth opportunities have a greater possibility of incurring high agency costs when a greater degree of separation exists between ownership and corporate control. Rashid (2016: 614) claim that “*growing firms may also achieve economies of scale; this may contribute substantially to reducing their agency cost*”. Florackis (2008) states that corporate governance mechanisms are expected to be more effective for high-growth firms. The results according to Florackis (2008) support the thesis that the relationship between different governance mechanisms and agency costs is not homogeneous but varies with growth opportunities. In contrast to his claim, his empirical evidence indicated that high-growth firms have lower asset turnover ratios, possibly because of extensive information asymmetries between managers, shareholders and debtholders in high-growth firms.

3. Methodology of analysis

3.1. Variable measurement, data analysis and results

Agency costs are not directly measurable, so, in this analysis, an approximation measure was used: asset turnover. Therefore, we used the approximation measure that was used by Cerović et al. (2011), Florackis (2008), Junwei et al. (2011), Fauzi (2012), Ang et al. (2000), Singh and Davidson (2003), Gul et al. (2012), Rashid (2016) and Panda and Leepsa (2017) in their studies. These authors claim that a higher assets turnover indicates lower agency costs.

Dependent variable of the analysis:

1. $AGENCYCOSTS_{i,t}$ – agency costs of company i in year t , measured as the total annual income divided by total assets (asset turnover). The data for assets turnover were collected from database INFOBIZZ.

Independent variables, including control variables, for the analysis:

2. $BOARD\ SIZE_{i,t}$ – board size of company i in year t , measured as the total number of supervisory board members. The data were collected from database INFOBIZZ.
3. $OWNERSHIP\ CONCENTRATION_{i,t}$ – ownership concentration of company i in year t , measured as sum of percentage shares of the top ten shareholders. The data were collected from database INFOBIZZ, company web sites, and other similar sources on the internet.
4. $DEBT_{i,t}$ – debt of company i in year t , measured as the total debt divided by the total assets. The data were collected from database INFOBIZZ. Control variable.
5. $GROWTH_{i,t}$ – growth of company i in year t , measured as a percentage increase in sales revenue compared to the previous year. The data were collected from database INFOBIZZ. Control variable.

We conducted a static panel data analysis to test the effects of the corporate governance mechanisms on the agency costs proxies for our panel data sample. The research model is the following:

$$AGENCYCOSTS_{i,t} = \alpha_i + \beta_1 BOARD\ SIZE_{i,t} + \beta_2 OWNERSHIP\ CONCENTRATION_{i,t} + \beta_3 DEBT_{i,t} + \beta_4 GROWTH_{i,t} + \varepsilon_{i,t}$$

$$i = 1, \dots, 109; t = 1, \dots, 5$$

where:

- i – number of observation units,
- t – number of observation periods,

α_i – overall intercept term,

$\varepsilon_{i,t}$ – the observation error for i^{th} units in time t , and

β_1, \dots, β_4 – beta coefficients.

To test whether the fixed-effects model is more suitable than the combined model, the F-test will be applied, which tests the null hypothesis of the equality of constant members for all spatial units of observation, and, if the null hypothesis cannot be rejected, the model with fixed effects is not appropriate (Wooldridge, 2002; Baltagi 2009; Bahovec and Erjavec, 2009; Skrabić Perić, 2012). The Lagrange Multiplier test (LM) was conducted, in which the null hypothesis assumes that the variance of the random effect of observation units is equal to zero, thus examining the justification of using the random-effect model compared to other models (Breusch-Pagan test). If the null hypothesis is accepted, the random-effect model is suitable for estimating the parameters in relation to the combined model (Wooldridge, 2002; Baltagi 2009; Bahovec and Erjavec, 2009; Skrabić Perić, 2012). If two diagnostic tests (F-test, LM test) indicate that the combined model is not suitable for estimating parameters, the Hausman specification test will be performed comparing the estimated coefficients of the fixed- and random-effect models. The Hausman specification test examines the null hypothesis, which assumes that both estimators are consistent but that the parameter estimates obtained from the random-effects model are effective, and, if the null hypothesis cannot be rejected, the random-effects model is more appropriate (Wooldridge, 2002; Baltagi 2009; Bahovec and Erjavec, 2009; Skrabić Perić, 2012).

4. Empirical data and results

4.1. Sample and data collection

The research was conducted with large Croatian companies that operate in two main categories of economic activity: Manufacturing (C) and Wholesale and retail trade (G). The total number of companies in these categories according to Financial Agency (cro. *FINA*) was 219, but, for some companies, the data for the observed period, 2014–2018, were not accessible, so those companies were excluded from further observation. The following companies were excluded from the defined sample: companies that did not have supervisory boards, companies that did not operate continuously in the defined period, companies that were in bankruptcy, companies which operate as limited partnerships and companies that did not have supervisory boards continuously in the defined period (2014–2018). The final sample includes 109 large companies. The board structure in the examined companies is the two-tier (Continental type) model. The observed period is defined according to the available data.

The research includes an analysis of the company’s basic financial statements (balance sheet as well as the profit and loss statement) available in the official data from the Statistical Base and the Public Announcement Report of the Financial Agency (cro. *FINA*). Secondary data were used for the analysis. To obtain financial indicators (assets turnover, firm growth, and debt financing), data were used from the unconsolidated financial statement of companies from 2014 to 2018, accessible in the Financial Agency database (*INFOBIZZ*). Information about board size was accessible in the Financial Agency database. To obtain ownership concentration, information was used from company web sites, yearbooks and other similar sources on the internet. The aim of this research was to examine the impact of board size and ownership concentration on the level of agency costs according to existing research conducted by Florackis (2008), Junwei et al. (2011), Fauzi (2012), Ang et al. (2000), Singh and Davidson (2003), Gul et al. (2012) and Rashid (2016).

Based on the defined aim of this paper, two research questions were identified:

RQ1: What is the relationship between the size of the supervisory board and the asset turnover ratio (level of agency costs) in the Croatian capital market?

RQ2: What is the relationship between ownership concentration and the asset turnover ratio (level of agency costs) in the Croatian capital market?

According to the literature and past study results, the paper’s hypotheses are as follows:

H1: Agency costs will be lower when companies have boards that are small in size.

H2: When the ownership concentration is greater, agency costs will be lower.

Table 1: Descriptive statistics

	AGENCY COSTS (asset turnover) (coefficient)	DEBT (coefficient)	GROWTH (percentage)	OWNERSHIP CONCENTRATION (percentage)	BOARDSIZE (number)
Mean	1.368294	0.540514	0.104654	0.949249	4.355963
Median	1.080000	0.490000	0.041184	1.000000	4.000000
Maximum	5.720000	3.020000	19.18736	1.000000	9.000000
Minimum	0.060000	0.050000	-0.900381	0.000000	2.000000
Std. Dev.	0.924811	0.313155	1.061647	0.140963	1.453282
Skewness	1.540875	2.598789	15.95420	-4.088231	0.819128
Kurtosis	5.543204	17.29294	267.1232	22.81004	3.328492

Source: Authors’ calculations

Table 1 shows the descriptive statistics for the variables included in the analysis. Agency costs ranged between 0.06 and 5.72. The maximum of this variable is 5.72, indicated the company with the lowest agency costs. Board size ranged between 2 and 9, and ownership concentration ranged between 0.0 and 1.0. The median of ownership concentration is 1, which indicates that 50% of the examined companies have a high level of ownership concentration. Debt ranged between 0.05 and 3.02, and growth, between -0,9 and 19.18. The mean of board size is 4.35. The mean of ownership concentration is 0.94 which indicates a high ownership concentration in the sample.

To define the appropriateness of the fixed- or random-effects regressions in the sample, diagnostic tests were done. The F-test, LM test and the Hausman test were conducted. The F-test indicated that the fixed-effects model is appropriate, while the LM test indicated the appropriateness of the random-effect model. The Hausman test indicated that the random-effects model is appropriate in our sample of panel data. A random-effects multivariate regression was conducted for companies from 2014–2018 to examine the impact of the selected corporate governance mechanisms (board size and ownership concentration) on agency costs.

Table 2: Panel data – results of analysis

Dependent variable AGENCYCOSTS (Asset turnover ratio)	Coefficient	Prob.
Independent variable		
Intercept	1.344115	0.0013
OWNERSHIP CONCENTRATION	0.253091	0.5410
BOARDSIZE	-0.031569	0.1667**
DEBT	-0.140231	0.0537*
GROWTH	-0.026343	0.0269*
F-test		0.0000
Hausman test		0.3118
Lagrange Multiplier test		0.000
Selected model		Random effects
Total observations		545

*significant at the 5% level; **significant at the 10% level

Source: Authors' calculations

The results of the analysis (Table 2) indicated a significant and negative relationship between BOARDSIZE and ASSET TURNOVER at the 10% level, which means that agency costs are lower when the board size is smaller. DEBT also exhibited a significant and negative relationship with the asset turnover ratio at the 5% level,

which means that, at the lower debt level, asset turnover will be higher and agency cost will be lower. GROWTH has a significant and negative relationship with ASSET TURNOVER at the 5% level. This relationship indicates that companies with lower growth will have lower agency costs. The results also indicated a positive but insignificant relationship between OWNERSHIP CONCENTRATION and ASSET TURNOVER.

5. Results and discussion

The results of the analysis indicated that the paper's hypotheses are partially supported. Between board size and asset turnover ratio is indicated significant and negative relationship, which means that agency costs are lower when the board size is smaller. Thus, hypothesis 1 is supported, because companies with a smaller board size will have lower agency costs. These results are in line with Gul et al. (2012), Florackis and Ozkan (2004), Singh and Davidson (2003) and Aziz et al. (2015), which also indicated the negative relationship between board size and asset turnover and which claim that, when the board size is larger, agency costs will be higher. This finding could be interpreted to mean that larger boards will result in higher agency costs because such boards are less effective (Aziz et al., 2015). Debt also exhibited a significant and negative relationship with the asset turnover ratio, which means that, at the lower debt level, asset turnover ratio will be higher and agency cost will be lower. This result is in line with the results found by Singh and Davidson (2003). Some authors claim that a higher level of debt can reduce agency costs (Zhang and Li, 2008; Ang et al., 2000). However, the contradiction in the empirical result could be explained by the various characteristics of the examined market because Garanina and Kaikova (2016) indicate that, in US companies, higher debt is associated with lower agency costs, but that, in Norwegian companies, higher debt is associated with increased agency costs. The Croatian market is more similar to the Norwegian than it is to the US market. Growth has a significant and negative relationship with asset turnover ratio. This relationship indicates that companies with lower growth will have lower agency costs. This result contradicts Mendoza and Yelpeo (2016) but is similar to Florackis (2008). The results indicated a positive but insignificant relationship between ownership concentration and asset turnover ratio for Croatian companies. Thus, hypothesis 2 is not supported. These results conform with those of Junwei et al. (2011) and Aziz et al. (2015), which also indicated an insignificant relationship between agency costs and ownership concentration. These results could be affected by the fact that most of the examined companies have a very high ownership concentration, in conformity with the Croatian market.

The main contribution of analysis is to examine if main corporate governance mechanisms as debt and boardsize can controlled agency costs and if defined

mechanisms are efficient for the principal on the Croatian capital market. Most of the present research have been conducted in US and China, so the contribution of a scientific field is to test how the corporate governance mechanisms effected on agency cost for Croatian companies. Also, these results indicate some recommendations for the business community that could be implied. First of all, when forming the size of the board, have to be taken into account that the results indicated that increasing the board reduces its efficiency. In addition, ownership concentration in the observed companies did not prove to be an effective corporate governance mechanism. This can be explained by the high level of concentration of ownership in all these companies.

6. Conclusion

The results of the analysis show that the paper's hypotheses are partially supported. Some of the indicated results in this paper are not similar to the results of previous studies. One of the reasons is that the Croatian market is not similar to those found in countries such as the US and the U.K. and has some imperfections. The most significant imperfection is low level of market liquidity. The results of prior studies of the impact of corporate mechanisms on agency costs are inconsistent because their analyses are conducted on markets with different characteristics. These results have to consider the aspects of the tradition of corporate governance in Croatia. Additionally, a different corporate governance model (the Continental type) is dominant in the Croatian market, while most analyses are conducted on the Anglo-American model. This model characterizes higher ownership concentration, the high level of debt financing, lower level of capital market development and low level of capital market liquidity. The results indicate the negative impact of board size because a larger number of supervisory board members leads to higher agency costs. The impact of ownership concentration as a corporate governance mechanism is not statistically significant. Prior studies indicated debt as a mechanism for decreasing agency costs, but, in our case, debt increases the agency costs. One of the control variables, growth, indicates that companies with lower growth opportunities will have lower agency costs.

This analysis is limited by the data. The analysis did not include all large companies in the Croatian market but only those involved in two main categories of economic activity. For a better representative sample of the research population, an analysis needs to be done on all large companies engaged in all economic activities. We included all large companies from the mentioned economic activities, but because of the inability to collect data we had to exclude some companies. In addition, the extended period (we collected data for 2014–2018) yields certain results. One limitation of the research is that agency costs were approximated through asset turnover ratio because such costs are not directly measurable.

References

- Ang, J.S., Cole, R.A., Wuh Lin, J. (2000) “Agency costs and ownership structure”, *Journal of Finance*, Vol. 55, No. 1, pp. 81–106, <https://doi.org/10.1111/0022-1082.00201>.
- Aziz, T., Majeed, S., Saleem, S. (2015) ‘The impact of corporate governance mechanism on agency cost: an empirical evidence of Pakistani listed companies’, *Business, Management and Economics Research*, Vol. 1, No. 6, pp. 79–91, Available at: <https://arpgweb.com/journal/8/archive/10-2015/6/1> [Accessed: 20.05.2020].
- Bahovec, V., Erjavec, N. (2009) *Uvod u ekonometrijsku analizu*, Zagreb: Element
- Baltagi, B. H. (2009) “Longitudinal Data Analysis”, *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, Vol. 172, No. 4, pp. 939–940, https://doi.org/10.1111/j.1467-985X.2009.00614_9.x.
- Bendickson, J. et al. (2016) “Agency theory: background and epistemology”, *Journal of Management History*, Vol. 22, No. 4, pp. 437–449, <https://doi.org/10.1108/JMH-06-2016-0028>.
- Bhojraj, S., Sengupta, P. (2003) ‘Effect of Corporate Governance on Bond Ratings and Yields: The Role of Institutional Investors and Outside Directors’, *Journal of Business*, Vol. 76, No. 3, pp. 455–475, <https://doi.org/10.1086/344114>.
- Cerović, L., Zaninović, V., Dukić, N. (2011) “Utjecaj vlasničke i kapitalne strukture na kretanje agencijskih troškova: studija slučaja vlasnički nisko koncentriranih poduzeća Republike Hrvatske”, *Ekonomika misao i praksa*, No. 2, pp. 419–442, Available at: <https://hrcak.srce.hr/75566> [Accessed: 10.05.2020].
- Eisenhardt, K. M. (1989) “Agency Theory: An Assessment and Review”, *The Academy of Management Review*, Vol. 14, No. 1, pp. 57–74, Available at: <https://psycnet.apa.org/doi/10.2307/258191> [Accessed: 20.04.2020].
- Fauzi, F., Locke, S. (2012) “Do Agency Costs Really Matter? A Non-linear Approach of Panel Data”, *Asian Journal of Finance & Accounting*, Vol. 4, No. 1, <https://doi.org/10.5296/ajfa.v4i1.1783>.
- Florackis, C. (2008) “Agency costs and corporate governance mechanisms: evidence for UK firms”, *International Journal of Managerial Finance*, Vol. 4, No. 1, pp. 37–59, <https://doi.org/10.1108/17439130810837375>.
- Florackis, C., Ozkan A. (2004) “Agency Costs and Corporate Governance Mechanisms: Evidence for UK Firms”, *Working Paper*, University of York, UK, Available at: https://www.efmaefm.org/0EFMSYMPOSIUM/2005/papers/29Aydin_Ozkan_paper.pdf [Accessed: 25.04.2020].
- Garanina, T., Kaikova, E. (2016) “Corporate governance mechanisms and agency costs: cross-country analysis”, *Bingley*, Vol. 16, No. 2, pp. 347–360, <https://doi.org/10.1108/CG-04-2015-0043>.

- Gul, et al. 2012) “Agency Cost, Corporate Governance and Ownership Structure (The Case of Pakistan)”, *International Journal of Business and Social Science*, Vol. 3 No. 9, pp. 268–277, Available at: https://ijbssnet.com/journals/Vol_3_No_9_May_2012/32.pdf [Accessed: 24.04.2020].
- Guney, Y., Karpuz, A., Komba, G. (2020) ‘The effects of board structure on corporate performance: Evidence from East African frontier markets’, Research in *International Business and Finance*. Elsevier, Vol. 53, No. 101222, <https://doi.org/10.1016/j.ribaf.2020.101222>.
- Huu Nguyen, A., Thuy Doan, D., Ha Nguyen, L. (2020) “Corporate Governance and Agency Cost: Empirical Evidence from Vietnam”, *Journal of Risk and Financial Management*, Vol. 13, No. 5, pp. 1–15, <https://doi.org/10.3390/jrfm13050103>.
- Huyghebaert, N., Wang, L. (2012) “Expropriation of Minority Investors in Chinese Listed Firms: The Role of Internal and External Corporate Governance Mechanisms”, *Corporate Governance: An International Review*, Vol. 20, No. 3, pp. 308–332, <https://doi.org/10.1111/j.1467-8683.2012.00909.x>.
- Jensen, M. C., Meckling, W. H. (1976) “Theory of the firm: Managerial behavior, agency costs and ownership structure”, *Journal of financial economics*, Vol. 3, No. 4, pp. 305–360, [https://doi.org/10.1016/0304-405X\(76\)90026-X](https://doi.org/10.1016/0304-405X(76)90026-X).
- Junwei, W., Guiqin, L., Ping, H. (2011) “Study on the Relationship between Agency Costs and Governance Mechanisms: Evidence from China’s A-share Listed Companies”. In *M&D Forum Studies*, pp. 258-271, Available at: <http://www.seidatcollection.com/upload/product/201108/2011gszlhy02a12.pdf> [Accessed: 22.05.2020].
- La Porta, R. et al.. (2000) “Agency Problems and Dividend Policies around the World”, *The Journal of Finance*, Vol. 55, No. 1, pp. 1–33, <https://doi.org/10.1111/0022-1082.00199>.
- McKnight, P. J., Weir, C. (2009) “Agency costs, corporate governance mechanisms and ownership structure in large UK publicly quoted companies: A panel data analysis”, *Quarterly Review of Economics and Finance*, Vol. 49, No. 2, pp. 139–158, <https://doi.org/10.1016/j.qref.2007.09.008>.
- Moez, D. (2018) “Agency Costs, Corporate Governance and the Nature of Controlling Shareholders: Evidence From French Listed Firms”, *International Journal of Accounting and Financial Reporting*, Vol. 8, No. 3, pp. 256–277, <https://doi.org/10.5296/ijaf.v8i3.13621>.
- Muñoz Mendoza, J. A., Sepúlveda Yellob, S. M. (2016) “Does managerial Discretion affect Debt maturity in Chilean firms? An agency cost and asymmetric information approach”, *Ecos de Economía*, Vol. 20, No. 43, pp. 65–87, <http://dx.doi.org/10.17230/ecos.2016.43.4>.

- Panda, B., Leepsa, N. M. (2017) "Agency theory: Review of Theory and Evidence on Problems and Perspectives", *Indian Journal of Corporate Governance*, Vol. 10, No. 1, pp. 74–95, <https://doi.org/10.1177%2F0974686217701467>.
- Rashid, A. (2016) "Managerial Ownership and Agency Cost: Evidence from Bangladesh", *Journal of Business Ethics*, Vol. 137, No. 3, pp. 609–621, Available at: <https://link.springer.com/article/10.1007/s10551-015-2570-z> [Accessed: 15.04.2020].
- Sanda U. A., Mikailu A. S., Garba, T. (2010) "Corporate governance mechanisms and firms' financial performance in Nigeria", Vol. 2, No. 1, pp. 22–39, <https://doi.org/10.1504/AAJFA.2010.035193>.
- Shan, Y. G., McIver, R. P. (2011) 'Corporate governance mechanisms and financial performance in china: Panel data evidence on listed non-financial companies', *Asia Pacific Business Review*, Vol. 17, No. 3, pp. 301–324, <https://doi.org/10.1080/13602380903522325>.
- Singh, M., Davidson III, W. N. (2003) "Agency costs, ownership structure and corporate governance mechanisms", *Journal of Banking & Finance*, Vol. 27, No. 5, pp. 793–816, [https://doi.org/10.1016/S0378-4266\(01\)00260-6](https://doi.org/10.1016/S0378-4266(01)00260-6).
- Škrabić Perić, B. (2012) *Statički panel modeli: primjena u analizi razvoja financijskog sustava zemalja srednje i istočne Europe*, Split: Ekonomski fakultet, pp. 173–199.
- Wooldridge, J.M. (2002) *Econometric Analysis of Cross Section and Panel Data*, The MIT Press, Cambridge.
- Zhang, H., Li, S. (2008) *The impact of capital structure on agency costs: Evidence from UK public companies*, Doctoral dissertation, Queens university of technology.

Utjecaj veličine nadzornog odbora i koncentracije vlasništva na troškove agenta: Analiza poduzeća u Republici Hrvatskoj

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Sažetak

Glavni cilj ovog istraživačkog rada je ispitati utjecaj veličine nadzornog odbora i koncentracije vlasništva, kao mehanizama korporativnog upravljanja, na troškove agenta u velikim hrvatskim poduzećima. Uz to, ispituje se utjecaj financiranja dugom i stope rasta poduzeća, varijabli koje također mogu imati utjecaj na troškove agenta. Teorija agenta definira okvir za potencijalne probleme koji nastaju prilikom razdvajanja vlasništva i upravljanja, kao i za sukob između vlasnika (principala) i menadžera (agenta). Najznačajniji problem u navedenom odnosu su troškovi agenta, međutim, njih nije moguće izravno mjeriti; sukladno tome u ovom istraživanju autori su troškove agenta aproksimirali putem koeficijenta obrtaja ukupne imovine. Istraživački rad obuhvaća empirijsko testiranje utjecaja veličine nadzornog odbora, koncentracije vlasništva, financiranja dugom i stope rasta poduzeća na troškove agenta u promatranom razdoblju od 2014. do 2018. pomoću analize panel podataka. Istraživanje je provedeno na velikim hrvatskim poduzećima koristeći podatke i informacije iz službenih godišnjih financijskih izvješća kako bi se osigurala objektivnost i usporedivost podataka. Istraživanjem je obuhvaćeno 219 poduzeća koja posluju u sljedećim djelatnostima: prerađivačka industrija (C) i trgovina na veliko i na malo; popravak motornih vozila i motocikala (G) sukladno Nacionalnoj klasifikaciji djelatnosti. Rezultati analize identificirali su značajan i negativan utjecaj veličine nadzornog odbora na troškove agenta. Financiranje dugom i stopa rasta imaju značajan i negativan utjecaj na troškove agenta. Istraživanjem nije utvrđen značajan utjecaj koncentracija vlasništva na troškove agenta.

Ključne riječi: Troškovi agenta, korporativno upravljanje, nadzorni odbor, koncentracija vlasništva, analiza panel podataka

JEL klasifikacija: G30, G32, K22

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Factors influencing students' startups intention – a case study at universities in Ho Chi Minh City*

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Abstract

This paper has been written in response to the need to identify the factors of environment affecting students' attitudes on startups intention within the period 2019-2020, at the time of the COVID-19 breakout. For this purpose, the research was conducted on the sample of 2,141 students in twelve universities in Ho Chi Minh City. This research finds out what motivates students to learn, shape start-up ideas as to start a new business, and how an environment approach affects students' startup intention as to gain confidence and positive feelings about the entrepreneurship. This study shows that both general and task environment, as well as positive and negative attitudes directly and indirectly affected students' startup intention. The implication of the findings of this study suggests that the government and universities should pay more attention to environment factors because of its providing opportunities and support to students' startup intention.

Key words: entrepreneurship, startup intention, task environment, general environment, attitudes

JEL classification: I2, I25, R11, R12

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1. Introduction

The universities in Ho Chi Minh City hold an important task in training and providing a high quality human resources, which are always forefront of innovation for all fields. Specially, the major fields are training and research to provide a potential entrepreneur with a burning spirit, and they will start a business in many fields, with the motto “learn to create jobs for yourself and for others”. This research finds out what motivates students to learn, shape start-up ideas to start a new business, and environment approach affects students’ startup intention to lead students to confidence and positive feelings about the entrepreneurship . It needs many strong enterprises’ creation in all fields to develop economics. The purpose of this paper is to review recent research into the startups’ intention that was supported for this view have come from studies of “The key factors affecting entrepreneurship: a comparative analysis” (Jabłońska and Stawska, 2020). According to Jabłońska and Stawska (2020: 140), “Entrepreneurship is an important element of any economy. In most countries, economic authorities are trying to stimulate the level of entrepreneurship in their countries because enterprises make a significant contribution to economic growth”. In general, startups activities can be found in almost every country and region around the world. These activities increase diversity in form and scale, and have become one of the main drivers of the economy today. So far, very little attention has been paid to the role of general environment and task environment effect on students’ startups intention through mediating attitudes towards the entrepreneurship. Moreover, the lack of research on this matter in Vietnam context. Therefore, we would like to identify which environment factors affect students’ entrepreneurial intention through positive and negative attitudes towards students’ entrepreneurship from twelve universities in Ho Chi Minh City. This study was selected for analysis mainly for the following reasons:

- Which environment factors affect students' startup intention as to build up confidence, shape students start-up ideas and positive feelings about the entrepreneurship?
- After graduating, do students decide to start up a new business or apply for a job?

This article is structured as follows, section 1 has established the importance of the topic and presents the subject matter of this research. Section 2 provides the literature review on entrepreneurial intention; positive and negative attitudes; general environment; task environment. Section 3 presents the applied methodology, statistical analysis and data employed. Section 4 presents the empirical data and analysis. Section 5 provides the main empirical results and discussions. Section 6 deals with the conclusions and implications.

2. Literature review

Entrepreneurship is the procedure of integrating the essential elements of production including the individuals, material, and knowledge resources and completing these progress in an effective way (Lazear, 2005). In previous periods of the evolution of entrepreneurship research, Shane and Venkataraman (2000) have built the borders for the area of entrepreneurship investigate. By consulting the work of Venkataraman (1997) has clarified the entrepreneurship as the particular is as the wide investigation of how, by whom, and with what influences chances to generate forthcoming productions are explored, appraised, and utilized (Shane and Venkataraman, 2000). As a result, Shane and Venkataraman (2000) claimed that the major concentration of this research area, which is applied to shape the definition of the entrepreneurship, is the origins of chances; the progress of exploration, assessment, and cultivation of chances; and the mixture of human beings who explore, assess, and cultivate them". Thus, the meaning of entrepreneurship covers more than launching new firms or controlling a small-scale firm.

Furthermore, there were many authors who debated on the notions that "situational elements" such as instruction, and firms' governance statutes or "individual elements" such as individual characteristics are the impoverished indicator to assess the establishment of the intention to start a business (Ajzen, 1991; Fitzsimmons and Douglas, 2011; Krueger et al., 2000). Obviously, the components of intentions are perplexing and challenging to examining (Ajzen, 1991). The individual whose personality is like others can think and act in distinct ways. On the contrary, the people whose characteristics are distinct from others may behave in the same way in the related climate. This is demonstrated apparently in the climate of university. Despite an individual is provided the same resources to the other entrepreneurs, it is hard to predict his/her tendency and decision to turn into a new firm establishment. Therefore, Krueger and Carsrud (1993) forecasting an individual's intention to launch a new organization through concentrating only on the individual and climate components may lead to weak arguments.

Entrepreneurial intention was defined as "the intention of an individual to set up a new business venture sometime in the future" (Thompson, 2009; Turker and Selcuk, 2009; Fitzsimmons and Douglas, 2011). Based on Douglas and Shepherd's (2002) *entrepreneurial intention model* have constructed a new model to investigate the effects of a human-being's perception towards the entrepreneurship on the entrepreneurial intention. They have operated an empirical study in the institution of higher education background through analyzing the results that were collected from ninety-four alumni of an Australian university who had achieved the Bachelors of Business degree between two and ten years previously. The results demonstrated the drivers of the university graduates' entrepreneurial intention conclude attitudes to work effort, attitudes to hazard, and attitudes to independence.

This research pursues and expand the framework of the Shapero and Sokol (1982), Douglas and Shepherd (2002) through concentrating on the exogenous elements such as the general environments and task environment, and clarifying their impacts on the entrepreneurial intention, as well as the perception towards entrepreneurship. Moreover, due to the fact this research is conducted in the university context, it also refers the framework of Nguyen and Phan (2014), Turker and Selcuk (2009). These frameworks investigated and displayed the antecedents of the entrepreneurial intention of university students in Turkey (Turker and Selcuk, 2009) and Vietnam (Nguyen and Phan, 2014).

Positive Attitudes that was suggested by Card and Lemieux (1996), Hayes and Schaefer (1999) proved that the relationship between the needs for earning and entrepreneurial intention by conducting empirical research and conforming that the people who are inspired to achieve the monetary benefits have the tendency to start their own business. Douglas and Shepherd (2002) conducted an empirical research and proposed that the presence of a combination of “income, risk, work effort required, and independence” inspire an individual to start a business. Thus, Devine (1994), Wright and Perrone (1977) also proved those arguments by explaining that the self-employment brings more financial benefits to an individual than being employed. As the consequences, the outcomes of this process are linked to the time that an individual is willing to spent to work (Arrow, 1962; Killingsworth, 1982). Therefore, the attitudes towards income, perquisites, personal financial performance created the positive perception of an individual towards entrepreneurship (Douglas and Shepherd, 2002; Shapero and Sokol, 1982).

According to Hofer (1976), and Schein (1987) have emphasized that the effective entrepreneurs tend to consecrate their personal life to put their effort on working, turning into the competitive advantage of their own business. On the contrary, Bird and Jellinek (1989) stated that the entrepreneurs are pleased with their work life and are willing to work diligently when there is no clue to forecast that their organizational can increase the monetary benefits. Thus, Douglas and Shepherd (2002) determined that the great perceptions of the working conditions will be created the benefits for the individual as well as the organizations, turning to the community benefits to receive the advantages from the successful start-ups. By having the motivation in the comparable working to the personal life, an entrepreneur tends to satisfy with both of them, creating the positive perceptions on the working conditions and personal quality of life. Therefore, the attitudes towards working conditions, personal quality of life, and community benefits are also analyzed as the positive attitudes towards the entrepreneurship (Douglas and Shepherd, 2002; Shapero and Sokol, 1982).

Negative attitudes as suggested by Knight (1921); Duchesneau and Gartner (1990) proposed that the human-being has a high tendency to start a new firm while he/she has a great tolerance for risk. In other words, a person might choose the

alternative to become a staff when they have an adverse feeling on the choice of becoming an entrepreneur. Johnson (1978), Jovanovic (1979), and Miller (1984) supported that youthful people have a high tendency to accept and operate riskier activities. However, Rees and Shah (1986) proved that an individual's intention to elect the start-up alternatives will be hindered due to the quality of risk perception. Therefore, the attitudes on risk are considered to be the negative attitudes towards the entrepreneurship.

Besides that, Alchian and Demsetz (1972), and MacDonald (1984) realized that people have distinct quality of disfavor to work effort. Work effort is correlated to the utilization of physical and intellectual endeavor in the organization. It can be assessed through and can be measured as the hours and magnitude of working shifts. As a result, the distinction between the work characteristics lead to the different achievements that people receive from the work effort. Hence, The equal earning may provide the dissatisfaction to an individual tend to put more effort in their tasks and sacrifice their free time to focus on their job, and the same task assignment may give the pressure to the people who tend to enjoy their personal life. Bird and Jelinek (1988) proved that an entrepreneur has to work for a long time with high work load instead of spending his/her time for personal life.

Moreover, stress is the related area to the work effort. As mentioned above, according to Hofer (1967) and Schein (1987), the effective entrepreneurs tend to consecrate their personal life to put their effort on working, turning into the competitive advantage of their own business. Douglas and Shepherd (2002) also determined the fact that a pressure for putting a huge effort to achieve the success while becoming an entrepreneur direct influence to an individual's point of view. Therefore, the stress that an individual can recognize in the duty of opening his/her own business may create the effort to work or hinder him/her from establishing a new firm. In addition, in the circumstance that a person starts a business, the pressure for leading his/her own business to success require a large amount of time and work effort, which may also influence the entrepreneurial decision-making process.

Independent attitude is associated with the refers to the favor or disfavor to manage and manipulate one's decision-making process. In addition, human being usually feel comfortable and favor the independence (Douglas and Shepherd, 2002). They also recommended that the level of preference to independence have the same ratio to the individual's capabilities. The level of independence is higher for the entrepreneurs than the individuals who choose to become a staff (Bird and Jelinek, 1989). According to Douglas and Shepherd (2000) stated that the independence consists of both the people who show the favor to independence and the people who display high independence preferring and those who have a relatively high condition for independence. In the circumstance, there is a staff displays a high quality resistance to independence, he/she will not have the thought of becoming an entrepreneur. Thus, this study also concentrated on negative attitude towards

the entrepreneurship, including the perception of risks, work effort, stress, and independence.

General environment try to empirical measure the startups' intention through positive and negative attitudes. Based on Dill (1958) found that the organization's environment can be classified into two major part including general environment and task environment. The general environment is the combination of the elements that have the indirect impacts on the business procedure of the firm instead of having the direct influences. Furthermore, Schermerhorn and Bachrach (2017) found that the general environment is very important for an organization, so the organization should consider and adapt to both internal and external environment because both of them have the potential to associate with and impact the organizational daily operation. According to Daft and Willmott (2010) emphasized that the organizational external climate has clarified as all the components that are presented at the external context of the organizational borders, which may have the impacts on the whole construct of the firm. Furthermore, Huges (1989) found that external climate environment are clarified various sectors that associated with the firms' function including "aesthetic, physical, technological, economic, financial, social, political, legal, cultural, institutional and policy". For the start-up procedure, the elements of social, economic, political, infrastructure development, and market emergence might have the business' formation (Specht, 1993). In specific, Amorós (2009) concentrated on the link between the quality of the institution and the entrepreneurship. The result from Amorós's study showed that the quality of government institutions is an essential element for the entrepreneurship activities, especially the rate of start-up (Amorós, 2009). In specific, Sobel et al. (2007) proposed that public policies can be analyzed as the foundation of the entrepreneurship in a nation through generating the entrepreneurship administrations and institutional frameworks that encourage the entrepreneurship. Audretsch et al. (2007) also examined various aspects of the distinct entrepreneurship policies within the entrepreneurship area. Those policies were risen from the general climate and the interaction between those policies and climates are the drivers of entrepreneurship (Storey, 2003). In addition, Johnson et al. (2002) analyzed the government regulation that gives the conducive climate for entrepreneurship actions. The quality of the regulations, which take cares of the start-up, is crucial for the people who launch a new firm because it provides the inspiration for them in start-up area (Schumpeter, 1961). Based on this assumption, Bowen and De Clercq (2008) enlarged it by recommending that a national level of regulations which secures the new ventures also influences the entrepreneurial efforts. Moreover, Mazzarol et al. (1999) claimed that the presence of the agencies that provides the assistance to the new ventures, which existed in the political climate, is also considered to be a key element of the entrepreneurship, turning into the motivation for the individual intention to become an entrepreneur (Gartner, 1985; Young and Francis, 1989).

Task environment try to measure the aspect of startups' intention. Task environment is defined as "munificence, hostility, dynamism, and complexity" (Dess and Beard, 1984; Rosenbusch et al., 2013) and affect positively entrepreneurial orientation. We have concentrated on the task environment that we have adopted different perspectives from different studies on the entrepreneurship by McNamara et al. (2005), Short et al. (2007) found out that the task environment affects decisions, actions, and the performance of organizations. Furthermore, the task environment has existed of the opportunities and the availability of resources (Salancik and Pfeffer, 1978); Staw and Sz wajkowski, 1975). Moreover, the task environment is the mixture of the factors that have direct impacts on the organizational functions and performance through the direct interacting with the business (Schermerhorn and Bachrach, 2017). Zeithaml and Zeithaml (1984) proposed that organizations ought to pursue an active "entrepreneurial mindset" to operate effectively in while dealing with the task climate. The financial system or the capital availability is a rational resource direct influences the start-up process due to the loan accessible capabilities of the new venture, turning into the successful organization establishment (Cross, 1981; Storey, 1982; Gartner, 1995; Nguyen and Phan, 2014). Besides that, Whitley (2003) has emphasized that the national financial system is an essential characteristic of the country, the national financial system shapes and encourages the entrepreneurship behaviors. Therefore, The more accessible the loans are, the more probable an individual become an entrepreneur (Bowen and De Clercq, 2008). Moreover, the chances to access to both the domestic and the international market that are provided to new ventures, which can also influence the entrepreneurship activities at a nation (Nguyen and Phan, 2014). Besides that, the opportunities go into the labour market, which is also assumed as the human resources, is also displayed as the significant components within the task environment that direct effect on the daily organizational functions (Nguyen and Phan, 2014). The intellectual capital is also a task environment's dimension within the framework of Nguyen and Phan (2014). Brooking (1998) introduced the term intellectual capital as a combination of market, human, and infrastructure properties. After that, Brennan and Connell (2000), Harrison and Sullivan (2000), Sullivan (2000) determined this term as the firms' knowledge-based assets or know-how exchangeable into outcomes. In addition, through a literature review study, Crupi et al. (2020) have concluded that various authors have investigated and proposed the connection between intellectual capital and particular features of entrepreneurship and entrepreneurship activities, as well as the intention to become an entrepreneur.

To analyze the impact of selected elements on the students' startups intention, we saw that this effect is very wide and diverse such as economy created jobs and incomes, Turker and Selcuk (2009) have noticed that" the environment approach" has a relationship with economics, sociological environment like religious particularity and cultural values" affect entrepreneurship defined by Chan et al. (2009); Rosenbusch et

al. (2013) have found that task environment involves “munificence, dynamism, and complexity” affect positively entrepreneurial orientation. The general Environment factors were elicited by Amoros (2009), Bowen and Clercq (2008), Specht (1993) categorizes five main environmental factors affecting organisation formation: social; economic; political; infrastructure development; and market emergence factors. Behavior like positive attitudes were Douglas and Shepherd (2002), Shapero and Sokol (1982) defined income, risk, work effort required, and independence. On this reason, we have proposed hypothesis as below:

The first hypothesis (H1): The environment factors affect and predict positive attitudes.

According to Duchesneau and Gartner (1990) defined negative attitudes “ the person has a great tolerance for risk when open a new business. In other words, a person might choose the alternative to become a staff when they have an adverse feeling on the choice of becoming an entrepreneur, Crupi et al. (2020) have investigated and proposed the connection between intellectual capital and particular features of entrepreneurship and entrepreneurship activities, as well as the intention to become an entrepreneur. Based on entrepreneurial intention defined the intention of an individual to set up a new business venture some time in the future (Thompson, 2009; Turker and Selcuk, 2009; Fitzsimmons and Douglas, 2011). Nguyen and Phan (2014) point out that finding an investment for business project and used to own business in the past and want to do this again. Nevertheless, we recognized that these factors are very important and strong impact on startups intention, then we have proposed more hypotheses.

The second hypothesis (H2): The environment factors affect and predict negative attitudes.

The third hypothesis (H3): The environment factors, positive attitudes, and negative attitudes affect startups' intention.

The fourth hypothesis (H4): The influences of the components on startups intention have direct and indirect through positive attitudes and negative attitudes.

3. Methodology

3.1. Questionnaire design and data collection

The measure scales were used in this current research. First, startups intention was adapted from Turker and Selcuk (2009), Fitzsimmons and Douglas, 2011; Nguyen and Phan (2014). Therefore, Positive Attitudes that was borrowed from Douglas and Shepherd (2002), Shapero and Sokol (1982). Then, Negative Attitudes that

was assessed from Shapero and Sokol (1982), Douglas and Shepherd (2002). Furthermore, General Environment that was elicited by Amoros (2009), Bowen and De Clercq (2008), Gartner (1985), Young and Francis (1989), Nguyen and Phan (2014). Finally, Task Environment was achieved from Nguyen and Phan (2014), Cross (1981), Storey (1982), Gartner (1995). All survey questions utilized a 5-point Likert scale from “strongly agree” to “strongly disagree”.

The sampling was followed three stages. The first stage we identified target population who are students, based on this we decide to choose the first criteria, students are third year students, senior students and newly graduates from universities; the second criteria, the students have studied some basic subjects, based on these subjects they already have knowledge to understand about startups.

The second stage we determined places and technique to collect data. The first criteria, the twelve universities are in the south of Vietnam that are neared our places to easy transport to collect data and save our time and money for transportation, the second criteria, there is not yet any researchers to study students' startups intention at these universities. And the third criteria, the students must be studied at Business field, Natural Science field, Social Science field from these fields they have basic background about the entrepreneurship.

The third stage, we collected data at the end we reached 2,141 respondents was recruited from five private and seven public universities. the self-administered questionnaire and a convenience sampling were used, the data was collected during November 2019 until August 2020 and the surveys were delivered to the participants through their email, their class, online surveys. The final data were analysed through SPSS “version 20” by descriptive analysis, factor analysis, reliability analysis, multiple regressions, and path analysis.

3.2. Factor analysis and reliability

To simplify these data with getting the validity in the scale, we conducted an exploratory factor analysis. Kim and Mueller's (1978) suggested that “factor loadings of 0.40 or greater, slightly above are accepted” and “recommended cut off factor loadings of 0.30”.

4. Empirical data and analysis

4.1. Profile of participants

Table 1: Information about respondents (N= 2,141)

		Number	%
Gender	Male	1,016	47.5
	Female	1,125	52.5
Age Group	20-25	1,909	89.2
	26-30	232	10.8
Type of university	Private university	985	46
	Public university	1,156	54
Field of Study	Business Area	949	44.3
	Natural Science Area	711	33.2
	Social Science Area	481	22.5
Marital Status	Single	2,080	97.2
	Married	61	2.8
Year of Education	Third year student	1,029	48.1
	Last year student	830	38.8
	Graduated less than 1 year	282	13.2

Source: Authors

Based on the results of the descriptive analysis, our valid sample of 2,141 respondents were a representative sample of private and public universities, and this finding showed that there were only 985 students at private universities were participated in this study and account for 46 %. However, the public universities joint more 1,156 students and account for 54%. And the results showed that more than half of participants was female (52.5%) who love to start their own business immediately after graduation than male. Only 47.5% of male respondents would start their own business. According to the age, participants were divided into two age groups based on the year of their study program at university: 89.2 % of respondents belonged to the group aged 20-25 indicating that there is an increased number in young people with entrepreneurial intention, and these results are consistent with Johnson (1978), Jovanovic (1979), and Miller (1984). However, only 10.8% of them belonged to group 26-30 years old. And 44.3% of the participants reported that their currently field of study was Business Area, 33.2% was Natural Science Area, and 22.5% was Social Science Area at their university.

After running the EFA, for dependent variables (startups intention, positive attitudes, negative attitudes) these items have factor loading ≥ 0.5 include 4 items of startups intention, 6 items of positive attitudes, 4 items of negative attitudes. KMO index of Dependent variables was .811 and Sig. of Bartlett's test was .000.

And for independent variables (task environment, general environment) include 4 items of task environment and 5 items of general environment. KMO index of independent variables was .868 and Sig. of Bartlett's test was .000 (Pallant, 2007), to be significant, the value had to be .60 or above; and Sig. of Bartlett's test $p < .001$, it showed that this data was appropriate for principal component's analysis.

Table 2: Summary of dependent variables and independent variables with reliability coefficients

Measures & items	Source	Cronbach's alpha (N= 2,141)
ENIN: Startups Intention 1. Start my own business after graduation. 2. Start my own business within next 2 years. 3. Looking for investment for my business project. 4. Used to have my own business in the past & want to start it over.	Turker and Selcuk, (2009); Fitzsimmons and Douglas, (2011) Nguyen and Phan, (2014)	.711
POSAT: Positive Attitudes 1. Higher independence, income. 2. Improve my working condition. 3. Receive special right/privilege. 4. Benefits, prosperity. 5. Quality of life. 6. Community benefits	Douglas and Shepherd (2002); Shapero and Sokol (1982)	.765
NEGAT: Negative Attitudes 1. Risky. 2. Spend more time & effort. 3. Stressful 4. Autonomy: a preference for decision-making control.	Douglas and Shepherd (2002); Shapero and Sokol (1982)	.652
TASENVI: Task Environment 1. Accessing loans easily. 2. Access to International & local market. 3. Highly qualified human resources. 4. Highly intellectual capital.	Cross, (1981); Storey, (1982); Gartner, (1995); Nguyen & Phan, (2014)	.779
GENENVI: General Environment 1. Quality of government. 2. Entrepreneurship support agencies. 3. Regulatory Environment/Legal System/Business regulations 4. Political Stability. 5. Encouraging policy for entrepreneurship	Amoros (2009); Bowen and Clercq (2008); Gartner (1985); Young & Francis (1989); Nguyen and Phan (2014).	.764

*All items have factor loading ≥ 0.5 ; KMO index of Dependent variables = .811 and Sig. of Bartlett's test = .000; Total Variance Explained = 50.3 %; KMO index of independent variables = .868 and Sig. of Bartlett's test = .000; Total Variance Explained = 56.1 %.

Source: Authors

Next, we run principal component analysis to test correlations among items and assumed uncorrelated (orthogonal) common factors (Kim and Mueller, 1978). Varimax rotation increased the interpret ability of factor structures for the group of dependent variables, it yields 3 factors with eigenvalues greater than one (3.643; 2.215; 1.187), together accounting for 50.321% of the variance, and it yields 2 factors for the group of independent variables with eigenvalues greater than one (3.999; 1.046), together accounting for 56.047% of the variance. In addition, five yielded coefficient alphas of 0.711, 0.765, 0.652, 0.779, and 0.764, which indicated a good reliability (see Table 2).

4.2. Factors affecting positive attitudes, negative attitudes and startups intention

To identify which factors had a relationship with start-ups intention, we used Pearson correlation to identify them. So, the results of the correlational analysis are shown in Table 3 illustrated the correlation coefficients between startups intention and independent variables: positive attitudes, negative attitudes, task environment, and general environment. According to Tabachnick and Fidell (2001), Pearson Correlation (r) is smaller than 0.7 will be retained. The highest Pearson correlation in this study is .254 which is less than 0.7, therefore all factors were retained and the moderately positive correlations between startups intention (ENIN) and three independent variables: positive attitudes (POSAT, $r = .254$), task environment (TASENVI, $r = .150$), and general environment (GENENVI, $r = .190$) indicating that an increase in these factors were lead to the high level of startups intention was. This implied that the more students felt positive attitudes, the stronger their startups intention was. However, the correlation coefficients between startups intention and negative attitudes (NEGAT. $r = -.046$) had negatively correlation with ENIN that implied that the more students felt stressed and depressed, get risky, spend more time and effort in the workplace, the weaker their startups intention was.

Table 3: Pearson's Correlation Coefficients between Variables and ENIN

	ENIN	1	2	3	4
1. GENENVI	.150	1.000			
2. TASENVI	.190	.597	1.000		
3. POSAT	.254	.306	.303	1.000	
4. NEGAT	-.046	.147	.063	.407	1.000
Mean	2.76	3.42	3.33	3.70	3.94
Std. Deviation	.814	.697	.735	.614	.618

Source: Authors

The findings from data are reported as mean of startups intention to become an entrepreneur was 2.76 on a 5-point scale, indicating relatively low intentionally across the sample (N = 2,141), they are not ready to start own business, they thought it's better to choose a job than self-employment. Moreover. Mean of negative attitudes was 3.94 that is the highest score among four factors. Indicating that our students are afraid of getting risky, they thought "Starting own business is risky", "Starting my own business requires me to spend more time and effort in the workplace" and "Starting a new business venture makes me feel stressful". The results are consistent with those reported previously by Alchian and Demsetz (1972) and MacDonald (1984) realized that people have distinct quality of disfavor to work effort. Work effort is correlated to the utilization of physical and intellectual endeavor in the organization. The results are in line with reported of Douglas and Shepherd (2002) also determined the fact that a pressure for putting a huge effort to achieve the success while becoming an entrepreneur direct influence to an individual's point of view. This finding also answers the objective of this study is after graduating student decide to apply for a job (they are not ready to start a new business).

4.3. Factors affecting Positive Attitudes

The result of testing hypothesis one was displayed in the Table 4, there was a significant positive correlation between GENENVI and POSAT. It had direct effects on positive attitudes with ($\beta=.151$, at Sig. = .000). Thus, the hypothesis one (H1) was supported. The results also indicated that the increasing in standardized coefficient was determined general environment, could lead to increasing in students' positive attitudes. However, no significant differences were found between TASENVI and POSAT, task environment did not yield significant relationships with positive attitudes. These results showed that task environment appeared to be unaffected by positive attitudes with TASENVI at sig. = .153 ($P > .05$), it fails to affect POSAT, the results did not confirm the positively affected and predicted POSAT saying that the developing in task environment did not produce the increasing in positive attitudes.

Table 4: Coefficients between independent variables and POSAT

Variables	Unstandardized coefficients (B)	t-value	Sig.
GENENVI	.151	6.386	.000
TASENVI	-.032	-1.428	.153

Dependent Variable: POSAT: Positive Attitudes; ANOVA: F (2,2138) = 24.789, Sig.=.000, $p < 0.05$; Model Summary: $R^2 = .023$.

Source: Authors

According to Lewis-Beck (1980) suggested that in the case R-squared reach 1.0 reveal the existence of multi-collinearity problems (Lewis-Beck, 1980), but our results showed that the adjusted R^2 was checked with the value of .023. This shows that the model with two independent variables (GENENVI, TASENVI) could explain 2.3% of variance of dependent variable (POSAT), and it defined that the multi-collinearity did not show any problems in this study.

4.4. Factors affecting Negative Attitudes

The result of testing hypothesis 2 was displayed in the Table 5, yielding significant positive correlation between two independent variables (GENENVI, TASENVI) and dependent variable (NEGAT). It had direct effects on negative attitudes with (GENENVI at $\beta=.171$, at Sig. = .000), and (TASENV at $\beta=.156$, at Sig. = .000). Thus, support existed for hypothesis two (H2). The results also indicated that increasing in standardized coefficient was determined general environment and task environment, could lead to increasing in students' negative attitudes. These results confirmed the positive affect and predict NEGAT saying that the developing in task environment, general environment did produce the increasing in negative attitudes.

Table 5: Coefficients between independent variables and NEGAT

Variables	Unstandardized coefficients (B)	t-value	Sig.
GENENVI	.171	7.677	.000
TASENVI	.156	7.393	.000

Dependent Variable: NEGAT: Negative Attitudes; ANOVA: $F(2,2138) = 140.713$, Sig.=.000, $p < 0.05$; Model Summary: $R^2 = .116$.

Source: Authors

According to Lewis-Beck (1980) suggested that in the case R-squared reach 1.0 reveal the existence of multi-collinearity problems (Lewis-Beck, 1980), but our results showed that the adjusted R^2 was checked with the value of .116. This shows that the model with two independent variables (GENENVI, TASENVI) could explain 11.6% of variance of dependent variable (NEGAT), and it defined that the multi-collinearity did not show any problems in this study.

4.5. Factors affecting Startups Intention

The result of testing hypothesis 3 was displayed in the Table 6, yielding significant positive correlation between two independent variables (TASENVI, POSAT) and dependent variable (ENIN). It had direct effects on startups intention with (TASENVI at $\beta=.106$, at Sig. = .000), and the most striking result in emerge from the data is

that positive attitudes has the highest score (POSAT at $\beta = .378$, at Sig. = .000). This results also indicated that the increasing in standardized coefficient was determined task environment, positive attitudes, which could lead to the increasing in students' startups intention. Specially, yielding significant negative correlation between NEGAT and ENIN with (NEGAT at $\beta = -.228$, at Sig. = .000). So, it shows that the increasing in standardized coefficient was determined negative attitudes could lead to the decreasing in students' startups intention. Thus, support existed for hypothesis three (H3) and the results confirmed the effect on ENIN. However, there was no significant differences were found between GENENVI and ENIN, general environment did not yield significant relationships with startups intention. These results showed that general environment appeared to be unaffected by startups intention with GENENVI at sig. = .232 ($P > .05$), it fails to affect ENIN, the results did not confirm the positively affect and predict startups intention saying that the developing in general environment did not produce any increasing in startups intention.

Table 6: Coefficients between independent variables and ENIN

Variables	Unstandardized coefficients (B)	t-value	Sig.
GENENVI	.036	1.197	.232
TASENVI	.106	3.699	.000
POSAT	.378	12.039	.000
NEGAT	-.228	-7.661	.000

Dependent Variable: ENIN: Entrepreneurial I Intention; ANOVA: $F(4,2136) = 61.566$, Sig.=.000, $p < 0.05$; Model Summary: $R^2 = .103$.

Source: Authors

According to Lewis-Beck (1980), in the case R-squared reach 1.0 reveal the existence of multi-collinearity problems (Lewis-Beck, 1980), but our results showed that the adjusted R2 was checked with the value of 0.103. This shows that the model with four independent variables (GENENVI, TASENVI, POSAT, NEGAT) could explain 10.3% of variance of dependent variable (ENIN), and it defined that the multi-collinearity did not show any problems in this study.

4.6. Indirect effects on Startups Intention

Based on the results of multiple regressions (see Table 6) identified that students' startups intention was main affected directly by three important factors: (TASENVI at $\beta = .106$, at Sig. = .000), (POSAT at $\beta = .378$, at Sig. = .000), (NEGAT at $\beta = -.228$, at Sig. = .000). From this finding we will use these affect index to find out indirect effect on ENIN. To test hypothesis four (H4), indirect effects on startups intention is "calculated by multiplying two related effect indexes".

Indirect affect between GENENVI and ENIN

$$(GENENVI * POSAT) + (GENENVI * NEGAT) = .151 * .378 + .171 * -.228 = .015$$

Indirect affect between TASENVI and ENIN

$$(TASENVI * NEGAT) = .156 * -.228 = -.036$$

Table 7: Summary of direct, indirect, and total causal effects on ENIN

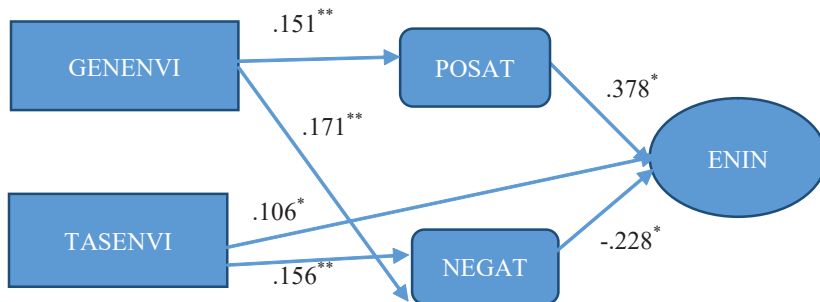
	Casual Effects		
	Direct	Indirect	Total
GENENVI	–	.015	.015
TASENVI	.106	-.036	.07
POSAT	.378	–	.378
NEGAT	-.228	–	-.228
Total	.256	-.021	.235

Source: Authors

4.7. The causal effects on students' startups intention

Table 7 provides the findings of the causal effects on students' startups intention. The most interesting finding was that POSAT was the factor had the strongest causal effect directly on ENIN with $\beta = .378$. Next, GENENVI factor had a substantial causal effect on EININ with $\beta = .015$. Then, TASENVI factor had a moderate causal effect on ENIN with $\beta = .07$. However, NEGAT factor had a negative causal effect on ENIN with $\beta = -.228$. The total causal effect of these factors on students' startups intention was .235. Based on this results hypothesis four (H4) was supported. (The results, as shown in Figure 1, (*): direct significant; (**): indirect significant).

Figure 1: Path coefficients of hypothesis testing



Source: Authors

5. Results and discussions

In this part, we answer the questions built in hypotheses and discuss our findings. This study proposed the research model including 4 factors, among these factors had three factors significantly and directly affected students' startups intention (TASENVIN, POSAT, NEGAT), and two factors had indirect effect on students' startups intention (TASENVIN, GENENVIN). Based on the previous studies and literature review was adapted and constructed 23 items to measure all concepts in the framework. Additionally, relatively large statistical differences are identified in the cases of positive attitudes (POSAT, $\beta = .378$) present the most significant role in students' startups intention when they thought that "Starting my own business is a great opportunity to have higher income, improve working condition, receive special right or privilege in life, improve quality of life, opportunity to contribute to community. This value agrees with that observed by Amorós, (2009) found that "Different individuals experience different changes over time in their ability as well as in their attitudes toward income". Therefore, the attitudes towards income, perquisites, personal financial performance created the positive perception of an individual towards the entrepreneurship, and the working conditions will create the benefits for the individual as well as the organization. It shows personal quality of life, and community benefits impact through positive attitudes towards entrepreneurship (Douglas and Shepherd, 2002; Shapero and Sokol, 1982).

Furthermore, relatively statistical differences are identified in the cases of general environment (GENENVI, $\beta = .015$) presenting the second significant role in students' startups intention when they thought that "strong and qualified government apparatus, several entrepreneurship agencies support, legal system is transparent and effective in protecting business owners' rights and interests". The political institution is stable, and government encourages the establishment of new business ventures. The results consistent with these reported previously by Schermerhorn and Bachrach (2017) that has indirectly impact on the business procedure of the firm instead of having the direct influences. In specific, Amorós (2009) concentrated on the quality of the institution and the entrepreneurship. It is an essential element for the entrepreneurship activities, especially the rate of startups. These findings also supported to the arguments made by, Sobel et al. (2007) proposed that public policies can be analyzed as the foundation of the entrepreneurship in a nation through generating the entrepreneurship administrations and institutional frameworks that encourage the entrepreneurship. In addition, Johnson et al. (2002) analyzed the quality of the regulations that take care of the startups, it is crucial for who want to launch a new firm, because it provides the inspiration for them in startups area.

Table 8: Summary of Hypothesis Testing

Hypothesis	Description	Indicator	Result
H1: The environment factors affect & predict positive attitudes.	General Environment	$\beta = .151$ P = .000	Support
	Task Environment	$\beta = -.032$ P = .153	Not support
H2: The environment factors affect & predict negative attitudes.	General Environment	$\beta = .171$ P = .000	Support
	Task Environment	$\beta = .156$ P = .000	Support
H3: The environment factors, positive attitudes, and negative attitudes affect startups' intention.	General Environment	$\beta = .036$ P = .232	Not support
	Task Environment	$\beta = .106$ P = .000	Support
	Positive Attitudes	$\beta = .378$ P = .000	Support
	Negative Attitudes	$\beta = -.228$ P = .000	Support
H4: The influences of the components on startups intention have direct and indirect through positive attitudes and negative attitudes.	Task Environment	Direct $\beta = .106$ P = .000	Support
	Positive Attitudes	Direct $\beta = .378$ P = .000	Support
	Negative Attitudes	Direct $\beta = -.228$ P = .000	Support
	General Environment	Indirect $\beta = .015$ P = .000	Support
	Task Environment	Indirect $\beta = -.036$ P = .000	Support

Source: Authors

These findings also reported by Bowen and De Clercq (2008) point out the national level of regulations secures the new ventures and the influences of the entrepreneurial efforts. These findings are consistent with Mazzarol (1999) who emphasized that agencies provide and support assistance to new ventures that existed in the political sector, and it is a key factor of the entrepreneurship, turning into the motivation for the individual intention to become an entrepreneur (Crupi *et al.*, 2020).

Another important finding was that task environment (TASENVI) factor has a moderate direct and indirect effect on ENIN ($\beta = .07$), and this result was consistent with

prior studies by Rosenbusch et al. (2013), Schermerhorn and Bachrach (2017). The financial system and the capital availability are the rational resource direct influences the startups process, because of the loan accessible capabilities of the new venture, turn to the successful organization, and the chances to access to both the domestic and international market which is provided to new ventures can also influence the entrepreneurship activities at a nation (Nguyen and Phan, 2014). Besides that, Whitley (1999) showed that the national financial system is an essential characteristic of the country, which shapes and encourages the entrepreneurship behaviors. Therefore, the more accessible loans existed for the entrepreneurs, the most probabilities of an individual to become an entrepreneur (Bowen and De Clercq, 2008).

In this study, negative attitudes (NEGAT) factor were found to cause directly to students' startups intention (ENIN), it had a negative direct effect on ENIN with $\beta = -.228$. The results are in the agreement with Knight (1921), Duchesneau and Gartner (1990) proposed that a human-being have a high tendency to start a new firm while he/she has a great tolerance for risk. According to Miller (1984) found that youthful people have the tendency to accept and operate riskier activities. Moreover, MacDonald (1984) realized that people have distinct quality of disfavor to work effort. This value also agrees with Bird and Jellinek (1988) proved that an entrepreneur has to work for a long time with high work load instead of spending his/her time for personal life. Douglas and Shepherd (2002) found that the level of preference to independence has the same ratio to the individual's capabilities to choose to become a staff, the fact that has a pressure for putting a huge effort to achieve becoming an entrepreneur. Therefore, the stress can recognize in the duty of opening his/her own business may create the effort to work to establish a new firm. In addition, in the circumstance that a person starts a business, the pressure for leading his/her own business to success require a large amount of time and work effort, which may also influence the entrepreneurial decision-making process to create entrepreneurial intention of an individual to set up a new business venture some time in the future" (Thompson, 2009; Turker and Selcuk, 2009; Fitzsimmons and Douglas, 2011). Nguyen and Phan (2014) point out that finding an investment for business project and used to own business in the past and want to do this again.

6. Conclusions

The present study was designed to determine the factors that directly and indirectly affect students' startups intention. This study has identified three significant factors that directly affected students' startups intention (task environment, positive attitudes, negative attitudes), and two factors had an indirect effect on students' startups intention (task environment, general environment) with the mediation of positive attitudes and negative attitudes. One of the most significant findings is that positive attitudes factors present the most significant role in students' startups

intention. The results of this study have provided several implications for the entrepreneurship area, managerial exercises, and government policy.

These findings suggest that positive attitudes in environment approach have the most important role of students' start-ups intention. Therefore, the government and universities should pay more attention to select suitable company partners and training programs. Owing to the fact that entrepreneurship needs both knowledge gained from adequate educational programs and practical skills provided in the real business environment, the government and universities should create an entrepreneurial education program in the curriculum for students such as a guide to open a new firm from starting to finishing the process, add new courses such as planning, team building, protecting intellectual property, identifying and negotiating funding, managing time, financial management, technology and so on. After being provided with the adequate knowledge, technical skills, psychological support services students will be ready and willing to participate in the start-ups and open their own business after graduation.

The other implication is that the universities should have a model company, where students can participate in good practices of the real business environment, seek profits and accept risks. Besides that, the government and universities should support services such as counseling centers where students can learn the rules, procedural requirements, and policies to establish a new firm. Moreover, the institutional environment, especially the role of the government has been emphasized in the results of this study. Therefore, the government should concentrate on building quality and support agencies and establish the policies which facilitate students to reach the legal system, loan assessing(financial system), international and local markets accessing (market system), human resources (workforce), and intellectual capital. Students will have the positive attitudes towards start-ups and will have the tendency to become an entrepreneur.

Although the current study is based on 2,141 sample of participants, the findings suggest that future research should invest more time on collecting data. Owing to the fact that this study has got few limitations such as collecting data during the breakout of corona virus disease (Covid-19), it was difficult to reach target respondents to get valid sample. The generalizability of these results is subject to certain limitations. For instance, the research used the existing variables to test effects on students 'entrepreneurial intention in Ho Chi Minh City. Future research could improve more potential elements that could be significant elements of students 'entrepreneurial intention like "stable psychological attributes" (Carsrud and Johnson, 1989), and use qualitative approach to conduct an in-depth interview among students about startups.

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References

- Alchian, A. A., Demsetz, H. (1972) "Production, information costs, and economic organization", *The American economic review*, Vol. 62, No. 5, pp. 777–795, <https://doi.org/10.1109/EMR.1975.4306431>.
- Ajzen, I. (1991) "The theory of planned behavior", *Organizational behavior and human decision processes*, Vol. 50, No. 2, pp. 179–211, https://www.dphu.org/uploads/attachements/books/books_4931_0.pdf.
- Amorós, J. E. (2009) *Entrepreneurship and quality of institutions: A developing-country approach*, No. 2009/07, WIDER Research Paper, <https://www.econstor.eu/bitstream/10419/45174/1/601792084.pdf>.
- Arrow, K. J. (1962) "Economic Welfare and the Allocation of Resources for Invention", *the Rate and Direction of Inventive Activity*, Princeton University Press and NBER, pp. 609–626, https://doi.org/10.1007/978-1-349-15486-9_13.
- Audretsch, D. B., Grilo, I., Thurik, A. R. (Eds.) (2007) *Handbook of research on entrepreneurship policy*, Edward Elgar Publishing, pp. 01–17.
- Bird, B., Jelinek, M. (1989) "The operation of entrepreneurial intentions", *Entrepreneurship theory and practice*, Vol. 13, No. 2, pp. 21–30, <https://doi.org/10.1177/104225878801300205>.
- Bowen, H. P., De Clercq, D. (2008) "Institutional context and the allocation of entrepreneurial effort", *Journal of International Business Studies*, Vol. 39, No. 4, pp. 747–767, <https://doi.org/10.1057/palgrave.jibs.8400343>.
- Brennan, N., Connell, B. (2000) "Intellectual capital: current issues and policy implications", *Journal of Intellectual capital*, Vol. 1, No. 3, pp. 206–240, <https://doi.org/10.1108/14691930010350792>.
- Brooking, A. (1998) *Intellectual capital*, Cengage Learning EMEA.
- Card, D., Lemieux, T. (1996) "Wage dispersion, returns to skill, and black-white wage differentials", *Journal of Econometrics*, Vol. 74, No. 2, pp. 319–361, [https://doi.org/10.1016/0304-4076\(95\)01757-7](https://doi.org/10.1016/0304-4076(95)01757-7).
- Carsrud, A. L., Johnson, R. W. (1989) "Entrepreneurship: a social psychological perspective", *Entrepreneurship & Regional Development*, Vol. 1, No. 1, pp. 21–31, <https://doi.org/10.1080/08985628900000003>.
- Chan, K. L., Sivapalan, S., Bahiyah, A. H. (2009) "Malay youth entrepreneurship in Malaysia: an empirical update/Chan Kim Ling@ Geraldine and Sivapalan Selvadurai, Bahiyah Abdul Hamid", *Geografia: Malaysian Journal of Society and Space*, Vol. 5, No. 2, pp. 61–68, https://www.researchgate.net/publication/50366371_Malay_youth_entrepreneurship_in_Malaysia_An_empirical_update.
- Cross, M. (1981) *New firm formation and regional development*, Gower Publishing Company.

- Crupi, A., Cesaroni, F., Di Minin, A. (2020) "Understanding the impact of intellectual capital on entrepreneurship: a literature review", *Journal of Intellectual Capital*, <https://doi.org/10.1108/JIC-02-2020-0054>.
- Daft, R. L., Murphy, J., Willmott, H. (2010) *Organization theory and design*, Cengage learning EMEA.
- Dess, G. G., Beard, D. W. (1984) "Dimensions of organizational task environment", *Administrative science quarterly*, Vol. 29, No. 1, pp. 52–73, <https://doi.org/10.2307/2393080>.
- Devine, T. J. (1994) "Changes in wage-and-salary returns to skill and the recent rise in female self-employment", *The American Economic Review*, Vol. 84, No. 2, pp. 108–113, <https://www.jstor.org/stable/2117812>.
- Dill, W. R. (1958) "Environment as an influence on managerial autonomy", *Administrative science quarterly*, Vol. 2, No. 4, pp. 409–443, <https://doi.org/10.2307/2390794>.
- Douglas, E. J., Shepherd, D. A. (2000) "Entrepreneurship as a utility maximizing response", *Journal of business venturing*, Vol. 15, No. 3, pp. 231–251, [https://doi.org/10.1016/S0883-9026\(98\)00008-1](https://doi.org/10.1016/S0883-9026(98)00008-1).
- Douglas, E. J., Shepherd, D. A. (2002) "Self-employment as a career choice: Attitudes, entrepreneurial intentions, and utility maximization", *Entrepreneurship theory and practice*, Vol. 26, No. 3, pp. 81–90, <https://doi.org/10.1177/104225870202600305>.
- Duchesneau, D. A., Gartner, W. B. (1990) "A profile of new venture success and failure in an emerging industry", *Journal of business venturing*, Vol. 5, No. 5, pp. 297–312, [https://doi.org/10.1016/0883-9026\(90\)90007-G](https://doi.org/10.1016/0883-9026(90)90007-G).
- Fitzsimmons, J. R., Douglas, E. J. (2011) "Interaction between feasibility and desirability in the formation of entrepreneurial intentions", *Journal of business venturing*, Vol. 26, No. 4, pp. 431–440, <https://doi.org/10.1016/j.jbusvent.2010.01.001>.
- Gartner, W. B. (1985) "A conceptual framework for describing the phenomenon of new venture creation", *Academy of management review*, Vol. 10, No. 4, pp. 696–706, <https://doi.org/10.5465/amr.1985.4279094>.
- Gartner, W. B., Shane, S. A. (1995) "Measuring entrepreneurship over time", *Journal of business Venturing*, Vol. 10, No. 4, pp. 283–301, [https://doi.org/10.1016/0883-9026\(94\)00037-U](https://doi.org/10.1016/0883-9026(94)00037-U).
- Harrison, S., Sullivan, P.H. (2000) "Profiting from intellectual capital", *Journal of Intellectual Capital*, Vol. 1, pp. 33–46, <https://doi.org/10.1108/14691930010324124>.
- Hayes, R. M., Schaefer, S. (1999) "How much are differences in managerial ability worth?" *Journal of Accounting and Economics*, Vol. 27, No. 2, pp. 125–148, [https://doi.org/10.1016/S0165-4101\(99\)00007-5](https://doi.org/10.1016/S0165-4101(99)00007-5).

- Hofer, C. W. (1976) "Research on strategic planning-survey of past studies and suggestions for future efforts", *Journal of Economics and Business*, Vol. 28, No. 3, pp. 261–286.
- Hughes, W. P. (1989) "Identifying the environments of construction projects", *Construction Management and Economics*, Vol. 7, No. 1, pp. 29–40, <https://doi.org/10.1080/01446198900000004>.
- Jabłońska, M., Stawska, J. (2020) "The key factors affecting entrepreneurship: a comparative analysis", *Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu*, Vol. 38, No. 1, pp. 125–146, <https://doi.org/10.18045/zbefri.2020.1.125>.
- Johnson, S., McMillan, J., Woodruff, C. (2002) "Property rights and finance", *American Economic Review*, Vol. 92, No. 5, pp. 1335–1356, <https://doi.org/10.1257/000282802762024539>.
- Johnson, W. (1978) *Muddling toward frugality*, San Francisco: Sierra Club.
- Jovanovic, B. (1979) "Job matching and the theory of turnover", *Journal of political economy*, Vol. 87, No. 5, Part 1, pp. 972–990, <https://doi.org/10.1086/260808>.
- Killingsworth, M. R. (1982) "Learning by doing" and "investment in training": A synthesis of two "rival" models of the life cycle", *The Review of Economic Studies*, Vol. 49, No. 2, pp. 263–271, <https://doi.org/10.2307/2297274>.
- Kim, J. O., & Mueller, C. W. (1978) *Factor analysis: Statistical methods and practical issues*, No. 14, Sage.
- Knight, F. H. (1921) *Risk, uncertainty and profit*, Boston, MA: Hart, Schaffner.
- Krueger, N. F., Carsrud, A. L. (1993) "Entrepreneurial intentions: Applying the theory of planned behavior", *Entrepreneurship & Regional Development*, Vol. 5, No. 4, pp. 315–330, <https://doi.org/10.1080/08985629300000020>.
- Krueger Jr, N. F., Reilly, M. D., & Carsrud, A. L. (2000) "Competing models of entrepreneurial intentions", *Journal of business venturing*, Vol. 15, No. 5-6, pp. 411–432, [https://doi.org/10.1016/S0883-9026\(98\)00033-0](https://doi.org/10.1016/S0883-9026(98)00033-0).
- Lazear, E. P. (2005) "Entrepreneurship", *Journal of Labor Economics*, Vol. 23, No. 4, pp. 649–680, <https://doi.org/10.1086/491605>.
- Lewis-Beck, M. S. (1980) *Applied Regression*, Beverly Hills.
- MacDonald, G. M. (1984) "New directions in the economic theory of agency", *Canadian Journal of Economics*, Vol. 17, No. 3, pp. 415–440, <https://doi.org/10.2307/135183>.
- Mazzarol, T., Volery, T., Doss, N., Thein, V. (1999) "Factors influencing small business start-ups: A comparison with previous research", *International Journal of Entrepreneurial Behavior & Research*, Vol. 5, No. 2, pp. 48–63, <https://doi.org/10.1108/13552559910274499>.
- McNamara, G., Aime, F., Vaaler, P. M. (2005) "Is performance driven by industry- or firm-specific factors? A response to Hawawini, Subramanian, and Verdin",

- Strategic Management Journal*, Vol. 26, No. 11, pp. 1075–1081, <https://doi.org/10.1002/smj.496>.
- Miller, L. M. (1984) *American spirit: Visions of a new corporate culture*, New York: W. Morrow.
- Nguyen, M., Phan, A. (2014) “Entrepreneurial Traits and Motivations of the Youth—an Empirical Study in Ho Chi Minh City-Vietnam”, *International Journal of Business and Social Science*, Vol. 5, No. 5(1), pp. 53–62.
- Pallant, J. (2007) *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*, Routledge.
- Rees, H., Shah, A. (1986) “An empirical analysis of self-employment in the UK”, *Journal of applied econometrics*, Vol. 1, No. 1, pp. 95–108, <https://doi.org/10.1002/jae.3950010107>.
- Rosenbusch, N., Rauch, A., Bausch, A. (2013) “The mediating role of entrepreneurial orientation in the task environment–performance relationship: A meta-analysis”, *Journal of Management*, Vol. 39, No. 3, pp. 633–659, <https://doi.org/10.1177/0149206311425612>.
- Salancik, G. R., Pfeffer, J. (1978) “A social information processing approach to job attitudes and task design”, *Administrative science quarterly*, Vol. 23, No. 2, pp. 224–253, <https://doi.org/10.2307/2392563>.
- Schein, E. H. (1987) “Individuals and careers”, *Handbook of Organizational Behavior*, Englewood Cliffs, NJ: Prentice-Hall.
- Schermerhorn Jr, J. R., Bachrach, D. G. (2017) *Exploring management*, John Wiley & Sons.
- Schumpeter, J.A. (1961) *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*.
- Shane, S., Venkataraman, S. (2000) “The promise of entrepreneurship as a field of research”, *Academy of management review*, Vol. 25, No. 1, pp. 217–226, <https://doi.org/10.5465/amr.2000.2791611>.
- Shapiro, A., Sokol, L. (1982) “The social dimensions of entrepreneurship”, *Encyclopedia of entrepreneurship*, Prentice-Hall, Englewood Cliffs, pp. 72–90.
- Short, J. C., et al. (2007) “Firm, strategic group, and industry influences on performance”, *Strategic management journal*, Vol. 28, No. 2, pp. 147–167, <https://doi.org/10.1002/smj.574>.
- Sobel, R. S., Clark, J. R., Lee, D. R. (2007) “Freedom, barriers to entry, entrepreneurship, and economic progress”, *The Review of Austrian Economics*, Vol. 20, No. 4, pp. 221–236, <https://doi.org/10.1007/s11138-007-0023-3>.
- Specht, P. H. (1993) “Munificence and carrying capacity of the environment and organization formation”, *Entrepreneurship Theory and Practice*, Vol. 17, No. 2, pp. 77–86, <https://doi.org/10.1177/104225879301700207>.

- Staw, B. M., Sz wajkowski, E. (1975) "The scarcity-munificence component of organizational environments and the commission of illegal acts", *Administrative Science Quarterly*, Vol. 20, No. 3, pp. 345–354, <https://doi.org/10.2307/2391995>.
- Storey, D. J. (1982) "Entrepreneurship and the New Firm Croom Helm", *Beckenham, Kent*.
- Storey, D. J. (2003) "Entrepreneurship, small and medium sized enterprises and public policies", *Handbook of entrepreneurship research*, pp. 473–511, Springer, Boston, MA.
- Sullivan, P. H. (2000) *Value driven intellectual capital: how to convert intangible corporate assets into market value*, John Wiley & Sons, Inc.
- Tabachnick, B. G., Fidell, L. S. (2001) "Principal components and factor analysis", *Using multivariate statistics*, Vol. 4, No. 1, pp. 582–633.
- Thompson, E.R. (2009) "Individual entrepreneurial intent: construct clarification and development of an internationally reliable metric", *Entrepreneurship Theory and Practice*, Vol. 33, No. 3, pp. 669–694, <https://doi.org/10.1111/j.1540-6520.2009.00321.x>.
- Turker, D., Selcuk, S. S. (2009) "Which factors affect entrepreneurial intention of university students?", *Journal of European industrial training*, Vol. 33, No. 2, pp. 142–159, <https://doi.org/10.1108/03090590910939049>.
- Venkataraman, S. (1997) "Value at risk for a mixture of normal distributions: the use of quasi-Bayesian estimation techniques", *Economic Perspectives-Federal Reserve Bank of Chicago*, No.21, pp. 2–13, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.28.2684&rep=rep1&type=pdf>.
- Whitley, R. (2003) "Changing transnational institutions and management of international business", *M.-L. Djelic & S. Quack (Eds) Globalization and institutions*, pp. 108–133, Cheltenham: Edward Elgar, https://ideas.repec.org/h/elg/eechap/2704_5.html.
- Wright, E. O., Perrone, L. (1977) "Marxist class categories and income inequality", *American sociological review*, Vol. 42, No. 1, pp. 32–55, <https://doi.org/10.2307/2117730>.
- Young, R. C., Francis, J. D. (1989) "Who helps small manufacturing firms get started?" *Rural development perspectives: RDP (USA)*, Vol. 6, No. 1, pp. 21–25.
- Zeithaml, C. P., Zeithaml, V. A. (1984) "Environmental management: revising the marketing perspective", *Journal of marketing*, Vol. 48, No. 2, pp. 46–53, <https://doi.org/10.1177/002224298404800204>.

Čimbenici koji utječu na stavove studenata o startupu: Studija slučaja na sveučilištima u Ho Chi Minh Cityju

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Sažetak

Ovaj rad nastao je kao odgovor na potrebu da se identificiraju čimbenici koji utječu na stavove studenata o pokretanju startupa u periodu od 2019. – 2020. godine, tijekom izbijanja bolesti COVID-19. Istraživanje je provedeno na uzorku od 2.141 studenta na dvanaest sveučilišta u Ho Chi Minh Cityju. Ovim istraživanjem otkriva se što potiče studente na proučavanje i oblikovanje start-up ideja za pokretanje novog posla. Pritom je utjecaj okoline od presudne važnosti za samopouzdanje studenata i njihov pozitivan stav prema poduzetništvu da bi potakli studentsku želju za realizaciju start-up poslovanja. Ovo je istraživanje pokazalo da kako opće i radno okruženje tako i pozitivni i negativni stavovi izravno i neizravno utječu na namjeru studenata za osnivanjem startup-tvrtki. Rezultati ukazuju na potrebu da vlada i sveučilišta posvete više pozornosti na čimbenike okruženja budući da izravno utječu na mogućnosti i pružanje potpore namjeri studenata za osnivanjem start-up biznisa.

Ključne riječi: poduzetništvo, startup namjere, radno okruženje, opće okruženje, stavovi

JEL klasifikacija: I2, I25, R11, R12

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Investors' herd behavior related to the pandemic-risk reflected on the GCC stock markets*

Marwan Mohamed Abdeldayem¹, Saeed Hameed Al Dulaimi²

Abstract

The purpose of this study is to examine the causal association between expectations of pandemic risk and herding behavior. The study was undertaken in two stages. First, it was felt necessary to obtain a broad overview of the effect of the pandemic related risk of COVID-19 on investors' herding in the GCC. This was achieved by analyzing secondary data (i.e. daily historic prices on five GCC country market indices). In analyzing the secondary data, the study follows Christie and Huang (1995) and employs the cross-sectional standard deviation (CSSD) of returns to detect investors' herding behavior. Second, in an attempt to obtain a more precise understanding of the impact of pandemic related risk, a questionnaire survey was distributed and collected from 318 investors from the GCC stock markets. A confirmatory factor analysis (CFA) was also used as the primary analysis between the two variables: i.e. expectations of pandemic risk and herding behavior. The findings reveal that expectations of pandemic risk have a significant positive impact on the herding behavior in the GCC stock markets during the coronavirus crisis in the first quarter of 2020. Finally, the results of this study are robust to a range of model specifications.

Key words: COVID-19, GCC Stock Markets, Investor Herding, Pandemic-Risk, Cross-Sectional Standard Deviation (CSSD), Confirmatory Factor Analysis (CFA)

JEL classification: G11, G15, G18, I18

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1. Introduction

Herding impact is obvious when individuals do what others are doing as opposed to utilizing their data or settling on autonomous choices. Herding has a long history in principle and gathering mind science. It is particularly appropriate in the region of reserve, where it has been discussed equivalent to the total unreasonableness of money related experts, including protections trade bubbles (Banerjee, 1992). In different territories of dynamic, for example, governmental issues, science, and mainstream society, crowd conduct is in some cases alluded to as 'data falls' (Bikhchandi et al., 1992). Herding behavior can be expanded by different variables, for example, dread (for example Economou et al., 2018), vulnerability (for example Lin, 2018), or a mutual character of leaders (for example Berger et al., 2018).

The coronavirus emergency has uncovered buyer conduct at its generally extraordinary, as lack fears have brought about individuals storing tissue and food. Nevertheless, among investors, we see the inverse to accumulating. There has been far-reaching dumping of risked resources and a trip to quality in resources like gold and government securities, trailed by times of sharp market rises. In any case, the COVID 19 impact is comparative. Pictures of uncovered store racks feed more frenzy purchasing among customers, while steep decreases in advertising lists and the apparition of circuit breakers being activated – which happened a few times in March 2020—sparkle further selling.

The purpose of this study is to examine the causal association between expectations of pandemic risk and herding behavior in the GCC stock markets. The main question of this research effort is: "would we be able to assume that investor behavior is correspondingly unreasonable?" In this study, The general hypothesis can be stated in the null form as follows: "Pandemic-Risk Related has no statistically significant impact on Investors Herding Behavior in the GCC Stock Markets"

This study will make a valuable and important contribution to the literature at both the theoretical and practical levels. At the theoretical level, the results of this research will provide empirically based information on the impact of pandemic risk related on investors' herding behavior in the GCC stock markets. This study also contributes to the larger area of economic and behavioral finance theories by highlighting the effect of pandemic risk related on investors' herding behavior in the GCC stock markets. At a practical level, this research may also contribute to Gulf policy makers' evaluation of the effectiveness of the stock markets, as well as contributing to the improvement of management and corporate governance practices. After all, the results of this study will have implications for improvements in practices of economic and finance and may be used as a guide towards advancing the management and performance of the GCC stock markets.

Furthermore, the findings of this study will have a clear economic significance as these results would contribute to advance the accumulated international literature

of the herding phenomenon in developing countries in general, and the GCC in particular. Our study has significant commonsense ramifications for investors, strategy producers, budgetary controllers, just as organizations. It ought to be noticed that, during the financial crisis, objective valuation happens to principal significance for organizations, which try to source value capital. Our study additionally will add to the continuous open discussion, which spins around the compromise between general wellbeing also, the economy.

The rest of this paper is organized as follows: Literature review is presented in section 2. Section 3 introduces the methodology. Discussion and results of statistical analysis are explained in section 4, while conclusions are in section 5.

2. Literature review

While the coronavirus pandemic is unsettling, we have survived some wild occasions in the course of recent decades, including multiple sickness flare-ups (SARS in 2002-2003, avian influenza in 2006, Swine influenza in 2009, Ebola in 2014, Zika in 2016, among a few others) such as: the Black Monday financial exchange crash in 1987; the blasting of the tech-stock air pocket in 2000; September 11, 2001 fear monger assaults; the 2008-2009 worldwide financial crisis and Great Recession; the 2016 Brexit vote; and the U.S. – China exchange war. Every one of these occasions activated extreme market stuns that went on for a considerable length of time or years. However, during this time from 1980 to 2019, the S&P 500 record has posted a normal yearly return of 11.8%. The worldwide markets likewise showed their flexibility during that time, with the MSCI World list posting an 8% normal yearly return and the MSCI Emerging Markets list posting a 10.7% normal yearly return (Abdeldayem and Aldulaimi, 2020).

History has demonstrated the benefit of staying contributed during earlier scenes of market unrest. The COVID-19 pandemic presents an incredibly troublesome transient emergency, however almost all drawn out investors will have a venture skyline past this pandemic. Concentrating on that skyline, will assist financial specialists with utilizing risk models better; and will eventually assist them with performing better as well. Markets in chaos are the place long haul financial specialists bring in their cash. Contributing counter consistently, when numerous others without long haul liquidity are selling, is a reasonable preferred position for long haul financial specialists. Financial specialists that play out the best over the drawn-out will have faced determined and intentional challenges and set cash to work during emergencies like this one. During circumstances such as the present, a drawn-out investor will comprehend that the world has moved outside of likelihood and that human conduct will influence both the reaction to the pandemic and the risk and return that monetary markets produce. Long haul investors perceive that

this emergency presents an administration chance to add to results that would satisfy their associations' motivations.

For the most part, financial specialists bought out-of-the-cash alternatives to support against surprising business sector moves (this is the point at which the hidden resource's cost is underneath the strike cost). In any case, as the market fell strongly huge numbers of these alternatives became at-the-cash (ATM) choices – as such, the ones with the most noteworthy gamma (which means the cost of the choice is the most receptive to changes in the cost of the hidden resource). Regardless of whether investors decided to clutch ATM choices or expected to get them to consider the risk of their portfolios, the cost of alternatives comparative with their strike cost demonstrated that financial specialist interest for ATM choices was higher than expected – something that brought about a supercharged market. The higher the volume of choices extraordinary, the higher the measure of delta supporting required by the choice vender. At the end of the day, whatever heading the market takes on some random day, its developments are probably going to be raised by the delta supporting of alternatives dealers. This elevated transient energy is to some extent liable for the size of the day-by-day swings we have seen. In the result of steep market falls, the cost of choices, like any protection after an occasion, has expanded pointedly, which should quiet their enhancing impact going ahead (see Abdeldayem and Sadeek, 2018; Abdeldayem and El-Sherbiney, 2018; Shaker and Abdeldayem, 2018).

To start with, the exploration that inspects the impacts of pandemic emergencies on monetary resource valuations has been an early stage (Baker et al., 2020). Two prominent special cases are (i) Donadelli et al. (2017), who study if the financial specialist state of mind, driven by news on internationally risky maladies (for example SARS, Influenza A (H1N1), Polio and Ebola) is evaluated in 2 pharmaceutical stocks in the US and (ii) Ichev and Marinc (2018), who report that the Ebola episode occasions were trailed by raised apparent risk in the US monetary markets. According to the COVID-19, just barely as of late, Onali (2020) looks at the COVID-19 cases and passing on the US securities exchange and finds that there is no effect on the US financial exchange returns. Baker et al. (2020) and that the instability connection between the Chinese securities exchanges and cryptographic forms of money advanced essentially during the pandemic. In a comparable Salisu et al. (2020) recommend that COVID-19 does not enhance crowding in digital currency markets. Uddin et al. (2020) inspect the associated elements of Asian monetary markets and find solid, positive reliance among the explored showcases because of the flare-up of COVID-19. Such uncommon occasions give an unedited chance to find out about investor behavior. Along these lines, our exploration intends to this void by considering 5 Gulf financial exchanges during the COVID-19 pandemic. In particular, we ask whether the ongoing far-reaching securities exchange breakdown is related to the nearness of herding behavior in Gulf financial exchanges.

Second, in contrast to past examinations on herding behavior in universal financial exchanges (e.g., Chiang and Zheng, 2010; Gebka and Wohar, 2013; Lin, 2018; Chen et al., 2019; Yarovaya et al., 2020), this investigation gauges the conceivable effect of pandemic-related risk (COVID-19 pandemic) on herding behavior in the GCC securities exchanges.

3. Methodology

At the point when investors are completely sound, CAPM expects a direct connection between the rates of return of securities. Such market risk of securities probably won't be the suitable answer for achieve market balance or equilibrium. In any case, CAPM, as proposed by financial specialists, for example, Treynor (1961), Sharpe (1964) Lintner (1965) and Mossin (1966), has bombed various exact tests as investors in the market frequently show herding behavior with the end goal that individual stock returns veer off altogether from market returns. In this part, we present the most widely recognized proportion of profits scattering, specifically the Cross-Section Standard Deviation (CSSD), and present the exact model to be utilized in testing for herding behavior in the GCC stock markets.

The goal of this study is to explore the impact of the pandemic related danger of COVID-19 on financial investors' herding in the Gulf Cooperation Council (GCC) securities exchanges. To this end, we center around five financial exchange files from the GCC (see Table 1 below). Day by day memorable costs on five GCC nation advertise records were made accessible by Reuters Middle East, Shuaa Capital in UAE, and from some online sources, for example, Bayan speculation organization: <http://www.bayaninvest.com> and MENAFN.COM: <http://www.MENAFN.com>. The information extend is from 1 January 2020, when the COVID-19 pandemic began spreading far and wide, to 31 March 2020 for the securities exchanges of Bahrain (BAX), Kuwait (KWSE), Oman (MSM30), Saudi Arabia (TASI), and the United Arab Emirates (ADX and DFMG).

Table 1: GCC Stock Market Indices

Gulf Country	Index	Description
Bahrain	BAX	It includes 39 listed stocks
Saudi Arabia	TASI	It includes 168 listed stocks
UAE	DFMGI	It includes 33 listed stocks
	ADX	It includes 41 listed stocks
Kuwait	KWSE	It includes 187 listed stocks
Oman	MSM30	It has the most liquid 30 stocks in the market

Source: prepared by authors

3.1 Measuring Herding Behavior

To measure investor herding, we follow Christie and Huang (1995), who recommend the utilization of cross-sectional standard deviation (CSSD) of profits to distinguish investors' herding behavior in a global market setting. In particular, CSSD_{i,t} for the nation I on day t is characterized as:

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^N (R_{i,t} - R_{m,t})^2}{N-1}}$$

Where $R_{i,t}$ is the arrival in the nation I on day t and $R_{m,t}$ is the GCC advertise return, which is determined as the cross-sectional worth weighted normal come back from the 5 Gulf nations. $CSSD_{i,t}$ is a unique proportion of herding behavior in the nation I, which is determined as a 20-day ($N=20$) moving window standard deviation of nation's I come back from the Gulf showcase return m on day t. Within the sight of herding behavior, during huge swings in stock costs and returns, the nation's I return should go astray 'less' from the worldwide market return than during less unstable periods. As such, 'little' $CSSD_{i,t}$ values signal more grounded proof of crowding conduct, though 'enormous' values signal more fragile proof.

In addition, the instrument used to collect the primary data is an online questionnaire survey. The questionnaire is consisting of 14 items to assess the two subscales (6 items to measure expectations of pandemic risk and 8 items to measure herding behavior). Further, there are 5 items to measure the demographic variables of the participants. The participants received an electronic version of the questionnaire using the google doc. online format. Several emails were sent to participants including the invitation to participate along with a link of the web page to guide them to the questionnaire survey.

Since all individual investors in the GCC Stock markets have been remembered for the second phase of the study embraced through an online questionnaire survey, completed by utilizing the convenience sampling strategy, comprising of 420 respondents in the sample. The 6-points Likert scale was employed. The surveys were disseminated on the web, with explicit purposes, through directors of financier firms of five GCC Stock Exchanges being considered capable to send arbitrarily to investors (respondents). The time limitations constrained us to choose just individual financial specialists in the study. Out of 420 questionnaires circulated to the respondents, just 318 surveys were discovered to be substantial, being finished in each regard were gotten back for breaking down of the study. This result in a response rate of 75.7 % which found to be acceptable for this research effort

By utilizing Cronbach's Alpha scale, the substantial questionnaires were introduced for appropriate reliability tests. At the point when combined construct validity

coefficient is applied, at that point Cronbach's Alpha must surpass 0.7. At exactly that point the scale is without a doubt viewed as valid, right and dependable (Arteaga-Ortiz and Fernández-Ortiz, 2010). As per our test outcomes, generally Cronbach's alpha remained at 0.832, while independently, it indicated figures as 0.711, and 0.750 for the two factors to be specific, expectations of pandemic risk and herding behavior. Cronbach's alpha shows that these elements are solid, since its subsequent figure ($\alpha = 0.863$) surpasses the base degree of adequacy. There is additionally an unmistakable sign that mean and standard deviations of the apparent multitude of four variables, which impact the behavior of investors in the GCC Stock Exchanges. The effect of different degrees of behavioral variables in venture choices are assessed by the basic figuring of mean estimation of every determinant. Since we have utilized the 6-direct scales toward figure and measure their effect levels, the estimations of mean are chosen in like manner, based on the accompanying existing standards (Rodriguez et al., 2014).

- Mean qualities under 2 shows that factors have low effects
- Mean qualities between 2 to 3 shows that the factors have low effects
- Mean qualities between 3 to 4 shows that the factors have moderate effects
- Mean qualities between 4 to 5 shows that the factors have high effects, and
- Mean qualities in excess of 5 shows that the factors have high effects.

4. Empirical data and analysis

Previous research in this area revealed that investors' herding behavior may vary with the level of economic development of countries (see Avery and Zemsky, 1998; Gill et al., 2018; Kizys et al., 2020). Therefore, the investors' herding behavior paradigm of developed countries does not appropriately reflect the problems of developing countries and thus cannot be applied to developing countries. Unlike investors' behavior in developed countries, investors' herding behavior in developing countries is usually prescribed by the International Donor agencies such as the World Bank and the International Monetary Fund (IMF), as a prerequisite for development and for obtaining structural adjustment consultancy and loans. Thus, these facts make research into the investors' behavior experience in the GCC the more interesting to evaluate.

Table 2 reports elucidating insights into the factors utilized. CSSD shows that an arrival on the financial exchange record of the nation I go astray on normal from the GCC showcase return by 0.6232%. The standard deviation of CSSD is 0.2077%. The GCC Index takes on values from 0 to 100. It midpoints 11.6921index focuses and goes amiss from the mean on normal by 14.6152 file focuses. We additionally note that both Ri and Rm highlight negative normal qualities, - 0.2926% and -

0.2956%, individually, which delineates the emergency of value estimation of organizations over the globe. Estimations of R_i and R_m veer off from the GCC advertise return on normal by 1.6204% and 0.9398%, separately. Thinking about individual Gulf nations. Since, 'little' $CSSD_i$ values signal more grounded proof of herding behavior, and 'huge' values signal more vulnerable proof, these outcomes demonstrate that there is a proof of investors' herding behavior in the GCC securities exchanges during the coronavirus emergency in the first quarter of 2020. This finding concurs with past research, for example, Miller (1977), Avery and Zemsky (1998), Gill et al., (2018); Kizys et al., (2020).

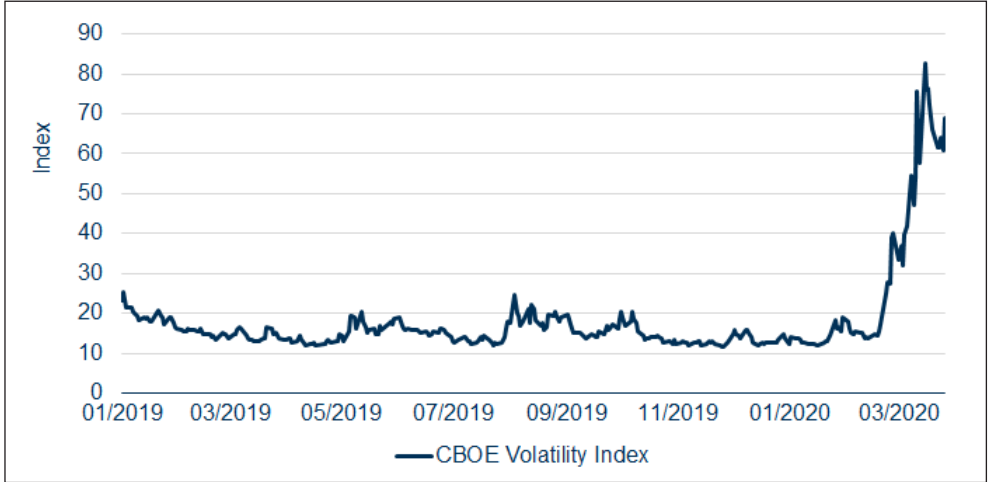
Table 2: Descriptive Statistics

Variable	Observation	Mean	Std. Dev.	Minimum	Maximum
CSSD	2,493	0.6232	0.2077	0.1038	4.1557
GCC index	1,670	11.6921	14.6152	0	100
R_i	2,368	-0.2926	1.6204	-10.6561	8.2885
R_m	2,420	-0.2956	0.9398	-4.2352	1.8150

Source: prepared by authors

In this regard, Abdeldayem et al. (2020) argue that during the COVID 19 pandemic time, volatility has dialed down to some degree in the course of the most recent seven day stretch of March 2020. Figure 1 shows that volatility has increased significantly in March 2020. This could be because of market weakness or ebbing vulnerability as the new reality becomes standardized and most pessimistic scenario situations are evaluated in. As indicated by specialists who are following how responsive market risk is to reports of new coronavirus cases, the flexibility of instability will in general die down in light of infection news or on the other hand, maybe, the mix of the expanded gravity of the infection and the "no restrictions" responsibility of specialists to relieving the monetary impact is having a nonpartisan mental effect.

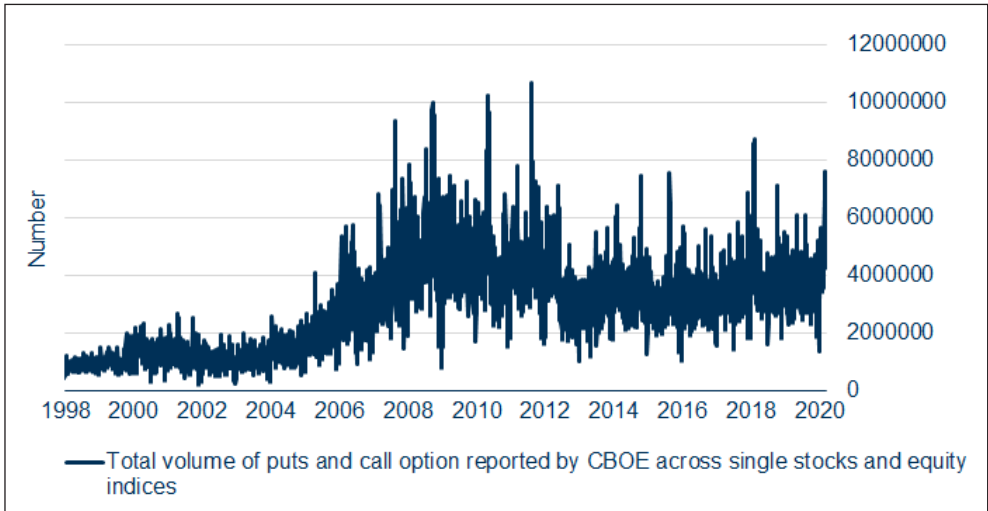
Figure 1: Volatility has Subsided in March 2020



Source: Bloomberg, as at March 2020.

Another explanation behind the sharp beginning swings could be the significant increment in alternatives being used before the COVID 19 pandemic as illustrated in figure 2 below. In February 2020, investors utilized more alternatives either to support their portfolios or addition convexity.

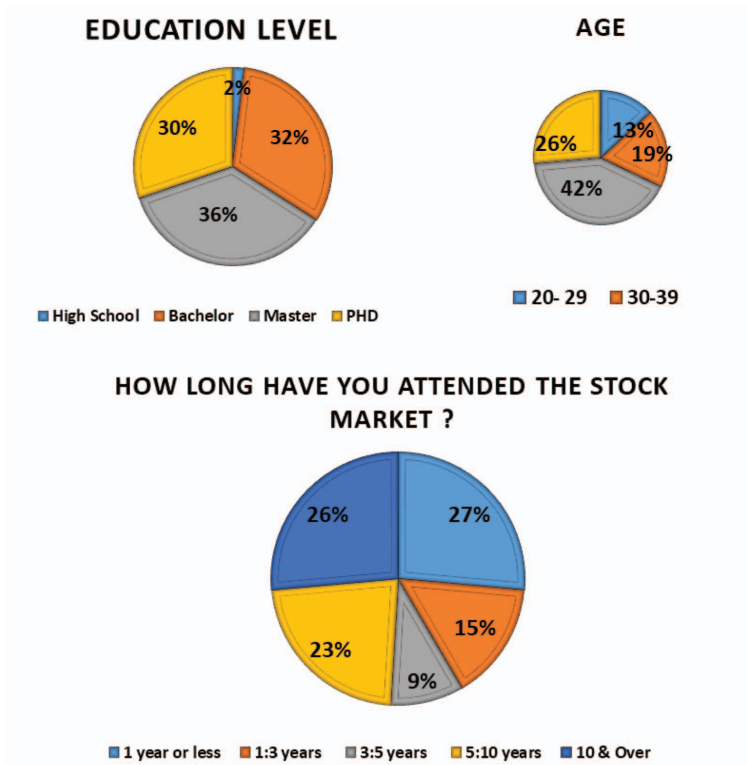
Figure 2: The Volume of Options in Use Soars



Source: Wei et al., 2020

As far as the primary data is concerned, a questionnaire survey was distributed and collected from 318 investors from the GCC stock markets (Bahrain, Kuwait, Saudi Arabia, UAE, and Oman). The demographics of the 318 investors who participated in this research effort are shown in figure 3 below. Figure 3 shows that 68% of participants are females (216) and 32% males (102)). 67% of the respondents (213) are highly qualified (having a Master or PhD). 26.4% (84) have attended the stock markets for 10 years or more and 41.5% (132) are with an average age of 45 ± 5 .

Figure 3: Demographic Variables of Respondents



Source: prepared by authors

In addition, a confirmatory factor analysis (CFA) has been considered as a proper method for estimating to assessing the two variables: i.e. expectations of pandemic risk and herding behavior utilizing AMOS 25 software. “The going with six fundamental measures were used to assess the model’s general respectability of fit: Chi-Square/Degree of Freedom extent, Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMSR)” (Kline, 2010; Hair et al., 2010: 19). Moreover, the study utilized structural equation

modeling (SEM) for the factual examination of information gathered to look at collaborations between the two subscales: SEM result presents the way examination of the guessed model of desires for pandemic risk and herding behavior.

The first step of analysis is the reliability test of items which was conducted using Cronbach's alpha Coefficient for every construct and it should be equal to or higher than 0.6 (Nunally,1994). Table 3 shows the value of Cronbach's alpha of every construct. It can be seen from this table that all values of Cronbach's alpha are acceptable indicating a high-reliability level to all constructs ($\alpha > 0.80$).

Table 3: Results of Reliability Test: Cronbach Alpha (N=318)

Scale items Statistics n=318	M	Std. Dev.	Cronbach Alpha
"I think that the spread of COVID 19 directly affects stock prices in stock market".	4.30	.861	.892
"I think it is not the right time to invest in stocks when COVID 19 in the country is dominating life"	3.90	1.138	.894
"COVID 19 which affecting international financial market will also affect local share prices".	4.26	.781	.893
"I think that the future return on the stock, from a company with strong performance during the COVID 19 pandemic, is likely to be higher".	3.60	1.089	.893
"I think that the future return on the stock, from a company with weak performance during the COVID 19 pandemic, is likely to be lower".	3.62	1.069	.882
"I think that there is a high probability of investment loss during the COVID 19 pandemic"	4.00	.972	.887
"Other investors' decisions of choosing stock types have impact on my investment decisions".	3.92	.774	.883
"Other investors' decisions of the stock volume have impact on my investment decisions".	3.84	.899	.883
"Other investors' decisions of buying and selling stocks have impact on my investment decisions".	3.75	.868	.886
"I usually react quickly to the changes of other investors' decisions and follow their reactions to the stock market".	3.62	.996	.884
"I feel myself NOT qualified enough to make investment decisions alone".	3.69	1.003	.887
"I feel others can predict future share prices better than me"	3.49	1.094	.889
"I feel uncertain m my ability to do better than others in picking stocks do".	3.56	.963	.889
"I feel always afraid that my investment will pay lower dividends as compared to others' investment".	3.60	.998	.879

Source: prepared by authors

4.1. Employing the SEM Model

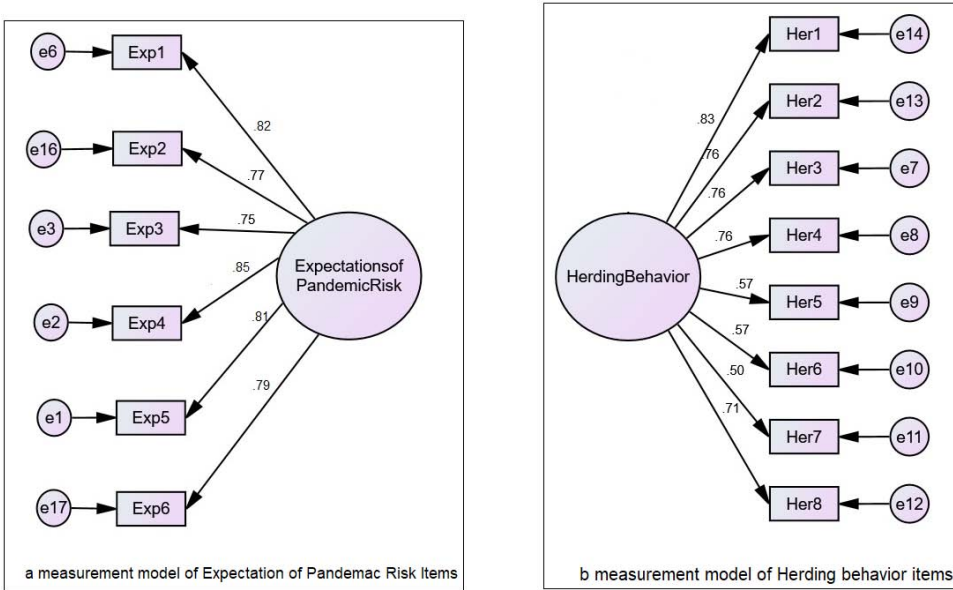
Structural Equation Modeling (SEM) is composed of the measurement model and the structural model.

4.1.1. Measurement Model

The objective of the measurement model is to describe how the indicators have seen work as a tool for measuring underlying variables, and the emphasis analysis is used to estimate the adequacy of the measurement model for each structure, and the efficiency and indicator (square-Chi) is determined to align the model from the defect of several indicators for good conformity. A confirmatory factor analysis was conducted using AMOS 25 software to validate the instruments.

In terms of the validity test, this study uses the factor loading and it must be equal to or higher than 0.5 (Argyris and Schön 1997). The evidence of confirmative factor analysis CFA contains two types: convergence and covariance. The results of the measurement model are shown in figure 4 below. We simply notice the ideal factor loading of the items. Referring to figure 5 design (a) represents the measurement model of expectations of pandemic risk, while the design (b) represents the herding behavior. All items are valid as the results of the factor loading is equal to/ or higher than 0.5.

Figure 4: Primary and Modified Measurement Model of the Two Main Variables



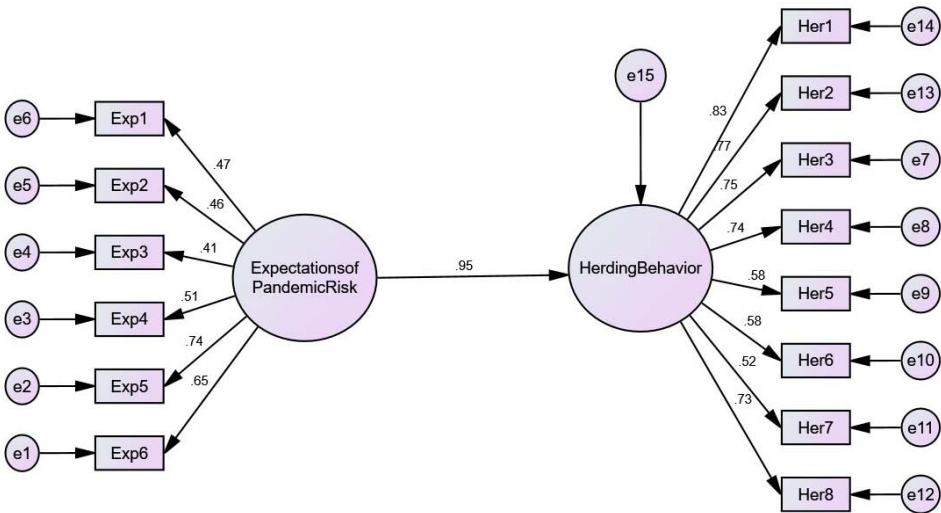
Source: computed data prepared by authors by using AMOS software

Measurement models in figure (4) are created and tested using confirmatory factor analysis (CFA) to evaluate the constructs validity of exogenous variables (Six dimensions of Expectations of Pandamic Risk), and endogenous variables (eight dimensions of Herding Behavior). The results shows high model Fit (Chi-Square: 2560,607 with degree of freedom=512; GFI = .906; CFI=921). All items factor loading are above the accepted level 0.5 therefore according to Kline (2010, 139) all items are valid.

4.1.2. Structural Model

Structural modeling is applied next to identify the hypothesized connection among research constructs (exogenous or endogenous), which is linked to the assumed model's concept. The main hypothesis is tested to examine whether the expectations of pandemic risk is affecting herding behavior. This relation of exhibits perfect model fit to the given data ([NFI] = 0.935, [CFI] = 0.926, [TLI] = 0.915, [IFI] = 0.906, [GFI] = 0.889, and [RMSEA] = 0.085). As presented in Figure 5, expectations of pandemic risk have a significant positive impact on herding behavior ($\beta = 0.95$; p-value < 0.001). Several modifications have been suggested by the AMOS software to improve the model fit.

Figure 5: A Primary Structural Model



Source: computed data prepared by authors by using AMOS software

To test hypothesis, the sturctural model created and the results of the path analysis of the influence of expectations pandamic risk on herding behavior as shown in Figure 5. At the first attempt in running the model, it seems that the model wasn't fit. Therefore, we remove all items have factor loading below 0.5.

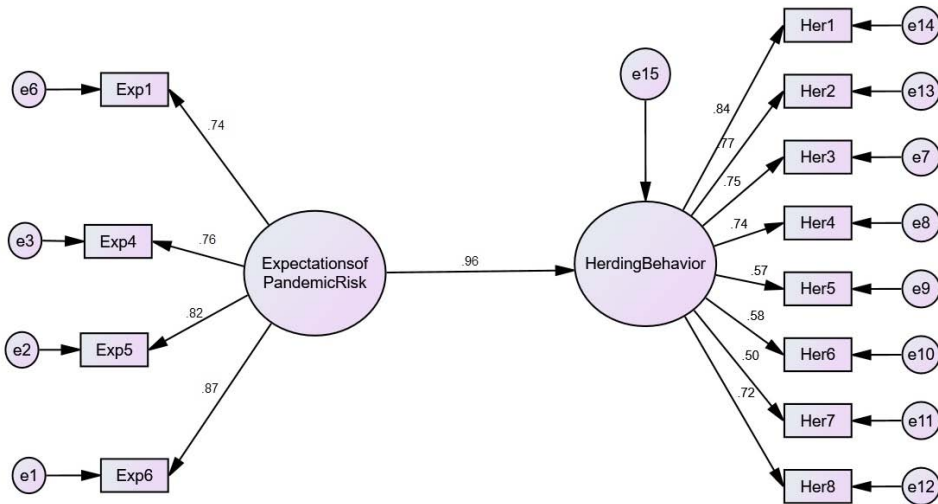
Table 4: Model Fitting Analysis and Modified Measurement Model of Herding Behavior and Expectations of Pandemic Risk

Fit Index	Primary Model	Critical (Acceptable) Value	Modified Model
“Normed fit index” (NFI)	0.935	>/=0.9	0.987
“Comparative fit index” (CFI)	0.926	>/=0.9	0.989
“Tucker Lewis index” (TLI)	0.915	>/=0.9	0.978
“Incremental fit index” (IFI)	0.906	>/=0.9	0.965
“Goodness of fit index” (GFI)	0.889	>/=0.9	0.954
“Root means square error of approximation” (RMSEA)	0.085	<0.08	0.065

Source: computed data prepared by authors by using AMOS software

To improve the model fit, two items was removed. Table 4 illustrqate the model fit measure score high in values of (CFI, GFI,NLI) and low in RMSEA. Which indicate the model become fit and all results are accepted.

Figure 6: Modified Structural Model



Source: computed data prepared by authors by using AMOS software

The objective of the structural model analysis is to test path analysis using SEM because it is a powerful analytical tool that is well-suited to the evaluation of complex models as well as the significance testing of hypotheses (Kline, 2010). The path analysis result shown in figure 6 indicate that there great and significant influence of expectations pandemic risk on herding behavior (0.96).

5. Results and discussion

After data collection and analysis of both secondary data and primary data, the researchers reject the null hypothesis and accept the alternative hypothesis that “Pandemic-Risk Related has a statistically significant impact on Investors Herding Behavior in the GCC Stock Markets”. The secondary data analysis using cross-sectional standard deviation (CSSD) demonstrates that there is a proof of investors herding behavior in the GCC securities exchanges during the coronavirus emergency in the first quarter of 2020. This finding concurs with past research, for example, Miller (1977), Avery and Zemsky (1998), Gill et al. (2018) and Kizys et al. (2020). In addition, the primary data analysis (i.e. the views of 318 investors from the GCC stock markets) offers a further investigation for an assessment of the impact of the pandemic related risk of COVID-19 on investors' herding in the GCC stock markets. A confirmatory factor analysis (CFA) was used as the primary analysis between the two variables: i.e. expectations of pandemic risk and herding behavior. Further, structural modeling is applied next to identify the hypothesized connection among research constructs (exogenous or endogenous), which is linked to the assumed model's concept. The main hypothesis is tested to examine whether the expectations of pandemic risk is affecting herding behavior. The results revealed that there is a statistically significant impact of the pandemic-risk related on investors herding behavior in the GCC stock markets.

This study will make a valuable and important contribution to the literature at both the theoretical and practical levels. At the theoretical level, the results of this research will provide empirically based information on the impact of pandemic risk related on investors' herding behavior in the GCC stock markets. This study also contributes to the larger area of economic and behavioral finance theories by highlighting the effect of pandemic risk related on investors' herding behavior in the GCC stock markets. At a practical level, this research may also contribute to Gulf policy makers' evaluation of the effectiveness of the stock markets, as well as contributing to the improvement of management and corporate governance practices. After all, the results revealed from this study may have implications for improvements in practices of economic and finance and may be used as a guide towards advancing the management and performance of the GCC stock markets.

Furthermore, the findings of this study have a clear economic significance as these results contribute to advance the accumulated international literature of the herding phenomenon in developing countries in general, and the GCC in particular. our study has significant commonsense ramifications for investors, strategy producers, budgetary controllers, just as organizations. It ought to be noticed that, during the financial crisis, objective valuation happens to principal significance for organizations, which try to source value capital. Our study additionally adds to the continuous open discussion, which spins around the compromise between general wellbeing also, the economy. Our findings show that the legislature and

administrative restrictions forced to control the transmission of COVID-19 inside and across nations can lighten the nearness of financial specialist herding behavior in the GCC stock markets.

The secondary data provided in this study, which relied on daily historic prices on five GCC country market indices i.e. Bahrain (BAX), Kuwait (KWSE), Oman (MSM30), Saudi Arabia (TASI), and the United Arab Emirates (ADX & DFMG), proved very helpful and informative. CSSD shows that an arrival on the financial exchange record of nation I goes astray on normal from the GCC showcase return by 0.6232%. The standard deviation of CSSD is 0.2077%. The GCC Index takes on values from 0 to 100. It midpoints 11.6921 index focuses, and goes amiss from the mean on normal by 14.6152 file focuses. We additionally note that both R_i and R_m highlight negative normal qualities, - 0.2926% and - 0.2956%, individually, which delineates the emergency of value estimation of organizations over the globe. Estimations of R_i and R_m veer off from the GCC advertise return on normal by 1.6204% and 0.9398%, separately. Thinking about individual Gulf nations. Since, 'little' CSSD_{i,t} values signal more grounded proof of grouping conduct, and 'huge' values signal more vulnerable proof, these outcomes demonstrate that there is a proof of financial specialist herding behavior in the GCC securities exchanges during the coronavirus emergency in the primary quarter of 2020. This finding concurs with past research, for example, Miller (1977), Avery and Zemsky (1998), Gill et al. (2018) and Kizys et al. (2020).

6. Conclusion

The purpose of this study is to examine the causal association between expectations of pandemic risk and herding behavior. This study, therefore, seeks to add to our knowledge of the herding phenomenon in developing countries in general, and the GCC in particular. The study was undertaken in two stages. First, it was felt necessary to obtain a broad overview of the effect of the pandemic related risk of COVID-19 on investors' herding in the GCC. This was achieved by analyzing secondary data (i.e. daily historic prices on five GCC country market indices). In analyzing the secondary data, the study follows the cross-sectional standard deviation (CSSD) of returns to detect investors' herding behavior. Second, in an attempt to obtain a more precise understanding of the impact of pandemic related risk, a questionnaire survey was distributed to the GCC stock markets.

To conclude, contributing is not generally agreeable. In any case, it is critical to recollect that, without risk, there are no profits. In this condition, on the off chance that we move our cash into money, we are probably going to pass up the best gains in the market, making it considerably harder to recuperate our misfortunes. Presently like never before, it is fundamental for all investors to follow the essential

precepts of contributing: i.e. to remain diversified, remain focused, and remain calm especially in the time of crisis.

The first limitation is the use of secondary data to obtain a broad overview on the effect of the pandemic risk related on investors' herding behavior in the GCC stock markets. An inherent disadvantage of secondary data in general is that it is not designed specifically to meet the study's needs; secondary data should apply to the population of interest, the time period must be consistent with the researcher's needs and secondary data must appear in the correct units of measurement. Therefore, despite a great deal of attention being paid to overcome these disadvantages, a caveat should be given in generalizing the results of the secondary data analysis.

Another limitation of this study is the methodology employed in analysing the secondary data (i.e. the cross-sectional standard deviation (CSSD) of profits to distinguish investors' herding behavior in the GCC stock markets between 1st January and 31st March 2020) which affected the number of observations included in this stage of the study. This also could probably affect generalizability. However, it is hoped that the representativeness of the sample and the concentration of this study only on those really important period of the COVID 19 pandemic would suffice.

A further limitation is that the study considered the views of limited number of people from the GCC stock markets in the second stage of this research (i.e. in the online questionnaire survey).. However, due to severe access problems as well as the time scale to which the researchers was working, this proved not to be possible. It was only due to the intervention and effort by other investors that eventual access was realized. In spite of the above limitations, this study has shown that several future research could be undertaken such as:

Before identifying directions for future research as indicated by this study, it is crucial to address the urgent need to establish an advanced database for the stock markets in the GCC, which would be useful for both researchers and policy makers. Such data should be maintained via databases to enable researchers to more adequately assess stock markets' performance. Hence, the availability of data would encourage future research and this would also allow the governments to see how things went and facilitate the tasks of decision-makers.

A useful starting point for future research would be to incorporate the perceptions and experiences of other investors of the impact of of the pandemic risk related on investors' herding behavior in the GCC stock markets. This could be undertaken by distributing the questionnaire utilized in this study to a much larger sample of investors and specialists. A greater understanding could then be obtained of these accumulated experiences. Face to face interviews might also be undertaken with officials holding strategic posts in many of the stock markets. This should lead to

a broader understanding of the impact of the pandemic risk related on investors' herding behavior in the GCC stock markets. A study of this nature should perhaps be undertaken in collaboration with the World Bank or IMF, as this would have the benefit of making the study official as well as making access to stock markets much more easier.

A comparative research that covers the impact of pandemic risk related on investors' herding behavior in different developing countries is needed. In particular, in the Middle East region and North Africa, as this part of the world seems to be much neglected in terms of research. These countries have also embarked on the road of COVID 19 pandemic dilemma and a study, which compares this, would be extremely useful and would shed important light on the impact of pandemic risk related on their stock markets behaviors.

References

- Abdeldayem, M. M., Sedeeq, D. S. (2018) 'Managerial Behavior and Capital Structure Decisions; Do Overconfidence, Optimism and Risk Aversion Matter?'. *Asian Economic and Financial Review*, Vol. 8, No. 7, pp. 925–945, <https://doi.org/10.18488/journal.aefr.2018.87.925.945>.
- Abdeldayem, M. M., El-Sherbiney, R. A. (2018) 'A comparative study of the financial performance of the three banking modes in Egypt: Islamic, conventional and mixed banks', *Archives of Business Research*, Vol. 6, No. 5, pp. 286–308, <https://doi.org/10.14738/abr.65.4555>.
- ABDELDAYEM, M. M., AL DULAIMI, S. H., NEKHILI, R. (2020) 'Cryptocurrency as a Fin Tech Instrument and Islamic Finance: The GCC Perspective'. *Journal of Xi'an University of Architecture & Technology*, Vol. 12, No. 5, pp. 2736–2747.
- Abdeldayem, M. M., Aldulaimi, S. H. (2020) 'Cryptocurrency In The GCC Economy'; *International Journal of Scientific and Technology Research*, Vol. 9, No. 2, pp. 1739–1755.
- Abdeldayem, M. M., Al Dulaimi, S. H. (2019) 'Trends of Global Fintech Education Practices and the GCC Perspective', *International Journal of Advanced Science and Technology*, Vol. 29, No. 3, pp. 7150–7163.
- Abdeldayem, M. M., Al Dulaimi, S. H. (2020) 'Cryptocurrency in the Time of Coronavirus', *Strad Research*, Vol. 7, No. 8, pp. 729–744, <https://doi.org/10.37896/sr7.8/073>.
- Aldulaimi, S. H., Sailan, M. S. (2012) 'The national values impact on organizational change in public organizations in Qatar'. *International Journal of Business and Management*, Vol. 7, No. 1, p.182, <https://doi.org/10.5539/ijbm.v7n1p182>.

- Argyris, C., Schön, D. A. (1997) 'Organizational learning: A theory of action perspective', *Reis*, No. 77/78, pp. 345–348, <https://doi.org/10.2307/40183951>.
- Arteaga-Ortiz, J., Fernández-Ortiz, R. (2010) 'Why don't we use the same export barrier measurement scale? An empirical analysis in small and medium-sized enterprises', *Journal of Small Business Management*, Vol. 48, No. 3, pp. 395–420, <https://doi.org/10.1111/j.1540-627X.2010.00300.x>.
- Avery, C., Zemsky, P. (1998) 'Multidimensional uncertainty and herd behavior in financial markets', *American economic review*, pp. 724–748.
- Baker, S. R. et al. (2020) 'The unprecedented stock market impact of COVID-19', *National Bureau of Economic Research*, No. w26945, <https://doi.org/10.3386/w26945>.
- Banerjee, A. V. (1992) 'A simple model of herd behavior', *The quarterly journal of economics*, Vol. 107, No. 3, pp. 797–817, <https://doi.org/10.2307/2118364>.
- Berger, S., Feldhaus, C., Ockenfels, A. (2018) 'A shared identity promotes herding in an information cascade game', *Journal of the Economic Science Association*, Vol. 4, No. 1, pp. 63–72, <https://doi.org/10.1007/s40881-018-0050-9>.
- Bikhchandani, S., Hirshleifer, D., Welch, I. (1992) 'A theory of fads, fashion, custom, and cultural change as informational cascades', *Journal of political Economy*, Vol. 100, No. 5, pp. 992–1026, <https://doi.org/10.1086/261849>.
- Bloomberg (2020) 'Bloomberg Markets: The close' Full show' <https://www.bloomberg.com/series/bloomberg-markets-the-close> [Accessed: March 31, 2020].
- Bloomberg (2020) 'Crypto Freeze Continued Last Year as Deals Plunged, PwC Says by Eric Lam', <https://www.bloomberg.com/news/articles/2020-04-06/crypto-freeze-continued-last-year-as-deals-plunged-pwc-> [Accessed: April 6, 2020].
- Chen, Z., et al. (2019) 'Do rating agencies exhibit herding behaviour? Evidence from sovereign' ratings, *International Review of Financial Analysis*, Vol. 64, pp. 57–70, <https://doi.org/10.1016/j.irfa.2019.04.011>.
- Chiang, T. C., Zheng, D. (2010) 'An empirical analysis of herd behavior in global stock markets', *Journal of Banking & Finance*, Vol. 34, No. 8, pp. 1911–1921, <https://doi.org/10.1016/j.jbankfin.2009.12.014>.
- Christie, W. G., Huang, R. D. (1995) 'Following the pied piper: Do individual returns herd around the market?', *Financial Analysts Journal*, Vol. 51, No. 4, pp. 31–37, <https://doi.org/10.2469/faj.v51.n4.1918>.
- Donadelli, M., Kizys, R., Riedel, M. (2017) 'Dangerous infectious diseases: Bad news for Main Street, good news for Wall Street?', *Journal of Financial Markets*, Vol. 35, pp. 84–103, <https://doi.org/10.1016/j.finmar.2016.12.003>.
- Economou, F., Hassapis, C., Philippas, N. (2018) 'Investors' fear and herding in the stock market', *Applied Economics*, Vol. 50, No. 34-35, pp. 3654–3663, <https://doi.org/10.1080/00036846.2018.1436145>.

- Gębka, B., Wohar, M. E. (2013) 'International herding: Does it differ across sectors?', *Journal of International Financial Markets, Institutions and Money*, Vol. 23, pp. 55–84, <https://doi.org/10.1016/j.intfin.2012.09.003>.
- Gill, S., et al. (2018) 'Factors Effecting Investment Decision Making Behavior: The Mediating Role of Information Searches', *European Online Journal of Natural and Social Sciences*, Vol. 7, No. 4, pp.758–766.
- Hair, J. F., et al. (2010) 'Multivariate data analysis' 6th Edition. Pearson Prentice Hall. New Jersey. humans: *Critique and reformulation. Journal of Abnormal Psychology*, Vol. 87, pp. 49–74, <https://doi.org/10.1037/0021-843X.87.1.49>.
- Ichev, R., Marinč, M. (2018) 'Stock prices and geographic proximity of information: Evidence from the Ebola outbreak', *International Review of Financial Analysis*, Vol. 56, pp. 153–166, <https://doi.org/10.1016/j.irfa.2017.12.004>.
- Kizys, R., Tzouvanas, P., Donadelli, M. (2020) 'From COVID-19 herd immunity to investor herding in international stock markets: The role of government and regulatory restrictions'. Available at SSRN 3597354, <https://doi.org/10.2139/ssrn.3597354>.
- Kline, R. B. (2010) 'Principles and Practice of Structural Equation Modeling', Series Editor's Note by Todd D. Little.
- Lin, M. C. (2018) 'The impact of aggregate uncertainty on herding in analysts' stock recommendations', *International Review of Financial Analysis*, Vol. 57, pp. 90–105, <https://doi.org/10.1016/j.irfa.2018.02.006>.
- Lintner, J. (1965) 'The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets', In *Stochastic optimization models in finance*, pp. 131–155, <https://doi.org/10.2307/1924119>.
- Miller, E. M. (1977) 'Risk, uncertainty, and divergence of opinion', *The Journal of finance*, Vol. 32, No. 4, pp. 1151–1168, <https://doi.org/10.1111/j.1540-6261.1977.tb03317.x>.
- Mossin, J. (1966) 'Equilibrium in a capital asset market', *Econometrica: Journal of the econometric society*, pp. 768–783, <https://doi.org/10.2307/1910098>.
- Nunnally, J. C. (1994) 'The assessment of reliability', *Psychometric theory*
- Onali, E. (2020) 'Covid-19 and stock market volatility', <https://doi.org/10.2139/ssrn.3571453>.

- Rodriguez, L. J., Tran, N. H., Le-Ngoc, T. (2014) 'Performance of full-duplex AF relaying in the presence of residual self-interference', *IEEE Journal on Selected Areas in Communications*, Vol. 32, No. 9, pp. 1752–1764, <https://doi.org/10.1109/JSAC.2014.2330151>.
- Salisu, A. A., Akanni, L., Raheem, I. (2020) 'The COVID-19 global fear index and the predictability of commodity price returns', *Journal of Behavioral and Experimental Finance*, Vol. 27, No. 83, <https://doi.org/10.1016/j.jbef.2020.100383>.
- Shaker, M. A., Abdeldayem, M. M. (2018) 'Examining asset pricing models in emerging markets: evidence from Egypt', Vol. 16, No. 1, pp. 50–57, <https://doi.org/10.22495/cocv16i1art6>.
- Sharpe, W. F. (1964) 'Capital asset prices: A theory of market equilibrium under conditions of risk', *The journal of finance*, Vol. 19, No. 3, pp. 425–442.
- Treynor, J. L. (1961) 'Market value, time, and risk', *Time, and Risk* (August 8, 1961).
- Uddin, M. Z., Nilsson, E. G. (2020) 'Emotion recognition using speech and neural structured learning to facilitate edge intelligence', *Engineering Applications of Artificial Intelligence*, Vol. 94, No. 75.
- Wei, Y., et al. (2020) 'Can CBOE gold and silver implied volatility help to forecast gold futures volatility in China? Evidence based on HAR and Ridge regression models', *Finance Research Letters*, Vol. 35, No. 87.
- Yarovaya, L., Matkovskyy, R., Jalan, A. (2020) 'The Effects of 'Black Swan' Event (COVID-19) on Herding Behavior in Cryptocurrency Markets: Evidence from Cryptocurrency USD, EUR, JPY and KRW Markets', https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3586511 [Accessed: June 17, 2020].

Psihologija stada investitora i pandemijski rizik na tržištu dionica zemalja arapskog zaljeva

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Sažetak

Svrha ove studije je ispitati uzročno-posljedičnu povezanost između očekivanja u svezi pandemijskog rizika i masovne reakcije ponašanja prema zakonu stada. Studija je provedena u dvije faze. Prvo, smatralo se potrebnim dobiti široki pregled učinka rizika od pandemije COVID-19 na masovnu reakciju investitora u ponašanju po zakonu stada u zemljama arapskog zaljeva. To je postignuto analizom sekundarnih podataka (povijesne dnevne cijene na tržištu pet zemalja arapskog zaljeva). Analizirajući sekundarne podatke, studija slijedi Christie i Huang (1995) i koristi presjek standardne devijacije (CSSD) prinosa kako bi otkrila fenomen "stada" u ponašanju ulagača. Drugo, u pokušaju da se dobije preciznije razumijevanje utjecaja rizika povezanog s pandemijom, distribuirano je anketno istraživanje koje je prikupljeno od 318 ulagača s tržišta dionica zemalja arapskog zaljeva. Konfirmativna faktorska analiza (CFA) koristi se također kao primarna analiza između dvije varijable: tj. očekivanja od pandemijskog rizika i ponašanje stada. Rezultati potvrđuju da očekivanja od pandemijskog rizika imaju značajan pozitivan utjecaj na ponašanje stada na tržištima dionica zemalja arapskog zaljeva tijekom krize s koronavirusom u prvom tromjesečju 2020. Napokon, rezultati ove studije robusni su nizu specifikacija modela.

Ključne riječi: tržišta dionica zemalja arapskog zaljeva; psihologija stada; rizik pandemije, presjek standardne devijacije, pandemijski rizik, konfirmativna faktorska analiza (CFA)

JEL klasifikacija: G11, G15, G18, I18

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Medium-term forecast of European economic sustainable growth using Markov chains*

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Abstract

Economic growth is a frequently analyzed aspect, both from theoretical and empirical standpoint, under the impact of the influence factors, while the issue of economic growth was studied by applying different methods and obtaining different results. In the case of EU28, the problem of economic convergence has to take into consideration the fact that the Member States are heterogeneous in terms of development and rate of growth. In the present paper, by using Markov chains we have made, a forecast of the GDP per capita evolution for the economies of the EU28 members, starting from the known time horizon – 1997-2016 as to approach a forecast horizon – 2017-2028. The results obtained show that the convergence process will be a slow one in the case of some Member States, especially in the Central and Eastern Europe. The future economic dynamics will intensify growth

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divergences, especially in the case of the European periphery, which will suffer minor modifications; the states with the most significant gaps will remain Bulgaria and Romania.

Key words: *economic growth, Markov chains, medium-term forecast, convergence, EU28*

JEL classification: *F43, N10, O11, O47, O52, R11*

1. Introduction

Growth and development that are to result in ensuring people's well-being and environmental protectionist processes to which converge all the actions undertaken by economy and society. It is necessary to point out here that we do not put a sign of equation between growth and development. Both processes are intensely theorized but there is still room for estimations and forecasts, given the importance of growth, whose finality is development. We are preoccupied with the long-run evolution of the European society and economy. Therefore, in the present analysis by applying the method of Markov chains, our aim is to forecast the future economic growth of EU28 Member States. Economic literature extensively analyses the causality of growth, without clearly establishing a set of factors that would be valid for all countries, under all circumstances. Each economic entity answers in a different way to certain stimuli, this is a fact that reality and complex researches have demonstrated.

Sustainability has been applied to a wide range of situations, the sustainability criteria depending a lot on the context, based on a common characteristic, namely that it is a concept that manifests itself in the long term (D'Ergole and Salvini, 2003). Sustainable growth is the process that ensures the over-size of wealth, over time, without periods of strong decline caused by the exaggerated use of limited natural resources or environmental degradation in production and consumption processes. Each country faces with different challenges in its path to sustainable development and seeks, in this regard, to lay a sustainable foundation so that in the future prosperity will grow concurrently with the sustainable management of resources (UNDP, 2017). Sustainable growth is subject to risks such as climate changes that require good resource management and adaptive capacity, hunger and poverty that are eradicated, inequalities of income that are required to be corrected, massive urbanization, provision of increasing amounts of energy, crises financials that require prevention and management. Sustainability is directly related to the environment, and the relationship between growth and the environment is not well understood, so as it will be understood in the future, the solution for sustainable growth will be the implementation of zero emission technologies.

Our purpose is not to analyse the causes of growth for the EU28 members, but only the future evolution of this quantitative process for each state, mentioning

the differences in the form of growth gaps, given that within the EU28 framework, economic standardization is desirable. The less developed Member States who joined the Union with the latest enlargements wish for the economic and social differences to be reduced, so that their populations could enjoy a standard of life similar to that of the population in the developed member countries.

The process of economic growth is defined, in simple terms, as an increase of the real GDP, real GDP per capita, real GDP growth rate and real GDP per capita growth rate (Sekreter, 2015), while its importance comes from the fact that it underlies development, without being its only condition. Although no unanimously accepted perspective has appeared by now, economic growth reflects aspects of quantitative nature, unlike development, which is essentially qualitative. Growth allows for increase of an economy's size, of the macroeconomic indicators, particularly of the GDP per capita, in an ascendant but not necessarily linear way, with positive long-term effects, subjected to constraints such as the excessive growth of the population, limited resources, inappropriate infrastructure, inefficient utilization of resources, excessive governmental interference, institutional and cultural models that might slow down growth. The present paper focuses on growth and not on development because growth underlies development and there is no equivalence between the two processes, as a country has the possibility to grow without developing, while the reverse is not true.

The economic convergence of developing and the less developed countries is vital in order to reduce the gap compared to the developed economies, an objective that ensures a higher standard of life and status for their population. As far as the EU28 is concerned, it aimed at becoming a strong construction, but for the time being it is only a vulnerable, yet to be finalized one (Stiglitz et al., 2014). EU28 progresses at different speeds in spite of the desiderata of making it work as a whole. One of the proposed objectives is the convergence of the less developed states and the reduction of the gap compared to the regional average by improving the conditions of growth and employment (Fontaine, 2010). The difficulty comes from the differences in terms of growth and development between the members, as well as from the way in which some of them manage to reduce gaps with the developed countries of EU28. If the best results were recorded by the north states, Finland, Sweden, and Denmark, at the other end of the scale we can find Greece, Romania and Bulgaria (Ardielli, 2016).

The factors of economic growth are different from state to state, some of them being sustainable, supporting the process in the long run, others less sustainable, as they support the process for shorter terms. The positive rates of economic growth, regardless of the determinant factors, theoretically reduce the development gaps between the European countries. Landon-Lane and Robertson (2009) reached the conclusion that, except for the *golden period* following World War II, one can observe a reduced β -convergence or not find it at all; the period after WWII

represents an anomaly of the growth process in the long run. Between the European regions, gaps persist between GDP per capita values and incomes, in spite of an increasingly higher degree of openness (Le Gallo, 2004). Convergence studies have their origin in the theory of economic growth being initially introduced by Solow (1956) later developed by Barro (1991) and Barro and Sala-i-Martin (1992) and then to be a widely accessed method to study the macroeconomic aspects of growth. Baumol (1986) developed the β -convergence equation to show its type (conditioned when the β value is positive and unconditioned when the β value is negative) and its speed.

Smętkowski and Wójcik (2010) studied the tendencies and factors of growth in sub-regions of Central and Eastern Europe for the period 1998-2006, reaching the conclusion that the integration of central and eastern European states helped to reduce the national and regional disparities in terms of income per capita and GDP per capita. Iancu (2009) gives special attention to Romania's case, which he describes as a peripheral European country from the point of view of the GDP per capita level, the indicator value being much under the EU average. Analyzing Romania's process of convergence to EU15 and the leader states Germany and France for the periods 1980-2003 and 1990-2004, Iancu reaches the conclusion that in Romania's case convergence is a simple illusion, while gaps, instead of decreasing, intensified.

In the present paper, we validate Iancu's hypothesis, starting from the analysis of GDP per capita as an indicator of growth for each European member. The forecast made by means of Markov chains shows an intensification of the growth gaps between the center and the periphery of EU28 by 2028. The Markov chains represent a successfully used methodology in order to demonstrate different hypotheses in varied fields of research. The novelty brought forth by our paper is the forecast of economic growth, measured in GDP per capita, for the next three decades, a forecast which confirms the intensification of growth gaps between the periphery and the developed European states, with two exceptions, starting from the economic reality of the last two decades, and noticing Romania's considerably lower performance compared to the rest of the peripheral states.

The comparative forecast of the GDP per capita rise in the European economies show whether the European states have or do not have in the future the ability to evolve on a positive trend, starting from the reality of the previous period. The used methodology is specific to fuzzy systems, more precisely to Markov chains, starting from the GDP per capita values for a known horizon, 1997-2016, in order to get to a future one, 2017-2028.

The choice of this methodology was also determined by the fact that the forecast of some macroeconomic indicators for Romania achieved by using the Markov chains (Nicolae-Bălan, 2009) was subsequently validated by the statistical data of the INS

(National Institute of Statistics, 2019). The paper is structured as follows: in Section 2 we briefly present the current state of knowledge through a Literature Review; in Section 3 we present the methodology used, more specifically the Markov chains. Here we describe the steps taken to achieve the forecast of European economic growth; in Section 4 we present the data and the main findings. Here we integrate the results obtained in the general European context, including the one determined by the crisis of 2020; Section 5 is dedicated to the results and discussions and, finally, in Section 6 we draw the conclusions by emphasizing the limits of research and the proposals for future analysis.

2. Literature review

There are many studies about economic growth and convergence, including empirical and theoretical analyses. They reach different results on this issue, according to the chosen variables, the type of data, the period of time and the empiric model used. It was demonstrated that a GDP growth rate of 3% per year leads to an increase of the potential GDP by 10% over three years and a doubling over 23 years, which, according to the *rule of 70*, implies that a growth rate of 1% per year doubles the potential GDP in a 70- year span (Angelescu and Socol, 2005). This rule, also called *the rule of 69* or *of 72* (as number 69 is the clearest, 70 the easiest to calculate, and 72 more precise for more modest growth rates), shows that small differences between the rates of economic growth result in big differences in the size of macroeconomic indicators (Beggs, 2019). Rule 69 (more precisely 69.3), 70 or 72 refer to the number of years required for a variable to double its value, in our case, economic growth. In the case of rule 69, in calculations the number 69 is related to the variable for which we calculate the period of doubling the value. The procedure is similar for rule 70 and rule 72. The choice is a matter of preference. Although the numbers 69 proved to be more accurate (Beggs, 2019), 70 and 72 are more easily divisible so that they became recognized. These rules are taken from the financial field.

The GDP rise is a valid measure of progress, prosperity and human well-being (Korten, 2010) and the states recording accelerated rhythms of economic growth are those with a developed industry, growth being associated to structural changes in the secondary sector (Rodrik, 2007) and industrialization stimulating the substantial changes in society and in the structure of income distribution (Sbardella et al., 2017).

The economies with a similar level of integration in the world economy have different ways to grow in the long run, according to the neoclassical models of growth. As long as the countries are not isolated from the world economy, they will grow in the long run in different manners, because this depends on the degree of integration into the global economy (London-Lane and Robertson, 2009).

The basis of economic growth is represented by the accumulation of capital, the human capital and knowledge used in production (Persson and Tapeline, 2013). Andolfatto (2008) puts economic growth on the account of technology, technical-scientific information, human capital and management-factors that are generally available for the industrialized states. The importance of growth consists in the direct consequences on well-being and in the fact that it provides the necessary financial resources at a social level, even if the benefits of growth are unequally distributed (Smętkowski and Wójcik, 2010). Herman (2015) postulates that the process of economic growth, as it manifests itself nowadays, leads to the fall of the ecological system and affects well-being, calling even survival into question, costs being higher than benefits.

Economic growth, especially the inclusive one, is important because it reduces poverty, inequality, gender differences, it creates new workplaces, it improves the governing process and reacts to climate changes (Kireyev and Chen, 2017) involving a continuous metamorphosis. Berg et al. (2012) identify the characteristics of sustainable growth as being a more equitable distribution of incomes, democratic institutions, trade openness, direct foreign investments, a production structure that would allow a sophisticated export, a stable macroeconomic environment, with low inflation rates, with a minimal external debt and low conditions of monetary depreciation. An analysis made by Alfaro et al. (2010), starting from the idea that there is a direct influence relationship between growth and direct foreign investments, demonstrates that there is a weak support for the positive exogenous effect of foreign investments upon growth; an important fact is that the capacity of a country to benefit from the advantages that direct foreign investments provide is limited by local conditions, such as the development of local financial markets or the country's educational level. Davis (2010) finds out another causal relation for economic growth, represented by the institutional quality (the bundle of property rights) and the institutional flexibility (the ability to develop new institutions). Eicher and Schreiber (2010) identified, analyzing 26 states in transition over a period of 11 years, the positive role that change plays in the quality of structural policies or of the rule of law, because a 10% change under the OECD standards will lead to a 2.5-2.7% rise of the economic growth rate.

Forecasts of economic growth in the short run were made by means of different methods and using different indicators. The European Commission (2018), for instance, made a forecast of economic growth and reached the conclusion that, over the years 2018 and 2019, the process would evolve positively, with rates of 2.3% and 2% respectively, especially due to the expansion of consumption in the context of the emergence of new workplaces and of investments. The World Bank (2017), following a short-run forecast for the period 2017-2018, notices that production, trade, trust and the funding conditions stay favorable, so that the growth rate for 2018-2019 will be of about 2.9% at the global level, that it will reach about 4.6% in

the case of the emergent and developing countries, but in the context of a negative trade balance, while in the Euro Zone it will record a rate of only 1.5%.

The IMF (2017) speaks of a growth forecast for 2018 by a rate of about 3.7% at the world level, as a result of the positive influence of investments, trade, industrial production and trust in the business environments, while in the Euro Zone the rate will reach about 1.9%, and about 4.5% in the case of the European emergent countries. With the help of regression equations, different methods were assessed to forecast economic growth in the short run for the Euro Zone on the basis of a quarterly GDP and of the monthly data, deemed much more relevant (Angelini et al., 2011). Other short-run estimations for the Euro Zone of the real GDP, using monthly data, also took into consideration indicators characterizing the industrial production except for the building trade, the new vehicle registration, the retail sales, the business environment, the consumers' confidence for the period 1990-2001 (Rünstler and Sédillot, 2003). The economic literature turns out to be poor in long-run forecasts of the GDP/capita growth for EU28.

The fuzzy analysis with Markov chains was introduced, in its dynamic model of growth, by Quah and Magrini, as an alternative to the standard analyses of regression (Fingleton, 1997). The fuzzy systems and the Markov chains in particular are considered by Quah (1992), a much deeper analysis compared to other long-term models of growth, and the analysis of the income per capita for 118 countries showed the instability of the models of growth in the long run in each country's case. Using the same methodology, Quah (1996) explains the dynamics of the distribution between the European regions, analyzing the incomes per capita, and concluding that they are not equal and they do not remain unchanged, because the distribution of regional incomes fluctuates over time.

Fingleton (1997) used the Markov chains starting from Quah's model, considering that the standard regression analyses lack the richness and flexibility of the Markov method. Cheshire and Magrini (1999) analyzed by means of Markov chains the determinants of growth, a complex process, for 122 urban regions in 12 western European countries in the period 1978-1994. Indicators such as income per capita, research and development activity and the role of the universities in establishing economic policies highlight the existence of divergences in the models of regional growth of the Western-European states. Le Gallo's analysis (2004) with Markov chains for the study of gaps between 138 European geographical regions in the period 1980-1995 reflects a progressive trend towards a poverty trap, as well as the importance of the geographical position in the process of convergence.

Abbasov and Mamedova (2003) applied the fuzzy logics for the simulation of the demographic process. Nastase et al. (2019) uses the theory of Markov chains to forecast the number of students enrolled in pre-university education, upper

secondary, by groups of studies and profile. Sledge et al. (2018) proposed an uncertainty-based, information-theoretic approach for performing guided stochastic searches that more effectively cover the policy space, and Sledge and Principe (2019) provided a novel, two-part information-theoretic approach for aggregating Markov chains. Ponzio and Di Gennaro (2004) applied the methodology of Markov chains by analyzing the income per capita for 92 Italian provinces in the period 1952-1955. They found out that the Italian provinces followed different models of growth, joining, eventually, a divergent trend. Le Gallo (2004) analyzed the evolution of disparities between 138 regions in 11 European countries with the help of Markov chains, in the period 1980-1995, using GDP per capita; he reached the conclusion that the period was characterized by the persistence of regional gaps, by the absence of the relative mobility of regions in the distribution of GDP per capita, as well as by a progressive trend towards a poverty trap, while the geographical position played an important role in the process of convergence. Anas et al. (2004) used the Markov chains to study the relations between the phases of the economic cycle of industrial production in the cases of USA and of the Euro Zone. Kooros and Badeaux (2007) make, by means of Markov chains, a short-term forecast about the future market shares of companies, in the context of consumers' migration from one company to another. Monfort (2008) analyzed the regional disparities at the level of EU with the help of several methods, including Markov chains, reaching thus the conclusion that the results regarding the convergence and divergence depend very much upon the chosen method. Rey (2010) analyzed the evolution of the distribution of the national income over time – the period 1929-1944, and space – USA territory, by means of the classical Markov method, reaching the conclusion that the geographical position is important in the distribution of incomes, at least in the American case.

Soloviev et al. (2011) use the Markov chains methodology for financial time series, finding out that this is successfully applicable to researches in the financial field, and not only. The model of the Markov chains, used with good results in fields such as the regional economy for the study of inequality of incomes, sociology, microeconomics and public health, is used by Lipták (2012), to describe processes on the labor market in Hungary for the period 1992-2009. Zhalezka and Navitskaya (2015) use the fuzzy multi-criteria analysis in order to assess regional competitiveness in Belarus, and also Moosavi and Isacchini (2017) analyzed, by means of the Markov chains, series of time corresponding to the period 1995-2011 in order to reveal the evolution of the works economic networks, reaching the conclusion that between balance and GDP there is a relation on which future economic growth depends.

The results of the researches based on the analyses with Markov chains make us choose this method for a forecast of the GDP per capita evolution in the case of the economies of EU28 members.

Starting from the fact that through various techniques and models, the medium-term forecasts of the macroeconomic indicators are necessary for identifying and highlighting their positive/negative tendencies from the first manifestation phases, and they function as an early warning system, we achieved the long-term GDP per capita forecast for EU-28 member states. However, any medium-term forecast should be reassessed after a period of time (2-3 years) under the new conditions of the world conjuncture.

3. Methodology

We opted, as an empirical model for a forecast of EU28 economic growth, for the Markov chains, due to the results obtained in other studies we referred to.

The Markov chains represent a stochastic process according to which the probability of a random variable at a moment $t+1$ depends only on its state in the moment t , but not on its states in previous moments (Ponzio and Di Gennaro, 2004). The simulation of the dynamics of economic growth and of the forecast of convergence for EU28 Member States was made with Markov chains, a suggestive example for the use of fuzzy techniques (Moosavi and Isacchini, 2017; Nicolae-Bălan, 2009; Gherasim, 2008). The Markov chain used for the forecast study of convergence can be described as follows.

For the simulation of the GDP per capita values, we consider the period 1997-2016, which we divide into sub periods g_1, g_2, \dots, g_{14} , with:

$$\left\{ \begin{array}{l} g_1 \equiv (1997, 1998, 1999, 2000) \\ g_2 \equiv (2001, 2002, 2003, K 2004) \\ M \\ g_5 \equiv (2013, 2014, 2015, 2016) \end{array} \right. \quad (1)$$

In order to forecast values of GDP per capita for 28(+1) EU states, plus the European average, we apply the method of simulation with Markov chains with values modelled using trapezoidal fuzzy numbers. Thus, we consider the horizon:

$$t \in \left\{ \underbrace{1, 2, 3, \dots, t_c}_{\text{known horizon}}, \underbrace{t_c + 1, t_c + 2, \dots, T}_{\text{forecast horizon}} \right\} = \left\{ \underbrace{1, 2, 3, 4, 5}_{\text{known horizon}}, \underbrace{6, 7, 8}_{\text{forecast horizon}} \right\} \quad (2)$$

where: t_c is the last year of the known time horizon.

The known horizon (20 years) comprise five periods ($t = 5$) of 4 years each, $T_1 = [1997 - 2000]$, $T_2 = [2001 - 2004]$, $T_3 = [2005 - 2008]$, $T_4 = [2009 - 2012]$ and $T_5 = [2013 - 2016]$. For each quadruple we round the four values of the GDP per capita and order them according to Table 1.

Table 1: Rounded values of GDP per capita and their grouping in the five periods of the known horizon (Dollars per capita)

t GDP per capita	1	2	3	4	5 = t_c
	1589	1840	4676	8220	8978
	1610	2125	5829	8297	9520
	1668	2775	8214	8558	9585
	1865	3553	10136	9200	10020
	1683,00	2573,25	7213,75	8568,75	9525,75

Source: Authors' calculations

A trapezoidal fuzzy number ($\tilde{a} \in NF4$) is a quadruple ordered like $\tilde{a} = (a_1, a_2, a_3, a_4)$, with $a_1 \leq a_2 \leq a_3 \leq a_4$.

The values of GDP per capita of the known horizon are trapezoidal fuzzy numbers. The fifth cell of Table 1 represents the center of gravity (real number associated) and was calculated as the arithmetic mean of the 4 components, according to the relation:

$$a_G = \langle \tilde{a} \rangle = \frac{a_1 + a_2 + a_3 + a_4}{4} \tag{3}$$

The values of GDP per capita in the known horizon, expressed with trapezoidal fuzzy numbers are the following:

$$\left\{ \begin{array}{l} \tilde{y}_1 = (1589, 1610, 1668, 1865)_{1683.00} \\ \tilde{y}_2 = (1840, 2125, 2775, 3553)_{2573.25} \\ M \\ \tilde{y}_{t_c} = \tilde{y}_5 = (8978, 9520, 9585, 10020)_{9525.75} \end{array} \right. \tag{4}$$

The forecast horizon $\{t_c + 1, t_c + 2, \dots, T\} = \{6, 7, 8\}$ consists of three groups, $\{\tilde{y}_{t_c+1}, \dots, \tilde{y}_T\} = \{\tilde{y}_6, \tilde{y}_7, \tilde{y}_8\}$. The fuzzy number \tilde{y}_8 corresponds to the last group $g_8 \cong (2025, 2026, 2027, 2028)$. The forecast of GDP per capita using (two-state) Markov chains with extreme variable (with NF4) is made in eight phases.

In the first phase we will select the maximal level, \tilde{y}_{max} , considering annual growths of about 40%.

$$y_{med} = \frac{\langle \tilde{y}_1 \rangle + \langle \tilde{y}_2 \rangle + \langle \tilde{y}_3 \rangle + \langle \tilde{y}_4 \rangle + \langle \tilde{y}_5 \rangle}{5} \quad (5)$$

$$y_{med} = y_{med} + y_{med} \cdot 0.4 \cdot (T - t) = 2.2 \cdot y_{med} = 7095.54 \approx 7096 \quad (6)$$

$$\begin{aligned} \tilde{y}_{max} &= (y_{med} \cdot 0.80, y_{med} \cdot 0.90, y_{med} \cdot 1.10, y_{med} \cdot 1.20) = \\ &= (5677, 6377, 7806, 8515)_{7096} \end{aligned} \quad (7)$$

In the second phase, we calculate the state probabilities for the known horizon, according to relation:

$$\tilde{w}_1(t) = \frac{\tilde{y}_t}{\tilde{y}_{max}}, \quad t = \overline{1, t_c} \quad (8)$$

$$\tilde{w}_2(t) = \tilde{I} - \tilde{w}_1(t)$$

where: $\tilde{I} = (1, 1, 1, 1)$ is considered trapezoidal fuzzy number.

In the third phase, we calculate, according to relations (9), (10) and Table 2, matrices with transition probabilities.

We calculate $n = \frac{(t_c - 1) \cdot (t_c - 2)}{2} = \frac{4 \cdot 3}{2} = 6$ matrices of 2×2 with elements of probabilities expressed by trapezoidal fuzzy numbers:

$$\tilde{p}^{(k)} = \begin{bmatrix} \tilde{p}_{11}^{(k)} & \tilde{p}_{12}^{(k)} \\ \tilde{p}_{21}^{(k)} & \tilde{p}_{22}^{(k)} \end{bmatrix} \quad (9)$$

Table 2: Matrices with probabilities of transition

Case k	t'	t''
k=1	1	2
2	1	3
3	1	4
4	2	3
5	2	4
6 (= n)	3	4

Source: Authors' calculations

For each pair $t' < t''$, we solve 2 systems of 2 equations with unknowns \tilde{p}_{ij} :

$$\left\{ \begin{array}{l} \tilde{w}_1(t'+1) = \tilde{w}_1(t') \cdot \tilde{p}_{11} + \tilde{w}_2(t') \cdot \tilde{p}_{21} \\ \tilde{w}_1(t''+1) = \tilde{w}_1(t'') \cdot \tilde{p}_{11} + \tilde{w}_2(t'') \cdot \tilde{p}_{21} \end{array} \right. \Rightarrow \left\{ \begin{array}{l} \tilde{p}_{11} = \frac{\tilde{w}_1(t'+1)\tilde{w}_2(t'') - \tilde{w}_1(t''+1)\tilde{w}_2(t')}{\tilde{w}_1(t')\tilde{w}_2(t'') - \tilde{w}_1(t'')\tilde{w}_2(t')} \\ \tilde{p}_{12} = \frac{\tilde{w}_1(t''+1)\tilde{w}_1(t') - \tilde{w}_1(t'+1)\tilde{w}_1(t'')}{\tilde{w}_1(t')\tilde{w}_2(t'') - \tilde{w}_1(t'')\tilde{w}_2(t')} \\ \tilde{p}_{21} = \frac{\tilde{w}_2(t'+1)\tilde{w}_2(t'') - \tilde{w}_2(t''+1)\tilde{w}_2(t')}{\tilde{w}_1(t')\tilde{w}_2(t'') - \tilde{w}_1(t'')\tilde{w}_2(t')} \\ \tilde{p}_{22} = \frac{\tilde{w}_2(t''+1)\tilde{w}_1(t') - \tilde{w}_2(t'+1)\tilde{w}_1(t'')}{\tilde{w}_1(t')\tilde{w}_2(t'') - \tilde{w}_1(t'')\tilde{w}_2(t')} \end{array} \right. \quad (10)$$

In the fourth phase, we verify the conditions of positivity. The components of the matrices $\tilde{P}^{(k)}$, $k = \overline{1, n}$ are probabilities. Therefore, they will verify 2 conditions reflected in next relation:

$$\left\{ \begin{array}{l} \langle \tilde{p}_{11}^{(k)} \rangle + \langle \tilde{p}_{12}^{(k)} \rangle = 1 \\ \langle \tilde{p}_{21}^{(k)} \rangle + \langle \tilde{p}_{22}^{(k)} \rangle = 1 \end{array} \right. \text{ and } 0 \leq \langle \tilde{p}_{ij}^{(k)} \rangle \leq 1 \quad (11)$$

In this phase, we will eliminate the matrices that do not meet conditions (11). If none fulfils them, we go back to the first phase and choose a different value \tilde{v}_{max} .

In the fifth phase, we select the most homogenous transition matrices. For each matrix $\tilde{P}^{(s)}$, $s \in S \subseteq \{1, 2, \dots, n\} = \overline{1, n}$ we calculate the distance between the elements, based on relation:

$$d^{(s)} = (\langle \tilde{p}_{11}^{(s)} \rangle - \langle \tilde{p}_{12}^{(s)} \rangle)^2 + (\langle \tilde{p}_{21}^{(s)} \rangle - \langle \tilde{p}_{22}^{(s)} \rangle)^2 \quad (12)$$

The most homogenous matrix has the smallest distance between elements:

$$\tilde{P} = \tilde{P}^{(o)} \text{ so that } d^{(o)} \leq d^{(s)}, \forall s \in S \quad (13)$$

The values of the indicators in the forecast horizon are obtained for each of the years. We set the temporal variable with the first year of the forecast, $t = t_c + 1$ and the probability of initial state for the forecast horizon:

$$\tilde{P}_{t_c} = \tilde{w}_1(t_c) \quad (14)$$

Phases 6, 7, 8 are followed for all the forecast years, $t = \overline{t_c + 1, T}$.

In the sixth phase, we calculate the state probabilities, based on the relationship (15), for the year t of forecast:

$$\tilde{P}_t = \tilde{P}_{t-1} \cdot \tilde{p}_{11} + (\mathbf{1} - \tilde{P}_{t-1}) \cdot \tilde{p}_{21}, \quad (t = \overline{t_c + 1, T}) \quad (15)$$

In *the seventh* phase, we evaluate the maximal level for year t of forecast, according to relation:

$$\tilde{y}_{\max}(t) = \tilde{y}_{\max} + \frac{\tilde{y}_{\max} - \tilde{y}_{t-1}}{T - (t - 1)} \quad (16)$$

In *the eighth* phase, we calculate GDP per capita (fuzzy number) for year t :

$$\tilde{y}_t = \tilde{y}_{\max}(t) \cdot \tilde{P}_t \quad (17)$$

For the interpretation of the results, we calculate the real numbers associated to the values of the forecasted values (fuzzy numbers).

4. Empirical data and analysis

The analysis of economic growth for EU28 members using Markov chains consists in the forecast of the phenomenon starting from the known horizon (1997-2016) for a forecasted horizon (2017-2028). Considering that the values of the growth indicator are final for the year 2016 (for 2017 are semi defined data and for 2018 are provisional data), we considered that the forecasted horizon had 2017 as a limit. The values of GDP per capita, the indicator we deemed suggestive for a description of the economic growth process, specific to the known horizon, were taken from the World Bank bases and are expressed in dollars (World Bank, 2017).

The known horizon, spanning 20 years, was divided into five intervals of four years each (T1:T5). The forecast horizon, spanning twelve years, was divided into three periods of four years each (T6:T8).

The 28 EU Member States, including the EU28 average as an entity by itself (+1) were divided, according to the decreasing value of the GDP per capita recorded in 2016, into three groups:

- the states with a high economic growth including 9 Member States: Luxemburg, Ireland, Denmark, Sweden, the Netherlands, Austria, Finland, Germany and Belgium – a group we designate as A, the highest speed states;
- the states with moderate economic growth, including 10 Member States: UK, France, Italy, Spain, Malta, Cyprus, Portugal, Estonia, Lithuania, Poland – a group we designate as B, the average speed states;
- the states with a modest, peripheral economic growth, including 9 Member States: Slovenia, Czech Republic, Greece, Republic of Slovakia, Latvia, Hungary, Croatia, Romania, Bulgaria – a group we designate as C, the low speed states. The third group of growth was designated as *the old* periphery, as it contains the states with the poorest growth results in 2016. We opted to keep UK in the analysis, as it theoretically preserves its status as a Member State.

Before presenting the results we have obtained, it is necessary to describe the European economic picture with a focus on the countries of Central and Eastern Europe, which, in fact, are the ones put in the situation to reduce the development gaps. After the change of the economic system, the countries of Central and Eastern Europe went through periods characterized by similarities. Bulgaria, Croatia, Estonia, Hungary, Latvia, Poland, Romania, Slovakia and Slovenia have applied different economic reform measures in their way to the market economy. The focus was on different sectors, and the speed of implementation of reform measures was very different. The stated goal was to reduce the gaps with the European developed states. Havrylyshyn et al. (2018) talk about European countries that implemented reforms in the early stages of their post-communist development and about countries that implemented reforms gradually. Havrylyshyn et al. (2018) divide European countries, relative to the speed of implementation of economic reforms, into several groups. These groups are Sustained Big-Bang (Estonia, Latvia, Lithuania, Czech Republic, Poland, Slovakia), Advanced Start/Steady (Croatia, Hungary and Slovenia), Aborted Big-Bang (Bulgaria along with other non-EU states), Gradual Reforms (Romania along with other non-EU states) and Limited Reforms (group to which no country in our interest group belongs).

During the transition period, these European states went through processes of economic, institutional and social transformation. Adnanes (2007) explained that, after the 1990s, the states of Central and Eastern Europe went through periods of imbalance that generated economic divergence on a recessionary background characterized by inflation, declining production, worsening social inequalities and unemployment (Estrin and Mickiewicz, 2010; Sykora and Bouzarovski, 2011; Rovelli and Zaiceva, 2013).

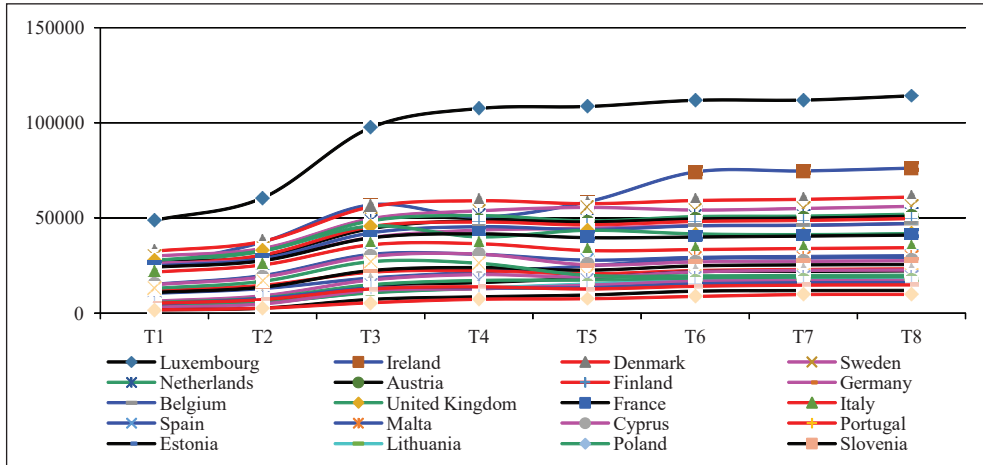
The reform measures undertaken in the period following the change of the economic system have left their mark on the subsequent economic evolution, which we also tried to prove in this research. The performances on the line of economic growth and convergence towards the developed European states depend on the start taken in the 1990s. In countries like Poland, the Czech Republic or Slovakia, the “shock therapy” has affected the economy and the quality of people’s lives. These countries have gone through transformational crises that have manifested themselves in declining industrial production, rising inflation, declining real incomes and the purchasing power of money. For example, the Czech Republic and Lithuania have opted for rapid privatization. In these countries the privatization process took place in only four years, 1991-1996 (Spicer et al., 2000). Romania and Hungary have opted for a gradual privatization process, carried out from close to close. Economic instability was, according to Spicer et al. (2000), more pronounced in Poland, lower in the Czech Republic, Slovakia and Hungary, while Romania and Bulgaria are in an intermediate

position. The Czech Republic, Hungary, Poland and later Slovakia and Hungary reduced the secondary sector and successfully developed the tertiary sector. Romania and Bulgaria have counterbalanced the contraction of industry with a slight expansion of agriculture (Zanewska and Mickiewicz, 2006). Croatia and Slovenia enjoyed favorable initial conditions due to a low degree of centralization prior to their transition period. The Czech Republic, Slovakia, Poland, Hungary, Estonia, Lithuania and Latvia have managed to complete the transition period ahead of other European states. Dabrowski (1995) considers Poland to be the European leader in the reform process, seconded by Slovenia.

An analysis of GDP per capita in the EU conducted by Haller (2020) confirms the aspects already mentioned but also the results of this research. The European average GDP increased 2.4 times in the period 1980-2016. Croatia, Czech Republic, Hungary, Romania, Latvia, Lithuania and Slovenia have managed to increase the value of GDP per capita more than twice but below the European average. The only countries on the European periphery that have managed to outperform the average European performance are Estonia, Poland and Slovakia. Developed countries, in their dynamism, maintain the economic gaps on European territory. Thus, we were interested in the extent to which in the future there is the possibility of reducing economic discrepancies in *caeteribus paribus* conditions.

Along the forecast horizon, in the context of an ascendant GDP per capita, the gaps between the groups of EU28 member states grow deeper. A relative convergence is maintained within each group of growth. The largest gaps will be recorded between the first (A) and the last (C) group of development. Considering the first group, including the countries with a significant GDP per capita growth, which is specific to high-speed European states, as a dynamic group, economic divergence is justified even under the circumstances of a rise of GDP per capita value for the Member States of group B and C (Figure 1).

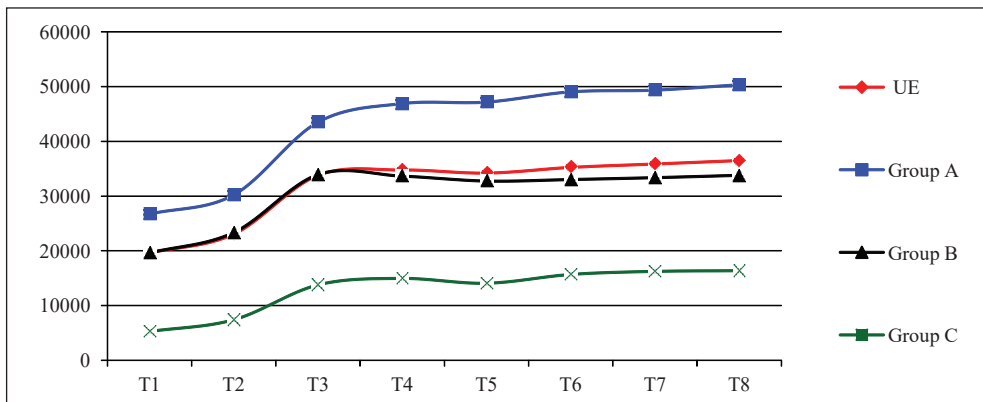
Figure 1: Evolution of GDP per capita over the time horizon known and forecast, in the Member States



Source: Author's calculations

The average GDP per capita for each of the three European growth groups is presented in Figure 2. Group B loses 2.3 pp (during the 12 forecasted years) from the differences in the GDP per capita value compared to group A, which demonstrates a slowdown in the convergence process between group B and group A states. Group C recovers (during the 12 forecasted years) from the differences in the GDP per capita value compared to group A and B, with 5.45 pp, respectively 2.7 pp.

Figure 2: Evolution of average GDP per capita over the time horizon known and forecast, groups of Member States



Source: author's calculations

The GDP per capita growth from T5 to T6 for the Group A countries was higher because, besides the fact that these are solid economies which, through the policies and measures adopted have more easily faced the challenges created by the recent economic and financial crisis, they also recorded high values of labor productivity by increasing the participation in the labor market, both of the native population, as well as by the presence of workers from abroad.

Uncertainties about Britain's position in the European Union after Brexit have led a significant number of companies to move their UK headquarters to some Group A countries, as a possible basis for the European market, which has contributed to their GDP growth.

The simulation using Markov chains is illustrative for how development gaps within EU28 (+1) intensify by 2028. The fuzzy analysis starts from a known horizon, during which the global and the national economies crossed the most serious crisis of the 2000s, a period of many economic and social challenges for most of the Member States.

Luxembourg will remain, in the next three decades, the European state with the best economic results reflected in the GDP per capita value. Ireland remains one of the leader countries, with an economic growth much beyond the level of the other members. The forecast reveals that in 2028 the GDP per capita value for this country will be 3 times bigger than at the beginning of the period considered. According to the Markov chain forecast, in some Western and Northern European countries, GDP per capita will increase 3-4 times, compared with the beginning of the period.

Another group of states is made of those members whose GDP per capita will be double or will at least increase in 2028 compared to the beginning of the forecast period. We forecast that Austria, Belgium and Spain France will manage to go on a positive trend without reaching the results of the states from the first group, doubling the value of GDP per capita. Malta, Poland, Slovenia, Hungary, Czech Republic and Croatia will be able to increase the GDP per capita value, reaching triple values compared to the forecast starting year; they are buffer-states between the periphery and the rest of the European states.

The third group of states is made up of Estonia, Lithuania, the Czech Republic, Latvia, Romania and Bulgaria.

Following the forecast with Markov chains, we find out that the EU28 periphery in 2028 will be somehow different, as the Slovak Republic, Estonia, Czech Republic, Latvia, Lithuania, Croatia and Hungary will manage to go towards the center, reaching a higher convergence degree, Slovenia, Greece, Romania and Bulgaria will preserve their status of peripheral European countries.

The average economic growth of EU28 will be modest in 2028. The GDP per capita of EU28 will rise at the end of the forecasted period by less than 1% compared to 2016. The forecast reflects clearly that inside the EU, the gaps will not disappear and they will even intensify in the periphery, especially in the case of countries such as Romania and Bulgaria and the accession of other countries of the former Yugoslavia.

Comparative analysis of the forecast made by using Markov chains indicates that in 2028, economies such as Italy, Spain, Malta, Cyprus, Greece, Estonia, Lithuania, Slovenia, the Czech Republic, Latvia, Hungary, Croatia, Romania and Bulgaria will record values of GDP/capita under the average of EU28. The only states from the *old* periphery that have chances to converge economically with the European mean will be Czech Republic and Slovakia. The rest of the states from the *old* periphery and especially those of the *new* periphery, particularly Bulgaria and Romania, will maintain significant gaps compared to the European average, especially the latter.

The core of the EU28 economic growth will record high rhythms of GDP per capita. Luxembourg will remain, compared to the other Member States, the country with the highest rate; the only states with a higher growth rhythm will be Germany and UK. The most significant gaps favoring Luxembourg can be noticed in relation to the peripheral and to the buffer states: Romania, Bulgaria, Latvia, Estonia, Lithuania, Greece and the Czech Republic. In the case of the *new* periphery, the gaps to Luxembourg will intensify in the horizon of the years 2028, an aspect noticed in the analysis using Markov chains, especially in the case of Bulgaria and especially of Romania.

If we refer to Ireland, Denmark, Sweden and Finland, we see that these countries have a positive economic evolution compared with other states. We notice the maintenance of the gaps between the old and new periphery. For Central and Eastern Europe it will be hard to reduce the economic growth gaps compared to countries like the ones we mentioned. The Danish economy will progress in tandem with the average growth rate of EU28, Sweden will record a higher economic growth than the majority of the Member States, Ireland will have a positive evolution compared to some countries such as Cyprus, Lithuania, Poland, Greece, Hungary, Croatia, Romania and Bulgaria, and Finland will have a growth rate slightly higher than the EU28 average. This group of countries is developed, with superior economic performances to other Member States, focused on services in high-tech, life science, finance, foreign direct investment flows (Ireland), on services and foreign trade (Finland), on high level of government services and foreign trade (Denmark and Sweden). The growth projections of OECD (2020) show that economy of this group of countries will recover in 2021 and expand in 2022. Ireland's economy will grow in 2022 at over 4% based on investments, domestic demand and public sector support. The economy of Finland will expand by around 1.5% in 2021 and 1.75% in 2022 based on investments. The Danish economy growth will be gradual

of nearly 2% in 2021 and 2.5% in 2020 and the Swedish economy is expected to expand by 3.3% both in 2021 and 2022. These projections of OECD (2020) made after our forecast come to support our results even if our analysis did not anticipate such a risk as that of 2020.

Netherlands, Austria, Belgium, UK belong to another group of European countries. In the case of Netherlands we notice progress in gaps reduction in the cases of Czech Republic, Latvia, Lithuania and Slovak Republic. The growth rate of Austria and Belgium will be higher than the EU28 average and higher than that of many other Member States. Even so, Greece and the Slovak Republic will manage to converge economically with Austria and Latvia, and the Czech Republic and the Slovak Republic with Belgium. The entire new periphery will remain divergent economically to Belgium. UK's economic growth is forecasted to be much beyond the EU28 average and over the majority of the Member States. Again, we discuss about countries with very good economic performances. Netherlands has an economy based on foreign trade and one of the highest-earning nation in the world. Austria has one of the richest economy in the world in terms of GDP with an increasing international competitiveness level and Belgium is a country with an excellent infrastructure and with an economy based on re-export that depends heavily on world trade. Regarding UK, this country has one of the largest economy in the world reported to nominal GDP, is one of the largest traders in the world and is based on foreign direct investments being dominated by the service sector. OECD (2020) made projections regarding this group of countries. Netherlands's GDP was set to fall by 4.6% in 2020, Austria's by 8%, Belgium's GDP by 7.5% and UK's GDP by 11.2%. OECD (2020) projects the rise of growth rate with 0.8% and 2.9% in 2021 and 2022 in the case of Netherlands, and a gradual rise below its pre-crisis level in the case of Austria. In the case of Belgium it is estimated a slow recovery starting with 2021 and UK will grow with a rate of 4.2% in 2021 and 4.1% in 2022. Moderate investments, consumption and public interventions will help these countries to revigorate.

Referring to so called Mediterranean countries, Italy, Spain, Malta, Cyprus, Greece and Portugal, our forecast shows, in Italy's case convergence with the more developed states and, at the same time, divergence with other economies; in the case of Spain only Czech Republic and Slovak Republic will economically converge with it and with Malta and Cyprus and, for Portugal and Greece the forecast reveal a lower growth than the developed European states. Italy is the third largest European country by nominal GDP and one of the largest in the world by exports, its well known for its tourists sector, like other Mediterranean countries, but even so, the country suffers from structural and non-structural problems. Spain is the fifth largest European country and, after the crisis in 2008, the Spain economy begun to recover, especially the labor market and labor productivity, the international trade because Spain significantly reduced imports and increased exports, and tourism.

Malta, Cyprus and Greece have a service and innovation based economy, especially Malta. In the case of Portugal, the economy has been steady but expanding continuously since 2014, with a continuous fall of the unemployment rate. For these group, OECD (2020) make positive projections. Italy, after falling sharply in 2020, will expand the economy with 4.3% in 2021 and with 3.2% in 2022 on the base of investments and exports and, in a very small extend on the job creation especially for the low-skilled women and youth. For Spain, GDP will grow by 5% in 2021 and 4% in 2022. In the case of Portugal, the fall in 2020 was by 8.4% but, starting with 2021, the recovery will be by 1.7% and 1.9% in 2022. The economy of Greece will contract with 10% in 2020 and the recovery will be gradual, based on services, exports, employment and investment. For this country, the projection for 2022 predicts an accelerated growth. In the cases of Malta and Cyprus we have no predictions from OECD. It is seen that OECD projections sustain our findings in the case of Mediterranean countries.

If we take in consideration Germany and France, the leading drivers of European economy, a part of European states will record an economic convergence with them but not the peripheral ones. No country from the old and the new periphery will manage to reduce growth gaps to Germany, while the biggest differences will be seen in Romania and Bulgaria's cases. Germany is one of the largest exporters in the world and has a well developed service sector but also Germany is one of the largest manufacturing economy globally. At its turn, France is the second European engine. Its economy will grow by a higher speed than the peripheral states, except Czech Republic and Slovak Republic which will follow a convergence process with the former economy. The new periphery will maintain or will accentuate the economic divergence with France, while Bulgaria and Romania will be characterized by chronic gaps. France has a diversified economy dominated by service sector and is the fifth largest trading economy in the world and the second in Europe after Germany. Also it is the third European manufacturing European country after Germany and Italy. In the case of these two leading countries we notice the contraction of GDP in 2020 but the projections of OECD (2020) show the ascending cadence starting with 2021. The German economy will contract by 5.5% in 2020 because of falling of private consumption, business investment and exports. In 2021, growth will be by 2.8% and in 2022 by 3.3% on the base of a rapid rise of consumption and exports. In the case of France, the fall will be by 9.1% in 2020 but the economy will expand by 6% in 2021 and 3.3% in 2022. We see that these results of OECD sustain our forecast.

The last group to which we refer consists of the states that represent the center of interest for our analysis: Czech and Slovak republic with the highest chances of convergence, Estonia, Poland, Slovenia, Latvia, Lithuania, Hungary, Croatia, Bulgaria and Romania. Estonia and Lithuania are countries with a lower growth than the European average. Poland is the country of the Central and Eastern Europe with the most spectacular economic evolution. The change of system took place

in about the same period as the other former socialist states of Europe. The GDP per capita value in 2016 places it in the group of states with an average speed of growth, without being a peripheral state. The forecast made by 2028 demonstrates Poland's capability to reach economic convergence with most of the Member States, while gaps are maintained with the developed European countries. At the end of the forecast period, Poland will record a GDP per capita value well below the EU28 average. Slovenia, a country of the *old* periphery, will undergo a process of convergence able to help the economy go beyond the status of peripheral country, but the gaps with most of the Member States will remain, including with the EU28 average. For Slovenia, the forecast shows GDP per capita values higher than Estonia, Lithuania, the Czech Republic, Croatia, Bulgaria and Romania. Latvia and Slovakia will preserve gaps with the developed Member States but, in their turn, will let behind them states from the periphery, especially Romania. Latvia will maintain gaps with most the European states, even if at a low level, with a GDP per capita value under the EU28 average. In the case of Hungary, a country of the *old* and *new* periphery, the process of convergence consists in a large gap in relation to most of the European states, including in relation to the EU28 average. Between Romania and Hungary, the gaps will be accentuated. Croatia will record a GDP per capita value under the EU28 average and the average of the developed states. The largest gaps will be those between the Croatian and the Romanian economies, in favor of the former. Bulgaria, a country whose economy evolved in tandem with Romania's economy and situated in a territorial proximity, will easily detach itself from Romania by its economic growth results. From the description of these economies we notice the progress that all have made especially after the accession to EU. Czech's economy is export oriented, based on services, manufactures and innovation, with an industrial sector that accounts 37.5% of GDP, while services accounts 60% of GDP. The growth of the country is focus on research and development, software and nanotechnology, among others. The GDP of Slovakia grew strongly after from 2000 and 2008 based on foreign direct investment, on skilled labor and on services. Estonia has an economy heavily influenced by the developments of the Finnish and Swedish economies, Lithuania has the largest economy among the Baltic states, Latvia has an economy based on service sector and a strong export sector, Slovenia has a service based economy, Poland is the country with the most remarkable performances among the former Eastern Bloc, Hungary has an export oriented economy, with a high accent on foreign trade, Croatia has one of the strongest economies in Southeast Europe where tourism is an important contributor to GDP and Bulgaria and Romania have, despite all the difficulties which they faced, made economic progresses, Romania being a leading destination in Central and Eastern Europe for foreign direct investment. However, these two countries are failing to catch up, especially with European developed economies at a sufficiently high level as they would like. For all group of countries, OECD (2020) projected the fall of growth rate in 2020 and the recovery after. The fall is set like it follows: 6.8% for Czech Republic, 6.3% for Slovak republic, 4.7%

for Estonia, a relatively mild contraction for Lithuania, 4.3% for Latvia, 7.5% for Slovenia, 3.5% for Poland, 5.7% for Hungary, 4.1% for Bulgaria and 5.3% for Romania. Starting with 2021 and 2022 the recovery of growth will be slowly for Czech Republic, around 2.7% and 4.4% for Slovak Republic, by 3.4% and 3.3% in 2022 for Estonia, by 3% in both 2021 and 2022 for Lithuania, by 2.4% and 4% for Latvia, 3.4% in average for Slovenia and in this case the growth will be based on investments and exports, by 2.9% and 3.8% for Poland, by 3% in average for Hungary, 3.3% and 3.7% for Bulgaria and 2% and 4.4% for Romania. If we take into account the estimations of OECD (2020) they support those of our study even if the analysis we made did not start from the idea of a such risk like current crisis. Our analysis and the OECD (2020) one are projections based on different hypotheses. These may or may not come true like any probability. Our predictions start from the premise that all conditions before 2020 remain constant because it was achieved before the Covid-19 crises, and that of OECD starts from the reality of the year 2020. Although statistics prove the strong economic and social impact of the Covid-19 crisis. Both forecasts provide the ability of the European economies to recover. Both results show that developed economies have a higher capacity for recovery compared to less developed ones, which certainly puts the new periphery in an inferior position but demonstrates the ability of all European states to resume growth in a short period of time maintaining the gaps between them.

Romania is a particular case. The forecast using Markov chains presents a country which, in the long run, will undergo a convergence process so slow that the growth gaps not only will not be reduced, but will be significantly intensified. Practically, in the 2028 horizon, Romania will record the largest growth gaps compared to the rest of the European Member States. The GDP per capita values in the period 1997-2016 (20 years, first 5 groups) are according to Table 3.

Table 3: GDP per capita values for Romania in the period 1997-2016

(dollars per capita)

Year	GDP/capita	Year	GDP/capita	Year	GDP/capita	Year	GDP/capita	Year	GDP/capita
1997	1589,01	2001	1839,73	2005	4676,32	2009	8220,11	2013	9585,27
1998	1864,99	2002	2124,87	2006	5828,75	2010	8297,48	2014	10020,28
1999	1610,13	2003	2774,96	2007	8214,19	2011	9200,28	2015	8978,39
2000	1668,16	2004	3552,92	2008	10136,47	2012	8558,40	2016	9519,88

Source: <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>

In the known horizon, the GDP per capita value increased about 6 times, but this proved not to be a guarantee for a real convergence in the long run. Romania's economic delay is and will be caused by a bundle of factors such as, for instance: the little evolved socio-economic structure; one of the most numerous rural populations

in Europe (Boia, 2012); political instability; a more and more numerically reduced elite with no decision-taking power; expired educational and medical systems; a diminished cult of work compared to other societies (Haller, 2011); a need to learn and to borrow knowledge from abroad, to always be in the others' "trailer"; as a EU member, Romania proves to be a rather mediocre entity, with no personality or initiatives, accepting what the others decide, being a fragmented, atomized country that does not manage to identify its own profile, maybe because it does not have one (2011). Making an analogy with what Thomas Friedman (2008), considered to be the objective of the developing countries, Romania is searching for comfort for a larger and larger part of its population, while being incapable of providing it in the next 30 years, even if social inequality is, on the whole, immoral and unjustified. Romania is one of the developing countries whose growth is mainly supported by its natural sources (McNabb and Le May-Boucher, 2014), and consumption, factors which are generally unsustainable, as shows the forecast using Markov chains.

The forecast for the next 12 years (2017-2028) reveal the economic convergence of the European states, but this is not harmonious, it does not reveal a whole, and not the same rhythm. EU28 will continue to evolve to different speeds. There will be situations in which convergence will be so slow that it will be negligible. At the horizon of the year 2028, the periphery will suffer modifications in the sense of its reduction, as the Czech Republic and the Slovak Republic will go out, managing to converge with most of the developed Member States. The Slovak Republic, Latvia, Hungary, Croatia will progress towards the center, following a process of convergence, without reducing significantly the gaps with all developed states. The leader European countries remain Luxembourg, Ireland, Germany and UK while those with the lowest results (convergence very low) remain Bulgaria and Romania. Romania will be the Member State with the poorest perspectives to reduce growth gaps. It will not only stay in the periphery group, but the economic convergence will be so slow, that gaps will intensify significantly, according to the forecast using Markov chains, including in relation with Bulgaria, though this is in its turn a peripheral country.

5. Results and discussion

Sustainability is a broad concept applied to a wide range of situations, in very different contexts, whose main feature is its long-term manifestation. The temporary component of sustainability resides in its dynamics during the production and consumption processes. As the effects of production and consumption on the environment and ecosystem manifest themselves over time, we characterize growth and implicitly development as sustainable after a gap between the moment of production and consumption and that of the actual manifestation of effects. Growth is the effect of industrialization and we notice the time elapsed between

the moment of the first industrial revolution and the manifestation of the negative effects of industrialization. For this simple reason, we must ensure a long-term, sustainable growth. Globally, efforts are being made to ensure the growth of prosperity in a sustainable way, so that the growth will take place in tandem with good resource management. Sustainability, in the long term, will be achieved as the main objective, as risks such as climate change, limited resource manager, hunger, poverty, income inequalities, urbanization, crises, will be diminished if not even eradicated. Sustainability is, without a doubt, a concept that refers to a dynamic movement in time of economic and social processes, including economic growth. This is the reason why an analysis of the economic growth implies a vision of perspective in the medium to long and even very long term. The growth, in the long and very long term, will only be sustainable so that the associated risks will not increase in intensity and their effects can no longer be managed.

The analysis using Markov chains shows that a process of convergence will take place inside each of the groups. All the EU28 Member States will progress with very different speeds, so that they will be situated on convergent or divergent trends in relation to the developed economies, to the European average, and to each other. A significantly divergent trend is noticed in the case of the peripheral countries, which will affect even the average economic growth of EU28. If between the groups A and B we forecast a reduction of the growth gaps (convergence), between the groups C and B and C and A, they will grow slightly larger in the first case, and more significantly larger in the second (divergence).

In the paper we showed that, despite the constant efforts made by the states in group B and C, the gaps between European countries are maintained. Although we have the evidence of nominal convergence, the gaps remain, mainly for the peripheral states. We have noticed that the countries in group B also continue to be below the average of European performance. This aspect demonstrates that the economic redundancy exists despite some economic developments. We note the lack of the long-term growth sustainability in the case of some European countries namely from our group C. This leads us to the conclusion that, following the ascension to the European Union, the recommended economic recipe for these countries was not fully efficient or the internal obstacles for its correct application are far too great to be successfully escalated. In this context, having the scientific proof of maintaining the European development gaps between the periphery and the center on the background of a slight convergence, we see and recommend that the solutions to be found in the application of economic policy measures. The model applied by Poland and Hungary appear as a plausible solution. It becomes necessary for each of the peripheral states to reevaluate their own comparative and competitive advantages. Also, to reevaluate its full economic and social potential. If these states seek to achieve a real convergence, not just a nominal one, they must reduce their external dependence on two paths. One that targets economic policy measures.

One that targets the economy and society. The first path involves the adoption of realistic and effective cyclical and structural policies. Strengthening the secondary sectors, increasing internal and external competitiveness are desirable objectives for achieving real convergence. The efficiency of export production is possible only by increasing the external competitiveness and selling abroad products with high added value. Investment policy plays an important role in the convergence process. The priority given to domestic investments, the support given to investors and the stimulation of the innovational process also contribute to the possibility of narrowing the center-periphery distance. An important economic issue for helping or hindering the sustainable growth in the future is the energy security and the use of renewable resources and this is a big challenge for some European states.

The economic reality of each country is complex and hence the difficulty of applying common measures. The same complexity keeps us from formulating a unique recommendation with the pretension of being efficient. For each of the groups B and C countries, once scientifically confirmed, the existence of gaps between them and European center becomes important for the analysis of its own situation, following that this will determine the framework for taking adequate measures.

Our research is a general one on the evolution of European economic growth in the medium term. We notice the maintenance of some economic nature problems without being able to determine the causality in each case or at the level of a specific analyzed group. The paper is a basis for future research to analyze the evolution of macro indicators in relation to certain influencing factors. Even so, the complexity of the phenomenon would still leave many aspects uncovered. We noticed that, despite a nominal convergence, the real one is expected in time. In the medium term, some European countries continue to lag behind others in terms of economic progress. Each of the analyzed countries must find the cause of this situation and improve its economic and social situation through particular economic policy measures.

The paper confirms the results of studies such as those of Iancu (2009), Smętkowski and Wójcik (2010), Haller (2020) and others. We showed in the paper that the peripheral European states, in caeteris paribus conditions, have the capacity of economic nominal convergence. However, there are countries that won't be able to close the development gaps and these will increase. The paper completes the specialized literature and brings the novelty of the grouping of European states according to other criteria than the classical ones, namely that of the periphery. We used a less common methodology in similar studies to be able to draw conclusions with forecasting titles. Of course, there are limits of research. Some have to do with the time interval researched, others with the methodology, others with the criteria for classifying the states in the focus group. Orientation to other temporary intervals, especially future ones, the use of another methodology, other macro indicators or variables analyzed may lead to results that contradict or support those obtained in this research.

Even the resuming of the methodological process only by extending the temporary horizon after 2020 can be surprising by results.

We consider the conclusions of research valuable through their usefulness. Not only do they strengthen the results of other scientific approaches but they also provide a theoretical basis for future research but also an inspirational basis for making macroeconomic decisions for the development of European states, especially in Central and Eastern Europe.

Starting from the research results, we found that, in the medium term, the gaps in the European perimeter are not reduced. They will be maintained and even accentuated. The research draws attention to the fact that there are problems that persist for at least the next 8 years. Additional analyzes are needed in which a complex of variables is linked in order to be able, in each case, to partially determine the causality of the lack of real convergence. This allows the development of concrete solutions.

6. Conclusions

In the present research we started from the hypothesis that, in the period 1997-2016, the European countries, especially the ones from Central and Eastern Europe, went through a period of economic growth, and the trend will be maintained in the future with the specification that development gaps will be continuously reduced. In this sense, we have made a forecast until 2028 with the help of Markov chains.

The results we have reached show that this group of states has gone through a process of nominal convergence but not through a process of real convergence. This last aspect is demonstrated by the existence and maintenance of gaps between the periphery and the center formed by the developed economies of EU. The hypothesis that by 2028 the less developed European countries will reduce the gaps compared to the developed ones is refuted. European convergence is slow and, in the case of some countries we have classified in the category of peripheral ones, by emulation. This shows the existence and maintenance of economic dysfunctions and draws attention to the fact that they must be notified and resolved. The results of the research show that the change of the economic system, although it might be beneficial, did not attract the desired effects in economic and social field. Even though remarkable progress has been made, the economies of the former communist states have failed to provide their population with a standard of living comparable to that of developed European countries. And this inability will continue, at least until 2028. According to Mill's paradox, there were expectations of spectacular leaps in the economic evolution of some European states. We have shown that this not only has not happened but will not happen in the short and medium term. Through our analysis we noticed that, on a positive growth trend, the gaps will be maintained. We have opened the way to find the causes of this situation that can differ substantially from country to country.

Future research, based on other methodologies, variables, time periods will further clarify the causal aspects. Future research based on Markov chains but on other period of time will demonstrate the correctness of the present scientific approach. Our analysis signals the non-fulfilment of a major objective of some European states, to align in terms of the conditions offered to the population with developed countries, which will be maintained over time. We also recommend rethinking the strategic mix and economic policy measures in the case of each country in relation to specific economic and social conditions.

References

- Abbasov, A.M., Mamedova, M.H. (2003) "Application of Fuzzy Time Series to Population Forecasting", *Vienna University of Technology* 2003, Issue 1, pp. 545–552, Available at: <<http://papers.cumincad.org/data/works/att/50b1.content.pdf>> [Accessed: May 3, 2019].
- Ådnanes, M. (2007) "Social transition and anomie among post-communist Bulgarian Youth", *Young*, Vol. 15, No. 1, pp. 49–69, doi: 10.1177/1103308807072684. [Accessed: November 3, 2020].
- Alfaro, L. et al. (2010) "Does Foreign Direct Investment Promote Growth? Exploring the Role of Financial Markets on Linkages", *Journal of Development Economics*, Vol. 91, pp. 242–256, Available at: <<http://econweb.umd.edu/~kalemli/assets/publications/foreign2010jde.pdf>> [Accessed: May 27, 2019].
- Anas, J. et al. (2004) "Business Cycle Analysis with Multivariate Markov Switching Models. Growth and Cycle in the Eurozone 2004", pp. 249–260, Available at: <<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.198.9647&rep=rep1&type=pdf>> [Accessed: May 2, 2019].
- Andolfatto, D. (2008) *Macroeconomic Theory and Policy*, 2nd ed.; Simon Fraser University, Available at: <https://mpra.ub.uni-muenchen.de/6403/1/MPRA_paper_6403.pdf> [Accessed: on 23 April 23, 2019)].
- Angelescu, C., Socol, C. (2005) *Politici economice*, Bucharest: Economic Publishing.
- Angelini, E., Camba-Mendez, G., Giannone, D., Reichlin, L., Rünstler, G. (2011). "Short-Term Forecasts of Euro Area GDP Growth", *Econometrics Journal*, Vol. 4, pp. C25–C44, Available at: <<https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp949.pdf?c0247f2d41bf052a82b2a910265528a0>> [Accessed: June 14, 2019].
- Angelini, E., et al. (2011) "Short-Term Forecasts of Euro Area GDP Growth", *The Econometrics Journal*, Vol. 14, No. 1, pp. C25–C44, Available at: <<https://www.jstor.org/stable/23127215?seq=1>> [Accessed: April 28, 2019].

- Ardielli, E. (2016) "Implementation of Good Governance Concept in the European Union Member Countries", *Proceedings of the 3rd International Conference of European Integration*, Ostrava, Czech Republic, May 19-20, Available at: <https://www.researchgate.net/profile/Magdalena_Zajackowska/publication/308360506_Threats_and_Challenges_to_EU_Energy_Security/links/57e1f13508ae9e25307d4da8/Threats-and-Challenges-to-EU-Energy-Security.pdf#page=29> [Accessed: June 11, 2019].
- Barro, R.J. (1991) "Economic growth in a cross-section of countries", *Quarterly Journal of Economics*, Vol. 106, No. 2, pp. 407–443, Available at: <<http://piketty.pse.ens.fr/files/Barro91.pdf>> [Accessed: November 25, 2020].
- Barro, R.J., Sala-i-Martin, X. (1992) "Convergence", *Journal of Political Economy*. Vol. 100, No. 2, pp. 223–251, Available at: <https://dash.harvard.edu/bitstream/handle/1/3451299/Barro_Convergence.pdf> [Accessed: November 25, 2020].
- Baumol, W.J. (1986) "Productivity Growth, Convergence, and Welfare: What the Long-Run Data Show", *American Economic Review*, Vol. 76, No. 5, pp. 1072–1085, Available at: <<http://piketty.pse.ens.fr/files/Baumol1986.pdf>> [Accessed: November 25, 2020].
- Beggs, J. (2019) *Understanding the Impact of Growth Rate Differences*, May 23, Available at: <<https://www.thoughtco.com/economic-growth-and-the-rule-of-70-1147521>> [Accessed: June 8, 2019].
- Berg, A., Ostry, D.J., Zettelmeyer, J. (2012) "What Makes Growth Sustained?", *Journal of Development Economics*, Vol. 98, No. 2, pp. 149–166, Available at: <<https://ideas.repec.org/a/eee/deveco/v98y2012i2p149-166.html>> [Accessed: May 27, 2019].
- Boia, L. (2012) *Why is Romania different?* Bucharest: Humanitas Publisher
- Cheshire, P., Magrini, S. (2000) "Endogenous Processes in European Regional Growth: Convergence and Policy", *Growth Change – Proceeding of 2nd Workshop on Endogenous Growth: Models and Regional Policy*, Amsterdam, Netherlands, Feb 1999; WILEY: Hoboken, USA, Vol. 31, No. 4, pp. 455–479, <https://doi.org/10.1111/0017-4815.00140>.
- D'Ergole, M.M., Salvini, A. (2003) "Towards sustainable development: the role of social protection", *OECD Social, Employment and Migration Working Papers*, No. 12, Available at: <<http://www.oecd.org/social/soc/16362056.pdf>> [Accessed: May 21, 2019].
- Dabrowski, M. (1995) "Western Aid Conditionality and the Post-Communist Transition", *CASE Network Studies and Analyses*, Vol. 37, <http://dx.doi.org/10.2139/ssrn.1479560>.
- Davis, S.L. (2010) "Institutional Flexibility and Economic Growth", *Journal of Comparative Economics*, Vol. 38, No 3, pp. 306–320, Available at: <<https://ideas.repec.org/a/eee/jcecon/v38y2010i3p306-320.html>> [Accessed: May 26, 2019].

- Eicher, S. T., Schreiber, T. (2010) "Structural Policies and Growth: Time Series Evidence from a Natural Experiment", *Journal of Development Economics*, Vol. 91, No. 1, pp. 169–179, Available at: <<https://ideas.repec.org/a/eee/deveco/v91y2010i1p169-179.html>> [Accessed: May 26, 2019].
- Estrin, S., Mickiewicz, T. (2010) "Entrepreneurship in Transition Economies: The Role of Institutions and Generational Change", *IZA Discussion Paper*, No. 4805, pp. 1–43, Available at: <<http://ftp.iza.org/dp4805.pdf>> [Accessed: November 3, 2020].
- European Commission (2018) *European Economic Forecast*, Institutional Paper 089, Available at: <https://ec.europa.eu/info/sites/info/files/economy-finance/ip089_en_0.pdf> [Accessed: on 18 May 18, 2019].
- Fingleton, B. (1997) "Specification and Testing of Markov Chain Models: An Application to Convergence in the European Union", *Oxford Bulletin of Economics and Statistics*, Vol. 59, No. 3, pp. 385–403, Available at: <<https://ideas.repec.org/a/bla/obuest/v59y1997i3p385-403.html>> [Accessed: May 3, 2019].
- Fontaine, P. (2010) *Europe in 12 Lessons*, Luxembourg: European Commission, Available at: <https://europa.rs/images/publikacije/26-EU_In_12_Lessons.pdf> [Accessed: June 11, 2019].
- Friedman, T. (2008) *Hot, Flat, and Crowded: Why We Need a Green Revolution and How It Can Renew America*; New York: Farrar, Straus and Giroux.
- Gherasim, O., (2008) "Fuzzy Models in Decision-Making", *Proceedings of International Conference on Computational Intelligence for Modelling, Control and Automation*, Vienna, Austria, Dec 10-12, pp. 958–962.
- Haller, A.P. (2011) "Exports in the Knowledge-Based Economy. Romania's Case", *Management of technological changes*, Book 1, Proceedings of the 7th International Conference Management and Technological Changes, Alexandroupoli, Greece, September 01-03, 2011, Democritus Univ Thrace: Komotini, Greece, pp. 513-516, Available at: <https://www.researchgate.net/publication/309577886_EXPORTS_IN_THE_KNOWLEDGE-BASED_ECONOMY_ROMANIA'S_CASE> [Accessed: June 13, 2019].
- Haller, A.P. (2020) "From Classical and Neoclassical Economic Growth to Degrowth in Europe. Challenges for Public Administration", *Administrație și Management Public*, Vol. 34, pp. 150–170, <https://doi.org/10.24818/amp/2020.34-9>.
- Havrylyshyn, O., Meng, X., Tupy, M. (2016) "25 years of reforms in ex-Communist countries: fast and extensive reforms led to higher growth and more political freedom", *Cato Institute Policy Analysis*, Policy Analysis No. 795, Available at: <<https://www.cato.org/publications/policy-analysis/25-years-reforms-ex-communist-countries-fast-extensive-reforms-led>> [Accessed: November 3, 2020].

- Herman, D. (2015) *Economics for a Full World. Great Transition Initiative. Toward Transformative Vision and Praxis*, Available at: <<https://greattransition.org/images/Daly-Economics-for-a-Full-World.pdf>> [Accessed: March 18, 2019].
- Iancu, A. (2009) *Convergenta reala*, Bucharest: NIER-CIDE, Available at: <<http://www.studii-economice.ro/2009/seince090701.pdf>> [Accessed: March 11, 2019].
- IMF (2017) *World Economic Outlook: Seeking Sustainable Growth, Short-Term Recovery, Long-Term Challenges*, Available at: <<https://www.imf.org/en/Publications/WEO/Issues/2017/09/19/world-economic-outlook-october-2017>> [Accessed: April 28, 2019].
- INS (2019) Available at: <<https://insse.ro/cms/>> [Accessed: April 28, 2019].
- Kireyev, A., Chen, J. (2017) *Inclusive Growth Framework*, IMF WP/17/127, Available at: <<https://www.imf.org/en/Publications/WP/Issues/2017/05/30/Inclusive-Growth-Framework-44951>> [Accessed: on 18 May 18, 2019].
- Kooros, S., Badeaux, L. (2007) “Economic Development Planning Models: A Comparative Assessment”, *International Research Journal of Finance and Economics*, Vol. 77, No. 7, pp. 120–140, Available at: <<https://www.rrojasdatabank.info/ecdevplanningmodels07.pdf>> [Accessed: April 28, 2019].
- Korten, D. (2010) *Agenda for a New Economy: From Phantom Wealth to Real Wealth*, Second Edition, Oakland: Berrett-Koehler Publishers.
- Le Gallo, J. (2004) “Space-time analysis of GDP disparities among European regions: a Markov chains approach”, *International Regional Science Review*, Vol. 27, No. 2, pp 138–163, Available at: <<https://journals.sagepub.com/doi/abs/10.1177/0160017603262402>> [Accessed: June 11, 2019].
- Lipták, K. (2012) “The Application of Markov Chain Model to the Description of Hungarian Market Processes”, *Zarządzanie Publiczne*, Vol. 4, No. 16, pp. 133–149, Available at: <<http://www.ejournals.eu/sj/index.php/ZP/article/view/1524>> [Accessed: June 14, 2019].
- London-Lane, J., Robertson, P. (2009) “Long Run Growth in the OECD: A Test of the Parallel Growth Paths Hypothesis”, *Explorations in Economic History*, Vol. 46, No. 3, pp. 346–355, Available at: <<https://doi.org/10.1016/j.eeh.2009.04.003>> [Accessed: May 10, 2019].
- McNabb, K., Le May-Boucher, P. (2014) “Tax Structures, Economic Growth and Development”, *ICTD-International Centre for Tax and Development*, Working Paper 22, Available at: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2496470> [Accessed: 5 June 5, 2019].
- Monfort, P. (2008) “Convergence of EU Regions Measures and Evaluation”, *European Union Regional Policy*, No. 1, Available at: <https://ec.europa.eu/regional_policy/sources/docgener/work/200801_convergence.pdf> [Accessed: June 14, 2019].

- Moosavi, V., Isacchini, G. (2017) "A Markovian model of evolving world input-output network.", *PLOS ONE*, Vol. 12, No. 10, <https://doi.org/10.1371/journal.pone.0186746>.
- Nastase, A., et al (2019) "Statistical prediction using to forecast the theory of Markov chains", *Journal of Science and Arts*, Vol. 2, No. 47, pp. 415–424, Available at: <<https://search.proquest.com/openview/aad6d9bfef4ac7544d02d10553608d7f1?pq-origsite=gscholar&cbl=105793>> [Accessed: May 3, 2019].
- Nicolae-Bălan, M., (2009) "The Markovian Models Use to Study the Evolution of Some Macroeconomic Indicators", Purica I (coord.) *"Nonlinear Approaches to Economic Processes"*, Bucharest: Editura Expert.
- OECD (2020) Available at: <<http://www.oecd.org/economy>> [Accessed: December 29, 2020].
- Persson, T., Tabellini, G. (2013) "Is Inequality Harmful for Growth?", *American Economic Review*, Vol. 84, No. 3, pp. 600–621, Available at: <https://econpapers.repec.org/article/aeaarec/v_3a84_3ay_3a1994_3ai_3a3_3ap_3a600-621.htm> [Accessed: May 28, 2019].
- Ponzio, S., Di Gennaro, L. (2004) "Growth and Markov chains: An application to Italian provinces.", *Research in Economics: Aims and Methodologies*, Second PhD Conference in Economics, Pavia, Italy, Sept 23-25, pp. 23–25, Available at: <<https://www.semanticscholar.org/paper/GROWTH-AND-MARKOV-CHAINS-%3A-AN-APPLICATION-TO-Ponzio/0b41d6c8f63feb341d92001038a396e3c95d0ca0>> [Accessed: May 3, 2019].
- Quah, D. (1992) "Empirical Cross-Section Dynamics in Economic Growth", *European Economic Review*, Vol. 37, No. 2-3, pp. 426–434, [https://doi.org/10.1016/0014-2921\(93\)90031-5](https://doi.org/10.1016/0014-2921(93)90031-5)
- Quah, D. (1996) "Regional Convergence Clusters across Europe", *European Economic Review*, Proceeding of 10th Annual Congress of the European Economic Assoc, Prague, Czech Republic, Vol. 40, No. 3-5, pp. 951–958, [https://doi.org/10.1016/0014-2921\(95\)00105-0](https://doi.org/10.1016/0014-2921(95)00105-0).
- Rey, J.S. (2010) "Spatial Empirics for Economic Growth and Convergence", *Geographical Analysis*, Vol. 33, No. 3, pp. 195-214, <https://doi.org/10.1111/j.1538-4632.2001.tb00444.x>.
- Rodrik, D. (2007) "Industrial development: Some stylized facts and policy directions", *Industrial Development for the 21st Century: Sustainable Development Perspectives*, New York: United Nations, pp. 7–28, Available at: <https://sustainabledevelopment.un.org/content/documents/full_report.pdf> [Accessed: May 28, 2019].
- Rovelli, R., Zaiceva, A. (2013) "Dissupport for economic and political reforms increase during the post-communist transition, and if so, why?", *Economics of Transition*, Vol. 21, No. 2, pp. 193–240, <https://doi.org/10.1111/ecot.12009>.

- Rünstler, G., Sédillot, F. (2003) “Short-Term Estimates of Euro Area Real GDP by Means of Monthly Data.”, *ECB Working Paper*, No. 276, Available at: <<https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp276.pdf?ef693dab796b365f5625a07d2dfcc152>> [Accessed: May 3, 2019].
- Sbardella, A., Pugliese, E., Pietronero, L. (2017) “Economic development and wage inequality: A complex system analysis”, *PLOS ONE*, Vol. 12, No. 9, <https://doi.org/10.1371/journal.pone.0182774>.
- Sekreter, A. (2015) “What is the Truth? Financial Development Causes Economic Growth or Economic Growth Causes Financial Development”, *The Empirical Economics Letters*, Vol. 14, No. 12, pp. 1207–1214, Available at: <<https://www.econbiz.de/>> [Accessed: January 11, 2019].
- Sledge, I.J., Emigh, M.S., Príncipe, J.C. (2018) “Guided policy exploration for Markov decision processes using an uncertainty-based value-of-information criterion”, *IEEE Transactions on Neural Networks and Learning Systems*, Vol. 29, No. 6, pp. 2080–2098, doi:10.1109/TNNLS.2018.2812709.
- Sledge, I.J., Príncipe, J.C. (2019) “Reduction of Markov Chains Using a Value-of-Information-Based Approach”, *Entropy*, Vol. 21, No. 4, <https://doi.org/10.3390/e21040349>.
- Smętkowski, M., Wójcik, P. (2010) “Regional Development in Central and Eastern Europe”, *Regional and Local Studies*, Special Issue, pp. 77–106, Available at: <http://www.euroreg.uw.edu.pl/dane/web_euroreg_publications_files/422/2010_5_smetkowski_wojcik.pdf> [Accessed: May 19, 2019].
- Soloviev, V., Sapsin, V., Chabanenko, D. (2011) “Markov Chains Applications to the Financial-Economic Time Series Prediction.”, *Computer Modelling and New Technologies*, Vol. 15, No. 3, pp. 16–20, Available at: <http://elibrary.kdpu.edu.ua/jspui/bitstream/0564/1189/1/15_3-2_soloviev.pdf> [Accessed: June 14, 2019].
- Solow, R.M. (1956) “A contribution to the theory of economic growth”, *Quarterly Journal of Economics*, Vol. 70, pp. 65–94, Available at: <<http://piketty.pse.ens.fr/files/Solow1956.pdf>> [Accessed: November 25, 2020].
- Spicer, A., McDermott, G., Kogut, B. (2000) “Entrepreneurship and Privatization in Central Europe: The Tenuous Balance between Destruction and Creation”, *The Academy of Management Review*, Vol. 25, No. 3, pp. 630–649, Available at: <<https://www.jstor.org/stable/259315?seq=1>> doi: 10.2307/259315. [Accessed: November 3, 2020].
- Stiglitz, E.J. et al. (2014) “A Call for Change. From the Crisis to a New Egalitarian Ideal for Europe”, *Progressive Economy*, No. 3, Available at: <https://www.socialistsanddemocrats.eu/sites/default/files/PROGRESSIVE%20ECONOMY%20-%20A%20Call%20for%20Changes_EN_2.pdf> [Accessed: January 12, 2019].

- Sýkora, L., Bouzarovski, S. (2011) “Multiple transformations: Conceptualising the Post-Communist Urban Transition”, *Urban Studies*, Vol. 49, No. 1, pp. 43–60, <https://doi.org/10.1177/0042098010397402>.
- UNDP (2017) *UNDP’s Strategy for Inclusive and Sustainable Growth*, New York: UNDP. Available at: <<https://www.undp.org/content/dam/undp/library/Poverty%20Reduction/UNDPs%20Inclusive%20and%20Sustainable%20Growth-final.pdf>> [Accessed: April 20, 2019].
- World Bank (2017) *Global Outlook. A Fragile Recovery*, Available at: <<https://openknowledge.worldbank.org/bitstream/handle/10986/26800/9781464810244.pdf>> [Accessed: June 15, 2019].
- Zalewska, A., Mickiewicz, T.M. (2006) “Deindustrialisation: Lessons from the Structural Outcomes of Post-Communist Transition”, William Davidson Institute Working Paper 463, <http://dx.doi.org/10.2139/ssrn.311410>.
- Zhalezka, B., Navitskaya, K. (2015) “Multi-Criteria Fuzzy Analysis of Regional Development”, *Econtechmod. An International Quarterly Journal*, Vol. 4, No. 3, pp. 39-46, Available at: <<http://journals.pan.pl/dlibra/publication/99247/edition/85552/content>> [Accessed: June 14, 2019].

Srednjoročna prognoza europskog ekonomskog održivog rasta pomoću Markovljevih lanaca

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Sažetak

Gospodarski rast je s teorijskog i empirijskog stajališta često analizirani aspekt pod utjecajem faktora utjecaja, dok je pitanje gospodarskog rasta proučavano različitim metodama i s različitim rezultatima. U slučaju EU28, u svezi problema ekonomske konvergencije mora se uzeti u obzir činjenica da su države članice heterogene u pogledu razvoja i brzine rasta. U ovom radu, uz primjenu Markovljevih lanaca za gospodarstva država članica EU28 dana je prognoza razvoja BDP-a po stanovniku, počevši od poznatog vremenskog horizonta za period 1997. – 2016., s ciljem približavanja horizontu predviđanja za period 2017. – 2028. Dobiveni rezultati pokazuju da će proces konvergencije biti spor u slučaju nekih država članica, napose u zemljama Srednje i Istočne Europe. Buduća ekonomska dinamika intenzivirat će razlike u rastu, ponajprije u slučaju europske periferije, koja će pretrpjeti manje izmjene; države s najdubljim jazom ostat će Bugarska i Rumunjska.

Ključne riječi: ekonomski rast, Markovljevi lanci, srednjoročna prognoza, konvergencija, EU28

JEL klasifikacija: F43, N10, O11, O47, O52, R11

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The interdependence between stock market development and economic growth: a multi-country examination*

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Abstract

This paper attempts to test the relationship between economic growth and equity market development in GCC region which is the Cooperation Council for the Arab States of the Gulf, namely, Saudi Arabia, Bahrain, the United Arab Emirates, Oman, Kuwait and Qatar over the period of 2000 and 2017. The Generalized Linear Mixed Model (GLMM) is adopted to find the nexus and the nature of the relationship. Compared to the conventional regression models, GLMM provides a more reliable conclusion accounting for the missing data and eliminate the country specific differences. The study finds a significant positive association between stock market liquidity (SML) and per capita real gross domestic product (GDP) but insignificant negative association between stock market capitalization (SMC) and GDP in the long run. The results also indicate that SML and SMC are significantly and positively correlated. Considering well-performing stock markets

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can enhance the nation's wealth, reduce the over-dependence on oil as a major contributor to the economic growth, the results suggest that policy makers in the region ought to play more active role to stimulate their equity markets together with global integration.

Key words: *stock market development, economic growth, financial market, causality*

JEL classification: *G10, G20, O40*

1. Introduction

The long-run economic growth has been a subject of interest to researchers and economists since late 1880s. Different views have been developed overtime to arrive at explanations of what spurs economic activities. Economically, growth is caused by increase in the aggregate demand and supply. Factors such as lower interest rate, increased consumer spending, increased government spending and increased financial stability and confidence are vital to create healthier economy and achieve better standards of living. Research studies find many factors that may contribute to or stimulate economic growth. For example, financial development, banking sector development, financial inclusion, stock market development, innovation and entrepreneurship may stimulate economic growth in the long or short term. The level and direction of this impact may be affected by the type of economy in which the study is conducted.

Economic growth is the increase in market value of the products produced and services provided by an economy over time adjusted for real inflation. Traditionally, it has been defined as the increase in productivity from traditional factors of production such as, land, labor and capital (Epley, 2003). Within the theoretical context, the mercantilism perspective regarding economic growth defends the idea that accumulation of silver and trade surplus explain economic growth (Gaido, 2016). However, under the neo-classical theory, factor inputs, workforce and productivity are the main determinants of growth. The “neoclassical production theory” focuses on the production as a building block, where firms optimize their production function with some degree of factor substitution (Fanti and Manfredi, 2009). On the other hand, Nelson and Winter (1974: 901) find that ‘the sharp “growth accounting” split made within the neoclassical paradigm is bothersome empirically and conceptually’. Additionally, the neoclassical models find a level of convergence between countries as the poorer economies faster to grow than richer ones (Pietak, 2014). Whereas, the endogenous growth theory assumes that the economic growth is resulted by internal (endogenous) factors. “The main determinants of growth are: the innovation, imperfect competition, increasing returns to scale, externalities” (Popa, 2016: 241). According to Popa (2016) the endogenous growth theory holds that the technical progress includes: investments in physical capital (Romer model); investments in human capital (Lucas model);

investments in public capital (Barro model); investments in research and development (Romer model). Increase in physical capital, human capital, public capital and investment in R&D play an important role to spur economic growth. According to Pietak (2014), countries with high stock of human capital grow faster in the long run.

On the other hand, Keynes believes that an economy cannot keep full employment automatically. Keynesians advocate that government intervention is needed to maintain a full or reasonable level of employment and enhance economic growth. “Keynes and the quantity theorists neglected the relevance of free banking and, indeed, the availability of credit in its widest sense” (Steele, 1998: 496). Economic growth can be spurred by several factors. Within the academic research context, a financial system that successfully performs its financial functions would also contribute to the economic growth in the long run (Mercan and Gocer, 2013). The financial development- economic growth relationship has been controversial since the early work of Bagehot (1873) who discussed the importance of financial system to economic growth by facilitating the mobilization of capital and enhancing industrialization. This idea was extensively studied in literature in 1960s and 1970s (Patrick, 1966; Porter, 1966). On the other hand, as it was argued by Robinson (1962) that “where enterprise leads, finance follows”. Economic growth creates the need for financial innovations and the financial system responds to those needs by creating innovative financial arrangements and services. This argument was also supported by some early studies such as the study by Levine (1997).

Stock markets, as a major part of financial systems, are mechanisms to transform savings into financing for the real sector. From a theoretical perspective, it can accelerate economic growth by improving the quantity and quality of investments and by boosting and mobilizing domestic savings. If the cost of saving mobilization reduced, stock market would extensively facilitate investments in expensive technologies and eventually leads to economic growth (Greenwood and Smith, 1997).

Generally, stock market ensures the proper environment for obtaining more financial resources for developing investment projects and sharing risks (Carp, 2012). This paper contributes the literature in two folds. First, a specific sample of countries, GCC region, is investigated which are highly dependent on oil production. Second, data are examined by GLMM type regression that produce relatively more reliable results. Moreover, the GCC countries have a very small part in the literature studying this relationship as most studies are about the financial sector in general. In addition, the stock market–economic growth relationship remains a subject of debate and disagreement among researchers. As a result, with their special economic conditions and characteristics, stock market–economic growth relationship in the GCC countries will add an important interpretation to the literature on this subject. It is the common fact that financial sector development which has been used in most researches –

especially those that were conducted in the GCC countries- is too general and may not help us to specify the direct originator of economic growth. The distinctiveness of the present study is to analyze the stock market as a major part in the financial systems of developed and oil production based economies and examine the differentials due to the time period, origin of countries and variables used.

2. Literature review

Apart from economic theories, there are those who brought the idea that economic growth is a product of financial development. Many significant studies on the same topic worked hard to prove this relationship and the nature and the direction of causality between financial development and economic growth (King and Levine, 1993). Bagehot (1873) has paid a great attention to the relationship between financial development and economic growth followed by many other researchers (i.e. Schumpeter and Opie, 1983; Robinson, 1962; Hicks, 1969).

Adjasi and Biekpe (2009) find that the stock market returns are major influencer on investment growth. This is because lower cost of capital and availability of investment funds are associated with increases in stock prices. They concluded that the well performance of stock markets has a positive effect on the formation of capital for investment in some selected African countries that are emerging economies. In Egypt, “widening financial development to include the stock market has paid off” (Bolbol et al., 2005: 193). Furthermore, well developed stock markets will shift the world portfolio from low risk and low return of investments to high risk and high return investments creating welfare gains and economic growth due to higher consumption (Obstfeld, 1994).

According to Jensen and Murphy (1990), stock markets enhance corporate governance and eliminate the problem of principle-agent, which is also beneficial to healthier economic growth. Jensen and Murphy (1990) support Wu et al. (2010) in that the contribution of stock market capitalization to economic growth is substantially larger than that of banking in the long-term.

The stock markets are also important in that they “enable firms acquire capital quickly and more efficiently by creating an open market platform for transparent and efficient business transactions to take place” (Adjasi and Biekpe, 2009: 109). The capital acquired through stock markets can be invested in profitable projects which promotes the sustainable investment growth. A study by Tobin (1969) and later by Furstenberg et al. (1977) concluded that stock market activities and investments are positively correlated.

It is also worth to mention that stock markets, through the liquidity they create, reduce the risk of investments by allowing investors the flexibility to buy or sell

equity stocks without locking their savings for a long period, while allowing firms to obtain long term capital (Levine, 1991).

According to Cheng et al. (2011), well developed stock markets directly promotes economic performance, aids in the development of credit markets and eventually brings an economic boom. To ensure the smooth and well-functioning of the whole financial system, a credible and reliable stock market is indispensable and important to increase economic productivity (Pradhan et al., 2014). The adequate functioning of stock markets is significant to the evolution of financial sector and the later has an essential contribution to sustainable economic development. Stock markets that are functioning adequately transform the national economy to an attractive market for foreign investors (Carp, 2012).

In a study by Pradhan et al. (2014) on the causal nexus between economic growth, banking sector development, stock market development and other economic variables, ASEAN countries show that all variables are co-integrated. This means that components of the financial system including the banking sector development, stock market development and other macroeconomic variables collectively play an important role in the determination of the long-run economic growth. It is also argued that markets can promote growth, and the process works in two ways so that growth in turn can encourages the formation of markets (Greenwood and Smith, 1997).

A Schumpeterian model analyzed the relationship between innovations, economic growth, and entrepreneurship. The analysis concludes that both innovations and entrepreneurship have a positive effect on economic growth. In this circular effect, all the three variables would have noticeable positive effects on each other. Greater entrepreneurship activity and innovation would spur economic activity, in turn the later would have positive effects on entrepreneurship and innovation. In contrast to the Keynesian theory, research shows that a tighter money supply would significantly and positively encourages innovation and entrepreneurship activities (Galindo and Mendez, 2014). The reason behind this may be that less fund availability can enhance motivation to save. As a result, innovations will be encouraged to arrive at financial and non-financial products and solutions that would reduce cost.

More recent studies on the same topic explain the nature of the relationship between financial development and economic growth as being affected by the type of economy or market. In developed countries, it may be easier and more reasonable to expect a positive relationship as economic growth in those countries has a big portion attributed to entrepreneurs expecting good investments and regulatory freedom, while this is not the case in developing countries (Valliere and Peterson, 2009). In contrast, Pradhan et al. (2014) found that the stock market development does not play a statistically significant role in spurring further economic growth

in relatively developed countries (i.e. OECD). This is because markets in such countries are mature enough not showing dramatic increase or decrease.

Using the dynamic panel threshold model Ruiz (2018) found two independent variables in finance (bank credit and domestic credit). He also finds that there is no consensus about how economic growth is affected by finance. The data analysis results show a positive relationship in industrialized economies because policy makers in such economies provide good regulations and incentives to institutional investors to encourage better investments. While in developing economies, the threshold of finance is lower. As a result, industrialized economies *grow* faster than developing economies.

Pan and Mishra (2018) concluded that in very large economies such as China where stock market plays a very small role in the economy, there is no significant effect of the stock market on the economic growth. Sometimes, in such countries stock market development is negatively related to economic growth and this could be explained by Chinese government using stock market as a tool to achieve specific goals. It is also worth mentioning that the nature of this relationship may vary in the short run versus the long-run and in one type of stocks versus another.

Batuo et al. (2018) used a dynamic panel method for the period 1985-2010 to investigate the relationship between financial instability, financial liberalization, financial development and economic growth in African countries. They first find that financial development and financial liberalization positively affect financial instability. Second, they also find that economic growth helps to reduce financial instability and the reduction is higher in the pre-liberalization period compared to post- liberalization period.

Since the above researches are based in different regions, there is a possibility that regional differences influence the nexus and nature of the financial (stock market) development- economic growth relationship. In the GCC countries, there is a long-run relationship between economic growth and its determinants and the financial development (Hamdi et al., 2014). Hamdi et al. (2014) detects the existence of this relationship in the GCC region by using panel unit root tests, panel error correction models and cointegration techniques. He finds that there is a strong evidence of long term but not short-term relationship.

Within the same context, Muhammad et al. (2016) use four estimation techniques to conduct a recent study on the finance-growth nexus based in the GCC countries. The study employs four estimation techniques which are Pooled OLS, System GMM, Random Effect Estimation and Fixed Effect Estimation using static and dynamic panel data. It also added more control variables to enhance the results of the research. The study resulted in a consistent positive relationship between financial sector development and economic growth when there is substantial improvement in the financial sector.

3. Methodology

As mentioned in the introduction and literature, the GCC countries have been chosen for their distinct economic characteristics as compared to other countries studied before. The study required three sets of data for each country: per capita real GDP (GDP), stock market capitalization (SMC) and stock market liquidity (SML), for the six countries in the period from 2000 to 2017, all of which have been collected from a single source which is World Development Indicators (WDI) which is the World Bank's premier compilation of cross-country comparable data on development. The dataset generated and formed a panel data that has more than one predictor varies over a period of time. The data for the six countries under study are pooled to form a panel of 108 (18 years* 6 countries) observations. Pooling the data of group of countries that share similar characteristics is common and used by many researchers in other studies such as Pradhan et al. (2014), Muhammad et al. (2016), Smaoui and Nechi, (2017) and others.

This empirical research aims at testing the stock market- economic growth nexus in the GCC countries during the period from 2000-2017. Mainly, papers on the same topic, use panel data techniques that observe different variables over a specific time period and cross-country regression analysis which is the best fit methodology for such studies. The panel data is tested to determine whether they are stationary, co-integrated, normal and non-collinear followed by relationship testing using Generalized Linear Mixed Model (GLMM).

The measurement of relevant variables is guided by past studies. Economic growth will be measured by per capita real GDP (GDP) that is widely used by researchers in the same field such as Livine and Zervos (1998). Stock market development will be measured by stock market capitalization and stock market liquidity which has been previously used by Livine and Zervos (1998) and Cooray (2010).

Per capita real (GDP) provides a better estimate to track economic output than nominal GDP. In contrast to nominal GDP, real GDP accounts for inflation by adjusting annual figures for price changes over time. GDP is defined as the total US dollar amount resulted from adding the gross value of an economy's resident producers in addition to product taxes and after subtracting subsidies that could not be included in the product value. It is calculated without considering depreciation of tangible assets, depletion of intangible assets or degradation of natural resources. Real GDP has no meaning by itself, for this, it must be compared with GDP figures of other years and is calculated using a "base year" prices. It is of great importance to note that because of the economic differences among the GCC countries, there is a need to unify the GDP measure and address differences in countries' population, income and natural resource availability. For example, the total GDP of Bahrain in a given year cannot be compared with the total GDP of Saudi Arabia in the same year. In this case the GDP figures will show a huge difference on behalf of Saudi Arabia.

In order to unify the measurement, the *Per Capita Real GDP* is used and it simply referred to as GDP in this research, which is total real GDP figure divided by mid-year population in USD:

$$\text{Per Capita Real GDP (GDP)} = \frac{\text{Total GDP}}{\text{Mid year population}} \quad (1)$$

Using per capita real GDP eliminates a country differences and allow for more accurate comparisons and research modeling.

Stock market capitalization is the share price multiplied by the number of outstanding shares of all listed domestic companies and excluding unit trusts, investment funds and companies whose purpose is only to hold shares of other listed companies using end of year values.

Stock Market Capitalization (SMC) is the ratio of the value of listed shares to real GDP and can be calculated using the following formula:

$$\text{StocMarket Capitalization Ratio (SMC)} = \frac{\text{The value of listed shares}}{\text{Total Real GDP}} \quad (2)$$

GCC data on stock market capitalization ratio are readily calculated and made available on WDI website except for the missing years data which have been accounted for by Log transformation and the addition of 5 to all values in the SMC data sheet.

Stock Market Liquidity (SML) is the end of year total number of domestic and foreign shares traded in an economy multiplied by their prices. While calculating the amount, only one side of the transaction is taken into consideration.

Stock Market Liquidity (Total value of stocks traded as a % of total real GDP), is the ratio of value of shares traded on a stock exchange divided by total real GDP and calculated as follows:

$$\text{Stock Market Liquidity (SML)} = \frac{\text{The value of shares traded}}{\text{Total real GDP}} \quad (3)$$

The GCC countries' data on stock market liquidity ratio are readily calculated and made available on WDI website except for the missing years data which have been accounted for by Log transformation and the addition of 5 to all values in the SML data sheet.

Country grouping is essential in all aspects specially for researches that are related to economics and finance. Previously, grouping was based on political boundaries, but this has been changed with time due to the industrial and economic development. Classification of countries into groups helps researchers to perform

comparative analysis on economies and regions as groups, especially that the main purpose of creating those groups is to form sets of homogeneous countries with common features. The total list of groups (economic, political and economic-political) represents the population for this research from which the GCC countries are selected as the study's sample.

The study uses a panel data consisting of annual observations of per capita real GDP, stock market capitalization and liquidity ratios of the 6 GCC countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates). Similar characteristics of countries under study make pooling of data easier and more realistic. The sample period spans from 2000 to 2017. The main reason behind the choice of this period is to consider the effect of different economic conditions such as, the global financial crisis 2007-2008. This period is also the most recent period with the maximum number of data available for the three predictors of the study.

The main models used to test the nexus of stock market development- growth relationship are: Levin, Lin and Chu (LLC) panel unit root test, Kolmogorov-Smirnov normality test, and Generalized Linear Mixed Model (GLMM) Repeated Measures analysis.

4. Empirical data and analysis

Table 1 shows descriptive statistic (means, standard deviations (SD), range, minimum, maximum and percentiles) across the selected time span of the studied variables for the six GCC countries (1= Bahrain, 2= Kingdom of Saudi Arabia (KSA), 3= Kuwait, 4= Qatar, 5= UAE, and 6= Oman).

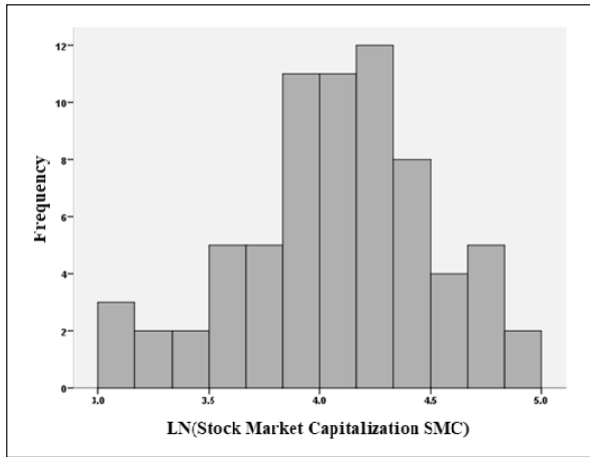
Table 1: Descriptive statistics for the measured financial indicators

	Stock Market Capitalization (SMC)	Stock Market Liquidity (SML)	Per Capita Real GDP (GDP)
Mean	41.63	24.93	31,141.39
Median	45.77	7.36	24,656.29
Std. Deviation	37.69	55.25	19,187.04
Range	128.37	372.26	80,088.21
Minimum	0.00	0.00	8,476.61
Maximum	128.37	372.26	88,564.82
Percentiles	25th	0.00	17,035.61
	50th	45.77	24,656.29
	75th	66.32	41,538.48

Source: Authors' calculations

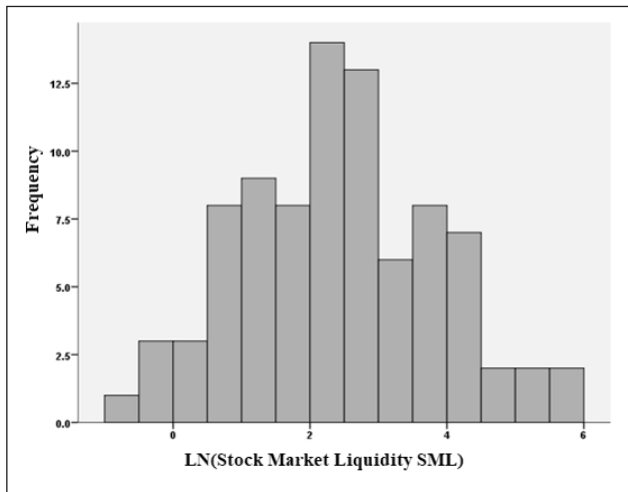
The mean and SD of SMC for the six countries equals to 41.63 points and 37.69 points, with a range of 128.40 points, but most of the countries (50%) have an SMC of 45.8 percent points or less (Figure 1).

Figure 1: Histogram of natural logarithm of stock market capitalization



Source: Authors' calculations

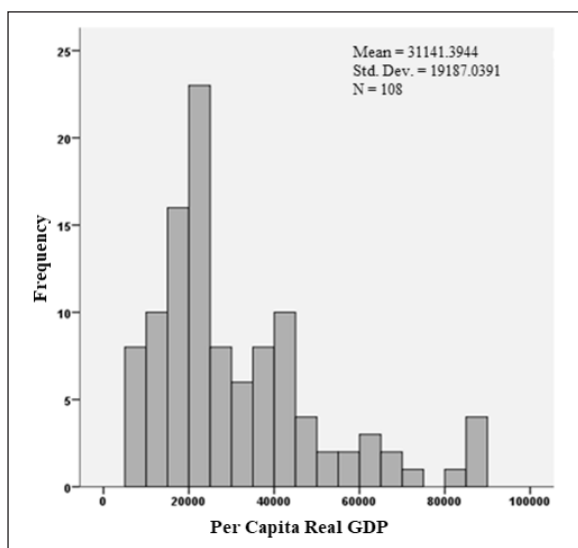
Figure 2: Histogram of natural logarithm of stock market liquidity



Source: Authors' calculations

This suggests an approximately normal distribution of the natural logarithm transformation of SMC which is used to get rid of the skewness in the original metric scale. On the other hand, the mean and SD of SML are 24.93 and 55.3 points respectively, with a range equals to 372.3 points between lowest and highest values. It is also important to notice that 50% of the countries' SML measures 7.36 points or less across the analyzed time span (Figure 2). Additionally, GDP shows an overall mean and SD equal to 31,141.39 and 19,187.04 points and a range of 80,088.21 points (Figure 3).

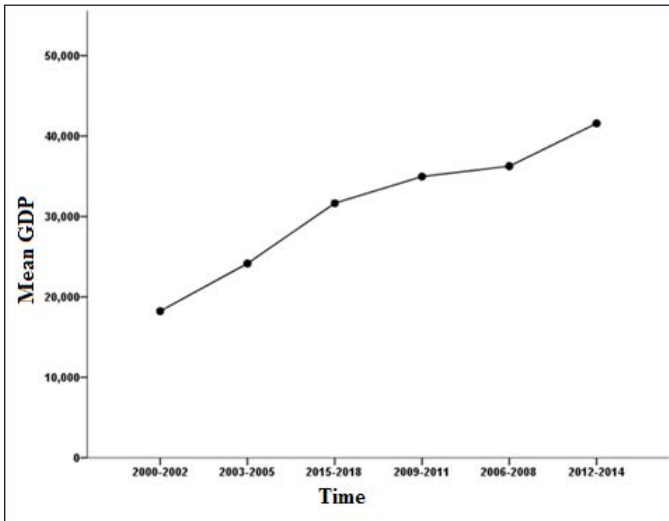
Figure 3: Histogram of per capita real GDP



Source: Authors' calculations

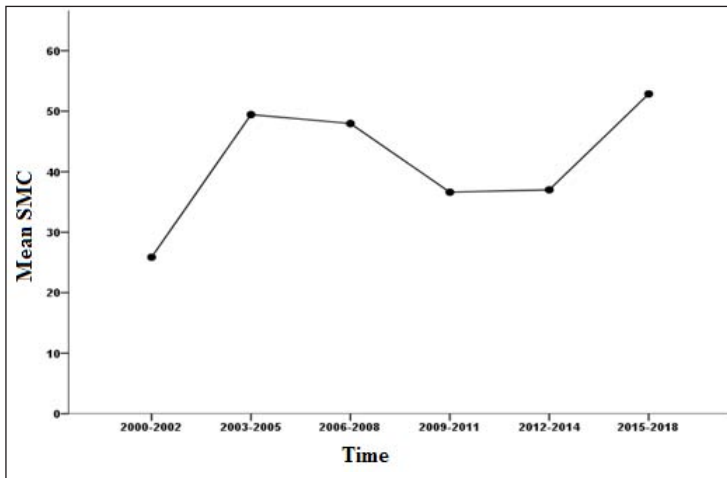
Overall, Figure 5 shows that SMC is the lowest between 2000-2002 with a mean of 25.87 points and SD of 33.71 points for all countries combined. SMC also shows a significant rise in the period between 2003-2005, where SMC in those countries combined had almost doubled with means equals to 49.5 and SD equals to 50.9. In successive periods SMC had declined between 2006-2011, followed by another period of rise between 2012 till 2018 as can be seen in the Figure 5.

Figure 4: Association between time (3-year groups) and average (mean) GDP



Source: Authors' calculations

Figure 5: Association between time (3-year groups) and average (mean) SMC



Source: Authors' calculations

Considering the country related differences, Bahrain's SMC has the highest mean and SD (71.98, 32.7), followed by Kuwait (37.93, 52.4) and then UAE (37.17, 21.6). The difference is considered high because both Kuwait and UAE have an average (mean) SMC that is nearly half of Bahrain's average (mean) SMC. Oman,

Qatar and KSA come after with KSA having the lowest SMC mean and SD among the six countries (31.61, 32.97).

In contrast to the above, the descriptive statistics of SML shows that KSA has the highest SML mean and SD (97.74, 104.6) followed by Kuwait (17.92, 32.69) then Qatar (14.1, 13.8), UAE (10.9, 10.1), Oman and finally Bahrain. In summary, SML statistics shows a significant association between SML values and SML variations. In other words, countries with high SML values tend to have higher variations in those values.

GDP, which is the dependent variable in this study, shows that Qatar has the highest GDP values with mean equals to 60,930.7 and SD equals to 21,145.3. UAE (mean= 38,388.83, SD=4,719.4), Kuwait (mean=35,210.49, SD=12,308.5) come directly after Qatar while Bahrain (mean=19,770.62, SD= 4,191.8) and KSA, then Oman which has the lowest GDP figures across years (Table 4). The overall average countries' GDP show incremental rise in their mean and variability. Higher GDP values are associated with higher GDP variability due to unrevealed reasons inherited in their systems (Figure 4).

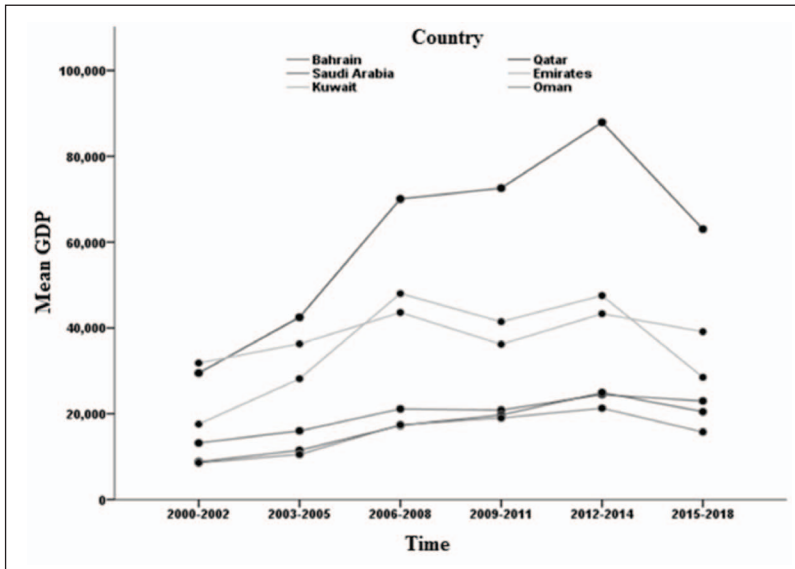
Table 2: Country specific means and standard deviations

Countries	N (years)	Mean (SD)		
		Market Capitalization SMC	Market Liquidity SML	Per Capita Real GDP
Bahrain	18	71.98 (32.67)	2.59 (2.25)	19,770.62 (4191.8)
Saudi Arabia	18	31.61 (32.97)	97.74 (104.6)	17,116.49 (5898.3)
Kuwait	18	37.93 (52.37)	17.92 (32.69)	35,210.49 (12308.5)
Qatar	18	34.4 (45.61)	14.06 (13.82)	60,930.7 (21145.3)
Emirates	18	37.17 (21.56)	10.9 (10.1)	38,388.83 (4719.4)
Oman	18	36.69 (17.3)	6.36 (4.74)	15,431.25 (4958.7)

Source: Authors' calculations

To understand the basic behavior of GDP for each country, the grouped time periods were plotted (x-axis), against the average (mean) GDP on the (y-axis) (Figure 6). It is evident that, for most countries, GDP rises then falls during the research period. On the contrary, some countries show constant rising trend like KSA and Qatar and some countries start with high/low GDP values and continue in the same level of GDP as compared to other countries. Remarkably, all six countries show decline in their GDP values after 2014. As such we analyze those countries for statistically significant differences on their overall average (mean) SML, SMC and GDP across the analyzed period using the conventional One-way ANOVA test in subsequent analysis (Table 4 and 5).

Figure 6: Association between time and country specific average (mean) GDP



Source: Authors' calculations

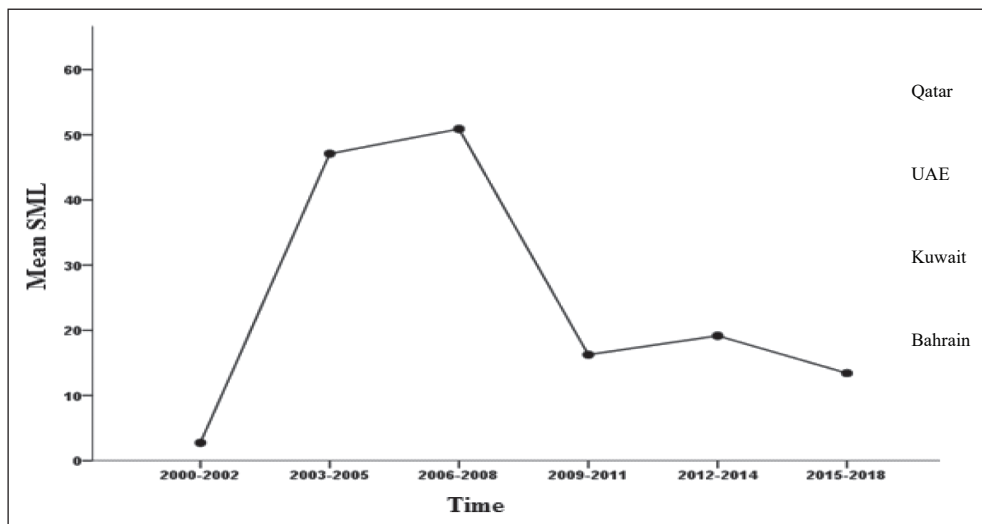
Table 3: Descriptive statistics across the study's period

Years	N	Mean (SD)		
		Market Capitalization SMC	Market Liquidity SML	GDP Mean (Standard Deviation)
2000-2002 Years	18	25.87 (33.71)	2.75 (5.04)	18,239.5 (9,586.4)
2003-2005 Years	18	49.45 (50.88)	47.09 (88.16)	24,158.23 (13,328.3)
2006-2008 Years	18	47.97 (45.15)	50.88 (90.13)	36,255.69 (20,667.8)
2009-2011 Years	18	36.62 (29.35)	16.26 (20.18)	34,967.6 (20,121.5)
2012-2014 Years	18	37.01 (30.27)	19.15 (23.35)	41,574.46 (23,692.8)
2015-2018 Years	18	52.86 (29.09)	13.42 (18.23)	31,652.89 (16,358.5)

Source: Authors' calculations

The average (mean) SML begins low (mean= 2.75, SD=5.04) for all countries between 2000-2002 however, it shows a significant rise in the successive years between 2003-2008 then a decline afterwards, see (Figure 7).

Figure 7: Association between time (3-year groups) and average (mean) SML



Source: Authors' calculations

Nonetheless, GDP shows a substantive linear rise across the time period between 2000-2018 on average. A Joncheere-Terpestra non-parametric independence alternatives test is used to assess whether or not the rise in the countries' GDP is significant in the analyzed time period. The analysis shows that there has been a significant rising trend between 2000-2018 in the countries average (mean) GDP with $\chi^2(108) = 3156$ and $p < 0.001$, denoting that those countries had measured a significant rise in their mean GDP across time (Figure 6).

Next, to understand whether those countries differed in their average (mean) measured financial parameters, a one-way ANOVA test is performed to assess the difference between those countries in their mean measured GDP, SML and SMC scores. However, an adjusted Welch's One-Way ANOVA is quoted for those tests due to the violation of the statistical assumption of equal variance found across the analyzed countries, Leven test is statistically significant to assess the equal variance assumption in each of GDP, SML and SMC. In addition, the study compares the logged (LN transformed values) of both SML and SMC.

To simply integrate the findings of the analysis, the study begins with the stock market capitalization. The Welch's one-way ANOVA test suggests that there are statistically significant differences on the average (mean) SMC among the GCC countries with $f(5,47.1) = 3.84$ and $p = 0.005$, and a post-hoc follow up Games-Howell pairwise comparison on the Average (mean) SMC (i.e., series of pairwise t-tests) suggests that Bahrain has significantly higher average (mean) SMC compared to Saudi Arabia with $p = 0.042$. Bahrain also has a significantly higher average (mean) SMC than Qatar but

lower SMC than Kuwait and no significant difference in its average (mean) SMC compared to Emirates and Oman, $p > 0.050$ respectively (Table 4).

Table 4: One-way ANOVA – country comparison

Countries	N (year)	Mean (SD)		
		LN (Stock Market Capitalization SMC)	LN (Stock Market Liquidity SML)	Per Capita Real GDP
Bahrain	18	4.12 (0.94)	1.99 (0.30)	19,770.62 (4,191.8)
Saudi Arabia	18	2.91 (1.34)	4.19 (1.04)	17,116.49 (5,898.3)
Kuwait	18	2.77 (1.5)	2.46 (1.1)	35,210.49 (12,308.5)
Qatar	18	2.74 (1.5)	2.65 (0.83)	60,930.7 (21,145.3)
Emirates	18	3.49 (0.91)	2.57 (0.7)	38,388.83 (4,719.4)
Oman	18	3.56 (0.75)	2.35 (0.66)	15,431.25 (4,958.7)
test statistic		$f(5,47.1)=3.84$	$f(5,45.30)=17.03$	$f(5,46.8)=63.14$
p-value		0.005	<0.001	<0.001

LN = Natural Logarithm transformation; A constant = (5) was added to all values of SMC and SML; N = 108

Source: Authors' calculations

Saudi Arabia has no statistically significant difference in its average (mean) SMC as compared to the remaining GCC countries ($p > 0.050$) when pairwise compared to Bahrain, Qatar, Kuwait, Oman and United Arab Emirates respectively. However, the pairwise analysis shows that Oman, Kuwait, United Arab Emirates and Saudi Arabia do not differ significantly in their respective average (mean) SMC. It is also evident that Bahrain has the highest average (mean) SML among the six GCC countries in the analyzed period.

The One-way ANOVA is used to compare the grouped year periods in their average (mean) GDP, SML and SMC (Table 5). When comparing the logged values of both stock market liquidity and stock market capitalization, the one-way ANOVA test shows that there is no statistically significant difference in the average (mean) SMC across year groups with $F(5,47.51)=1.46$ and $p=0.219$. However, the study uses another Welch's adjusted one-way ANOVA test to compare year groups for their respective mean SML and find that there is a significant mean differences between those spans in their respective average (mean) SML indexes having $f(5,46.40)=7.50$ and $p < 0.001$. Games-Howell post-hoc pairwise comparison between those groups of years shows that the average (mean) SML in the time period of 2000-2002 is not significantly different from those in the period of 2006-2008 with $p=0.088$ and in the period of 2015-2018, but the remainder years has significantly greater SML indexes with $p < 0.050$.

Table 5: One-way ANOVA analysis across the study's period

Years	N	Mean (SD)		
		LN(Stock Market Capitalization +5) (SMC + 5)	LN(Stock Market Liquidity + 5) (SML + 5)	Per Capita Real GDP (GDP)
2000-2002 Years	18	2.70 (1.3)	1.96 (0.50)	18,239.5 (9,586.4)
2003-2005 Years	18	3.27 (1.43)	2.91 (1.4)	24,158.23 (13,328.3)
2006-2008 Years	18	3.36 (1.33)	3.3 (1.15)	36,255.69 (20,667.8)
2009-2011 Years	18	3.24 (1.21)	2.71 (0.84)	34,967.6 (20,121.5)
2012-2014 Years	18	3.25 (1.2)	2.81 (0.86)	41,574.46 (23,692.8)
2015-2018 Years	18	3.76 (1)	2.56 (0.82)	31,652.89 (16,358.5)
test statistic		$f(5,47.51)=1.46$	$f(5,46.40)=7.50$	$f(5,46.7)=5.69$
p-value		0.219	<0.001	<0.001

LN = Natural Logarithm transformation; A constant = (5) was added to all values of SMC and SML; N=108.

Source: Authors' calculations

In general, pairwise comparison between the remainder of the year groups suggests no statistically significant differences on the average (mean) SML indexes when each of those periods are pairwise compared. In short, the period of 2000-2003 may have the lowest SML compared to the rest of the years, but the periods of 2000-2002 and 2003-2005 does not differ in their respective average (mean) SML indexes, indicating they are close in their average (mean) SML indexes on average. The period between 2015-2018 show a decline in SML compared to the previous time periods between 2003-2014 (Figure 5).

In the same way, the study compared the GDP across year groups using the Welch's adjusted one-way ANOVA. The yielded results are shown in Table 5. To explain the yielded analysis findings, the one-way ANOVA test indicated that there is a statistically significant differences in the average (mean) GDP indexes between the analyzed time periods with $F(5,46.7)=5.69$, $p<0.001$, and a post-hoc Games-Howell pairwise comparison between those time periods indicates that the GDP index is not different in the adjacent time periods 2000-2002 and 2003-2005 ($p=0.649$), but the time period of 2000-2002 has significantly lower GDP average (mean) index compared to time periods after 2005 ($p<0.050$).

Nonetheless, the time period between 2003-2005 is characterized by a non-statistically significant difference on the average (mean) GDP compared to the

rest of time periods ($p > 0.05$). The remainder of the time periods do not differ significantly in their respective average (mean) GDP when each pair of them are pairwise compared ($p > 0.050$). This indicates that there is a rise in the per capita real GDP between 2006-2018 which stays constant across those years, at the same time the time period of 2000-2005 has the lowest average (mean) GDP scores for all the GCC countries combined (Figure 4).

Furthermore, Welch's adjusted one-way ANOVA test is used to assess differences between the analyzed GCC countries on their average (mean) SML. The analysis results suggest that there are statistically significant differences on the overall average (mean) SML between countries during 2000-2018, ($F(5,45.30)=17.03$, $p < 0.001$). According to Games-Howell post-hoc pairwise comparison between each pair of those countries, Bahrain has a statistically significant lower average (mean) SML as compared to KSA ($p < 0.001$). Bahrain also has a statistically significant lower SML compared to Qatar ($p = 0.042$), Emirates ($p = 0.025$) and Oman ($p = 0.051$). The pairwise comparison on SML between Kuwait and Bahrain suggested that they do not significantly differ in their average (mean) SML when pairwise compared ($p = 0.498$). Additionally, the test finds that KSA has a significantly greater average (mean) SML compared to other GCC countries ($p < 0.001$) when pairwise compared with each of them. The pairwise comparison between Kuwait, Qatar, Emirates and Oman suggests that they do not statistically significantly differ in their respective average (mean) SML across the analysis period ($p > 0.050$).

To sum up, Saudi Arabia differs substantively in its average (mean) SML compared to the other countries (has the highest SML rates) across the analysis period. Other countries have similar average (mean) SML except Bahrain and Kuwait which have the lowest average (mean) SML. Figure 5 shows a clear rise then fall pattern in their measured market liquidity.

Likewise, study compares the overall average (mean) (18-years mean) using Welch's adjusted one-way ANOVA test and finds that a statistically significant 18-year mean difference in GDP between those countries may exist ($F(5,46.8)=63.14$, $p < 0.001$). In addition, Games-Howell pairwise comparison indicates that Bahrain, Oman and Saudi Arabia do not significantly differ in their overall eighteen years' average (mean) GDP index ($p = 0.632$). Bahrain has a significantly lower average (mean) GDP compared to Kuwait ($p = 0.001$), Qatar and UAE ($p < 0.001$) each respectively. Moreover, the pairwise comparison between KSA and the other countries suggests that KSA has a significantly lower average (mean) GDP as compared to Qatar, Kuwait and UAE ($p < 0.001$) each respectively. When Kuwait compared to Qatar, it shows significantly lower mean overall GDP index across the span of the eighteen years ($p = 0.002$). Kuwait also has a significantly higher GDP compared to Oman ($p < 0.001$). In addition, in pairwise comparisons, Qatar has significantly the highest average (mean) GDP across years as compared to the remaining five GCC countries, ($p < 0.001$) each respectively. Oman, on the other hand, has the lowest average (mean) GDP compared to others.

In sum, Qatar has the highest 18- year average (mean) GDP compared to the other countries but, KSA, Oman and Bahrain do not differ significantly with Oman having the lowest average (mean) GDP (Figure 4).

The One-way ANOVA analysis compares the behavior of the studied indicators across the six countries and despite economic size differences it shows how similar are those countries which is rationale of choosing them as a group and pooling their data.

Unit root and stationarity is one of the most important tests in any study. Stationary data is predictable and better to analyze and assess. For the purpose of testing our data stationarity, two main tests are used that are Im, Pesaran and Shin (IPS) and Levin, Lin and Chu (LLC).

After rejecting the null hypothesis of unit root at 1 % significance test was repeated by using first differencing LLC and ISP. It was found that GDP, SML and SMC are stationary in their respective log-difference at the 0.05 significance level. As such, it can be concluded that the variables are integrated of order one I(1) (Table 6).

Table 6: Results of (Im, Pesaran and Shin) and (Levin, Lin and Chu)

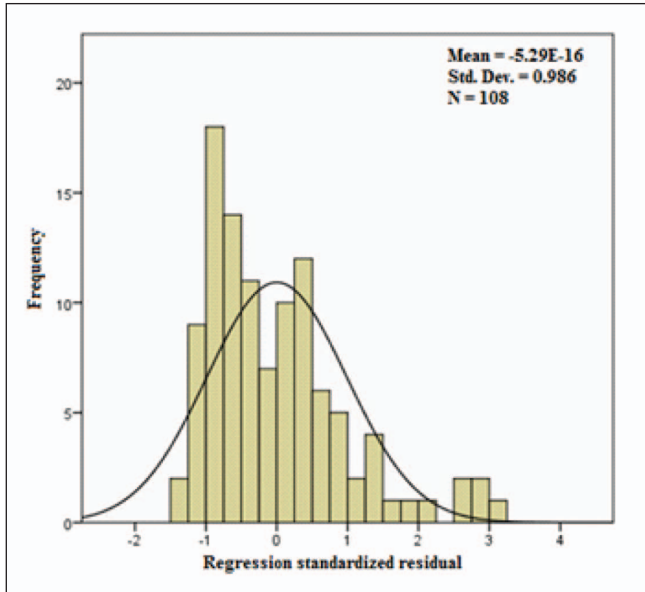
Levin, Lin & Chu		Im, Pesaran & Shin		
1st difference	Level	1st difference	Level	
-7.07 (< 0.001) **	-2.17 (0.015) *	-5.05 (< 0.001) **	-0.54 (0.295) //	Log of GDP_CAP
-8.37 (< 0.001) **	-3.27 (< 0.001) **	-4.82 (< 0.001) **	-3.00 (0.001) **	Log of SMC
-4.16 (< 0.001) **	1.41 (0.080) /	-2.69 (0.004) **	-0.70 (0.241) //	Log of SML

Testing Unit-Roots in log of (GDP_CAP, SMC and SML)

Source: Authors' calculation

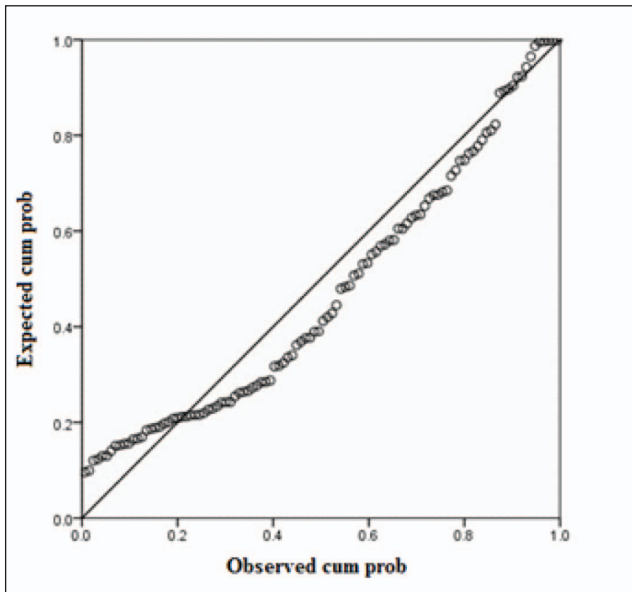
The linear regression multivariate analysis was conducted to assess the collinearity levels between stock market liquidity and capitalization when regressed against GDP as the dependent variable (DV). The tolerance level is substantively above 0.350, and the VIF is low in general and does not exceed the critical value of 10, denoting the absence of unwanted collinearity between the independent variables (IV). However, the residuals of the prediction model were positively skewed (Figure 8), as can be seen in the p-p plot (Figure 9). This indicates that this study's dependent variable (GDP) could not be analyzed by the conventional linear regression analysis due to the presence of inconstant error in the prediction. Moreover, data has a repeated measured structure in which data is nested within countries across years. Therefore, data was analyzed using the Generalized Linear Mixed Model (Table 7).

Figure 8: Histogram of GDP (Dependent Variable)



Source: Authors' calculation

Figure 9: Normal P-P plot of regression standardized residual of GDP



Source: Authors' calculation

Table 7: Multivariate Gamma Generalized Linear Model (GLM)

Beta 95% Confidence interval						
Model term	Beta coefficient (β)	Std. Err	Lower	Upper	t-value	p-value
Intercept	9.484	0.249	8.885	10.083	38.1	<0.001
LN(SML) Percent	0.125	0.032	0.062	0.188	3.953	<0.001
LN(SMC) Percent	-0.011	0.017	-0.046	0.023	-0.66	0.512
Time-Years	0.117	0.01	0.098	0.137	12.12	<0.001

Dependent Variable = GDP. Link function = Gamma log function. Model AIC = 4.078, BIC = 18.40, β = regression coefficient.

Explains the combined and individual association between Economic Growth (GDP), Stock Market Capitalization (SMC), Stock Market Liquidity (SML) and Time (3-years groups). N=108 repeated records.

Source: Authors' calculation

As a result of the pitfalls of the standard linear regression multivariate analysis in processing our data, the Generalized Linear Mixed Model is used and better fits our dataset. It shows that per capita real GDP correlates significantly with their measured SML with $r=0.17$ and $p<0.010$, denoting that as countries measured SML tends to rise by a factor equal to one logarithmic unit, the average (mean) GDP tends (on average) to rise incrementally too ($r\text{-square} (r^2) \times 100= 0.16^2 \times 100 =2.6\%$) across the analyzed period. SMC, on the other hand, do not correlate significantly with GDP with $r=-0.056$ and $p=0.282$.

Nonetheless, SMC correlates significantly, and positively, with the Liquidity of market index ($r=0.30$, $p<0.010$) denoting that as the countries SML tends to rise, their average (mean) SMC tends to rise incrementally by a factor equal to $r\text{-square}= r^2= 0.3^2 \times 100= 9\%$ of the shared covariance units across the analysis period (Table 8).

Table 8: Pearson's correlations between GDP, SML and SMC

	Per Capita Real GDP	Ln (LC)
GDP	1	
Ln (SML+ 5)	0.156*	
Ln (SMC+ 5)	-0.056	0.300*

*Correlation is significant at the 0.01 level, i.e. p-value <0.010, note: this correlation was weighted by country level.

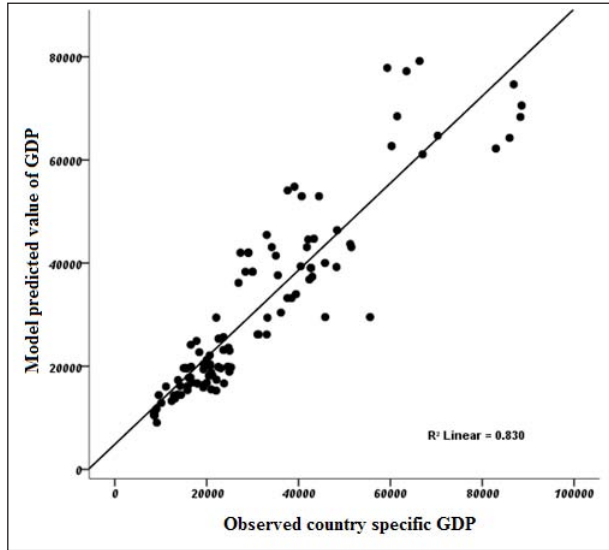
Source: Authors' calculation

Due to the presence of repeated measures in GDP and other parameters, the Generalized Linear Mixed Model Repeated Measures analysis was utilized. The time span was grouped into six intervals of three years each. This structure of data is fed into the generalized linear modelling suite in the analytical program, the countries are set as a random factor and the independent predictor variables (time, natural logarithm of liquidity and natural logarithm of the market capitalism) are set as fixed predictors regressed against GDP scores for those countries.

The analysis results are driven using the Gamma linked with pseudo-likelihood estimation method with Pseudo-likelihood=7.80. This model fits the data well compared to a model without any predictors as evidenced with a very low Bayesian criteria (AIC =22.96, BIC=40.31). Those low values of the Bayesian criteria denote better fit and enhanced accuracy of the model (Figure 10). The GDP data significantly match those predictions using the predictor independent variables.

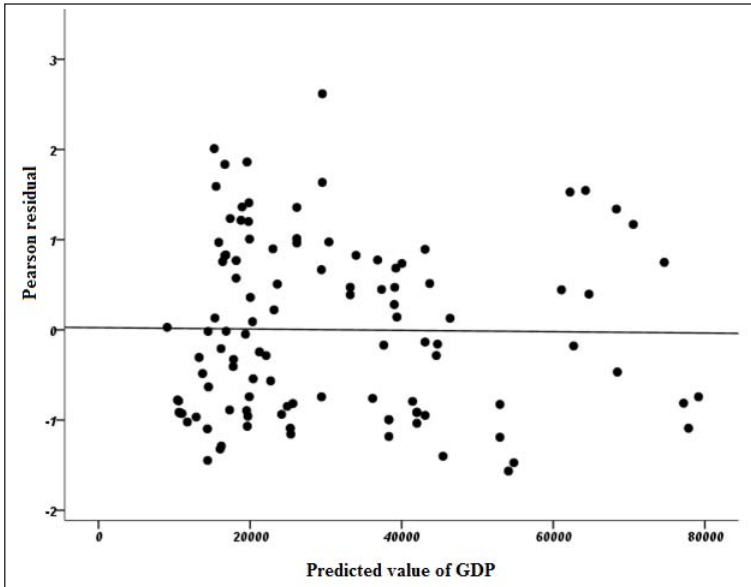
Figure 11 displays the predicted GDP values on the x-axis against the error (residuals) from the analysis model. This figure shows no distinct pattern or over-dispersion that may affect the accuracy of the model. Therefore, the results of the model can be accepted and its main findings can be relied on. The analysis shows that SML in logarithmic units converged significantly and positively on their respective GDP denoting that the SML correlates significantly and positively with higher GDP for those countries. For example, as the SML increase by a factor equal to one percent, GDP tends to rise across the analysis period by a factor equal to (Beta= 0.125). This expresses that the exponentiated value is equivalent to 1.13 times the rise in GDP, or a rise in SML is associated with a rise in GDP equivalent to $(1.13-1) \times 100 = 13\%$ on average ($p < 0.001$), by accounting for the other predictor independent variables in the analysis.

Figure 10: Observed versus GLMM predicted values of GDP



Source: Authors' calculation

Figure 11: Scatterplot of model predicted values versus the residual (error)



Source: Authors' calculation

Unexpectedly, the analysis shows that SMC does not correlate significantly with GDP ($p=0.512$) but, the sign of Beta coefficient (Beta=-0.011) is negative, suggesting a negative but insignificant association between SMC and GDP in the GCC countries by accounting for the other predictor independent variables in the model.

Interestingly, the analyzed model suggests that there is a significant, and positive, association between time and the GDP index of those countries (Beta=0.117, $p<0.00$), denoting that as time lapses the rate of GDP tends to rise by factor equals to 0.117 on the logarithmic scale.

The analysis of the variance component of the six countries suggests that countries' GDP has varied significantly around the overall average (mean) GDP trajectory ($p<0.050$), denoting that some of those countries experience rise and fall in their GDP across time (Figure 4). For example, UAE's GDP has a rise and fall patterns in the period between 2001-2011. Despite these variations, GDP of those countries correlates positively and significantly with time (Beta=0.117) and this is clearly evidenced in the analysis model (Table 8).

The analysis is summed up to conclude that SML as well as time correlated positively and significantly with GDP, denoting that as time lapses the GDP tends to rise significantly. Higher SML predicts greater GDP, while SMC correlates insignificantly and negatively with GDP.

5. Results and discussion

Behavior of GDP, in response to increase in stock market, strongly depends on the indicator used to measure stock market (SMC/SML). The Generalized Linear Mixed Model analysis results show that in the long run SML positively correlates with per capita real GDP. In other words, there is an intense long run positive relationship between economic growth and stock market liquidity. Surprisingly, unlike SML, SMC correlates negatively but insignificantly with per capita real GDP (Table 9).

Table 9: Summary results

	SMC	SML
Generalized Linear Mixed Model GLMM	Correlated negatively but insignificantly with GDP in the long run	Correlates positively and significantly with GDP in the long run
	Correlates positively with SML	Correlates positively with SMC

Source: Authors' calculation

Since our data pass the normality, collinearity and stationarity tests, there should be no issues with the reliability of the tests applied and hence no issues with the results found. The panel data is well prepared and made suitable to fit in the Generalized Linear Mixed Model (GLMM) analysis to help in expressing the relationship between the chosen variables.

SML which is the value of shares traded divided by GDP, have a significant long run effect on the GCC economic growth. On the other hand, SMC which is the value of listed stocks divided by GDP is insignificant to the GCC economic growth in the long run. Overall, stock markets correlate positively with economic growth in the long run which is caused by increase in SML. This is in line with Pradhan et al. (2014) in that banking sector and stock market development in developing countries such as ASEAN countries along with other macroeconomic variables play an important role in the determination of long run economic growth.

The existence of a positive relationship between stock market development and growth is also supported by Coskun (2017) who gave an evidence that the aggregate effect of mutual fund, pension fund, stocks and corporate bonds is positively related to economic growth in Turkey. ASEAN and Turkey, as developing countries, have immature stock markets that can be compared to the stock markets in the GCC countries and this may explain the existence of stock market- growth relationship. According to Pradhan et al. (2014) stock market development does not play a statistically significant role in spurring further economic growth in relatively developed countries with mature stock markets such as the case of OECD. While Valliere and Peterson (2009) find that in developed countries it may be easier and more reasonable to expect a positive relationship as economic growth in those countries has a big portion attributed to entrepreneurs expecting good investments and regulatory freedom while this is not the case in developing countries

The difference in the results between the effect of SML and SMC on the economic growth is because that SML measures how active and responsive is the stock market whereas SMC measures the potential of the market from which real stock market activities can be stimulated. Stock market liquidity refers to the ability of investors to trade their shares quickly at low cost without affecting the share prices substantially (Chordia et al., 2005).

If SML has greater values than SMC, it can be concluded that the stock market is liquid and listed stocks are being traded without the need to reduce their prices. Whereas in illiquid markets, SML has lower values than SMC which indicates that in order to increase the tradability of the stocks, material changes to stock prices shall be forced.

Generally, SMC takes the first step in affecting GDP by making short run changes to stock prices to which investors respond immediately and start acting based on the available market information. Aali-Bujari et al. (2017) find that an increase in

the capitalization of listed companies supported by other financial factors have a positive relationship with per capita income. This study finds that this effect does not last for a long period as the price equilibrium is restored again but at a slightly higher price range. The accumulation of short run stock price changes will lead to an environment of better information acquisition and direct investment actions by investors that enhance SML and eventually increase GDP. Chu and Chu (2020) confirms that financial liquidity, in terms of financial intermediaries and stock markets, are not linearly correlated with economic growth and these results are supported by Lind and Mehlum (2010), Law and Singh (2014) and Samargandi et al. (2015), which contradict our finding of insignificant negative correlation between SMC and economic growth.

The indirect link between insignificant correlation of SMC with economic growth and the long run behavior of SML explains the correlation the study finds between SMC and SML using GLMM. This study shows the significant association between GCC's SML and SMC. As market liquidity rises market capitalization tended to rise insignificantly by 9%. The increase in liquidity indicates higher stock market activity levels which, to some extent, may encourage corporations to issue more shares or slightly increase stock prices.

Based on the conditional convergence model, convergence of stock market capitalization (SMC) and stocks traded (SML) is found for high and low-income panels, the OECD panel, and the Sub-Saharan African panel and the speed of convergence is in the range of 20–30% (approximately 10 and 15 years for convergence to take place) (Narayan et al., 2011). These fresh insights on financial market convergence is evidenced in this study by the results of the relationships found between SML and GDP, SMC and GDP and SML and SMC.

This result can be further explained because real stock market activities (SML) is more powerful than potential stock market activities (SMC) to create real changes to the economy in line with Apergis et al. (2015) whose empirical results suggests that SML and economic growth are strongly associated in UK and Germany, even though the UK is a capital market-based economy and Germany a bank-based economy. For example, if there are X and Z values of listed shares, both will have no significant effect on the growth even if one is greater than the other, unless actively traded in the market. This means it does not matter how much shares of stocks are listed in a stock exchange, what truly matters are the value of stocks that stimulate trade and exchanges. In other words, it is how tradable are the stocks not the availability of the stocks that causes growth. SML strongly contributes to boost economic growth by improving the process of information acquisition and corporate governance (Bencivenga et al., 1996).

The existence of a relationship between SML and economic growth supports the stock market – economic growth nexus and shows that regional and economic

differences have no influence in this field. Developed (high income) (Fufa and Kim, 2018), emerging (BRICS) (Carp, 2012), developing (ASEAN) (Pradhan et al., 2014) and oil rich (GCC) (Muhammad et al., 2016) all show positive and significant relationships either between financial markets and economic growth or between stock market in specific and economic growth.

In addition, this study demonstrates a significant relationship between time -as measured by groups of three years- and the growth- as measured by per capita real GDP- which means that overall economic prosperity increased over time. This could be due to the technological and financial innovations and advances that evolves overtime which stimulates efficiency and eventually growth (Pradhan et al., 2018). The increase in GDP overtime could be explained by and be supportive to the neo-classical and endogenous theories in that innovative advances that evolves overtime positively affect growth in a society's wealth and economic prosperity. Another explanation of GDP growth over time is the effect of inflation that may lead to hyperinflation in case consumer accepts to pay more even before prices really increase. The increased spending makes demand higher than supply which results in more people hired, better living and increased GDP.

6. Conclusion

Generally, stock market development affects economic growth in the long and in many ways having its direct and indirect effect. In addition, financial innovations and technological advance as well as inflation that evolves overtime increase the standard of living and have positive impact on economic growth. Stock market technological innovations enable better market research, easier execution of trade, higher frequency trading and more convenient and favorable trading programs. This allows for more rational investment decisions to be taken by investors and enhanced corporate governance using stock incentives and this would support income creation and GDP maximization.

On the managerial level, companies with listed stocks shall thrive to enhance the reputation of their stocks by proper market capitalization management that in turn will increase investors' confidence in the company' shares. This means that well managed listed companies can form the basis for high performance stock markets and eventually higher economy's wealth and greater per capita real GDP. Generally, properly managed corporations can boost its share price by growing its earnings and dividend payment. In the short run cutting R&D layoffs could dramatically increase profits but in the long run productivity enhancement like acquiring productive personnel, improving R&D and buying back corporation's shares to boost its market liquidity.

GCC oil returns, especially during economic boom periods, can be used to provide financial support and facilities to successful corporations and corporations that

have the potential to enhance the stock markets such as well performing banks and financial institutions and large listed companies. To account for the cultural and religion characteristics of the region, financial institutions located in the GCC region shall consider investing in Islamic financial instruments (that are halal/Sharia'a compliant) such as sukuk and Murabaha and Mudarabah contracts. This could attract the GCC Muslim investors to pump their savings into the stock market and lift up GCC's SML.

Further researches on the same the topic may apply the same methodology on other markets with different economic and cultural characteristics (i.e. Egypt, Yemen and Sudan). Other recommended researches could be very specific to apply the same research methodology on each of the GCC countries separately. The reason is that during data analysis, noticeable differences were detected in the size as well as the value of stock markets among the six countries. In addition, the GCC countries still do not reach the desired level of collaboration and economic unification which generates differences in their political and economic policies. Researchers can also limit the study to the effect of Islamic instrument market on the growth of the GCC economies to discover whether or not to invest more in such instruments.

Future researches can also use different combination of data analysis tests, tools and models to validate the finding of this research. If further researches can reach the same conclusion, then our findings and results could be proven reliable. Last but not least, the use of GDP as an indicator of economic growth may be enhanced by using GDP proxies such as the index of industrial production (IP). IP gives more frequent growth indicator observations than annual per capita real GDP used in the current study. Using more frequent GDP observations will enhance the research conclusion especially that SMC and SML measures are much more frequent than annual.

References

- Aali-Bujari, A., Venegas-Martinez, F., Pérez-Lechuga, G. (2017) "Impact of the stock market capitalization and the banking spread in growth and development in Latin American: A panel data estimation with System GMM", *Contaduría y Administración*, Vol. 62, No.5, pp. 1427–1441, <https://doi.org/10.1016/j.cya.2017.09.005>.
- Adjasi, C. K. D., Biekpe, N. (2009) "Do Stock Markets Matter in Investment Growth in Africa?", *Journal of Developing Areas*, Vol. 43, No. 1, pp. 109–120, DOI: 10.1353/jda.0.0032.
- Apergis, N., Artikis, P. G., Kyriazis, D. (2015) "Does stock market liquidity explain real economic activity? New evidence from two large European stock markets", *Journal of International Financial Markets, Institutions & Money*, Vol. 38, pp. 42–64, <https://doi.org/10.1016/j.intfin.2015.05.002>.

- Batuo, M., Mlambo, K., Asongu, S. (2018) “Linkages between financial development, financial instability, financial liberalisation and economic growth in Africa”, *Research in International Business and Finance*, Vol. 45, pp. 168–179, <https://doi.org/10.1016/j.ribaf.2017.07.148>.
- Bagehot, W. (1873) *Lombard Street: A Description of the Money Market*, 1st ed., New York: Scribner, Armstrong & Co.
- Bencivenga, V. R., Smith, B. D., Starr, R. M. (1996) “Equity Markets, Transactions Costs, and Capital Accumulation: An Illustration”, *World Bank Economic Review*, Vol. 10, No. 2, pp. 241–265, <https://doi.org/10.1093/wber/10.2.241>.
- Bolbol, A. A., Fatheldin, A., Omran, M. M. (2005) “Financial development, structure, and economic growth: The case of Egypt, 1974-2002”, *Research in International Business and Finance*, Vol. 19, No. 1, pp. 171–194, <https://doi.org/10.1016/j.ribaf.2004.10.008>.
- Carp, L. (2012) “Can Stock Market Development Boost Economic Growth? Empirical Evidence from Emerging Markets in Central and Eastern Europe”, *Procedia Economics and Finance*, Vol. 3, pp. 438–444, [https://doi.org/10.1016/s2212-5671\(12\)00177-3](https://doi.org/10.1016/s2212-5671(12)00177-3).
- Cheng, S.-Y., et al. (2011) “Financial systems and mechanisms of growth in different conditions of country risk”, *Applied Economics Letters*, Vol.18, No.11, pp. 1021–1028, <https://doi-org.libweb.uob.edu.bh/10.1080/13504851.2010.522511>.
- Chu, L. K., Chu, H. V. (2020) “Is too much liquidity harmful to economic growth?”, *Quarterly Review of Economics and Finance*, Vol. 76, pp. 230–242, <https://doi.org/10.1016/j.qref.2019.07.002>.
- Chordia, T., A. Sarkar, A. Subrahmanyam. (2005) “An empirical analysis of stock and bond market liquidity”, *The Review of Financial Studies*, Vol. 18, No. 1, pp. 85–129, doi: <https://doi.org/10.1093/rfs/hhi010>.
- Cooray, A. (2010) “Do stock markets lead to economic growth?”, *Journal of Policy Modeling*, Vol. 32, No. 4, pp. 448–460, doi: <https://doi.org/10.1016/j.jpolmod.2010.05.001>.
- Coskun, Y. (2017) “Capital market and economic growth nexus: Evidence from Turkey”, *Central Bank Review*, Vol. 17, No. 1, pp. 19–29, <https://doi.org/10.1016/j.cbrev.2017.02.003>.
- Epley, D. R. (2003) “Measurement of Local Economic Growth as A Critical Part of Market Analysis”, *Real Estate Issues*, Vol. 28, No. 2, pp. 8–13, https://www.cre.org/wp-content/uploads/2017/04/28_2_measurement.pdf.
- Fanti, L., Manfredi, P. (2009) “Neoclassical production theory and growth with unemployment: The stability issue revisited”, *Structural Change and Economic Dynamics*, Vol. 20, No. 2, pp. 126–135, <https://doi.org/10.1016/j.strueco.2008.12.002>.
- Fufa, T., Kim, J. (2018) “Stock markets, banks, and economic growth: Evidence from more homogeneous panels”, *Research in International Business and Finance*, Vol. 44, pp. 504–517, <https://doi.org/10.1016/j.ribaf.2017.07.120>.

- Furstenberg, G.M., Lovell, M.C., Tobin, J. (1977) "Corporate Investment: Does Market Valuation Matter in the Aggregate?", *Brookings Papers on Economic Activity*, Vol. 1977, No. 2, pp. 347–408, <https://doi.org/10.2307/2534406>.
- Gaido, D. (2016) "Rudolf Hilferding on English Mercantilism", *History of Political Economy*, Vol. 48, No. 3, pp. 449–470, <https://doi-org.libweb.uob.edu.bh/10.1215/00182702-3638631>.
- Galindo, M., Méndez, M. T. (2014) "Entrepreneurship, economic growth, and innovation: Are feedback effects at work?", *Journal of Business Research*, Vol. 67, No. 5, pp. 825–829, <https://doi.org/10.1016/j.jbusres.2013.11.052>.
- Greenwood, J., Smith, B. D. (1997) "Financial markets in development, and the development of financial markets", *Journal of Economic Dynamics & Control*, Vol. 21, No. 1, pp. 145–181, [https://doi.org/10.1016/0165-1889\(95\)00928-0](https://doi.org/10.1016/0165-1889(95)00928-0).
- Hamdi, H., Sbia, R., Tas, B. K. O. (2014) "Financial Deepening and Economic Growth in Gulf Cooperation Council Countries", *International Economic Journal*, Vol. 28, No. 3, pp. 459–473, <https://doi.org/10.1080/10168737.2014.913653>.
- Hicks, J. (1969) *A Theory of Economic History*, Oxford University Press.
- Jensen, M. C., Murphy, K. J. (1990) "CEO Incentives – It's Not How Much You Pay, But How", *Harvard Business Review*, Vol. 68, No. 3, pp. 138–149, <http://dx.doi.org/10.2139/ssrn.146148>.
- King, R. G., Levine, R. (1993) "Finance, entrepreneurship, and growth: Theory and evidence", *Journal of Monetary Economics*, Vol. 32, No. 3, pp. 513–542, [https://doi.org/10.1016/0304-3932\(93\)90028-E](https://doi.org/10.1016/0304-3932(93)90028-E).
- Law, S. H., Singh, N. (2014) "Does too much finance harm economic growth? Publication Date License Does too much finance harm economic growth?", *Journal of Banking Finance*, Vol. 41, No. 1, pp. 36–44, <https://doi.org/10.1016/j.jbankfin.2013.12.020>.
- Levine, R. (1997) "Financial Development and Economic Growth: Views and Agenda", *Journal of Economic Literature*, Vol. 35, No. 2, pp. 688–726, <https://doi.org/10.1596/1813-9450-1678>.
- Levine, R., Zervos, S. (1998) "Stock Markets, Banks, and Economic Growth", *American Economic Review*, Vol. 88, No. 3, pp. 537–558, <https://www.jstor.org/stable/116848>.
- Lind, J.T., Mehлум, H. (2010) "With or without U? The appropriate test for a U-Shaped relationship", *Oxford Bulletin of Economics and Statistics*, Vol. 72, No. 1, pp. 109–118, <https://doi.org/10.1111/j.1468-0084.2009.00569.x>.
- Mercan, M., Göçer, I. (2013) "The Effect of Financial Development on Economic Growth in BRIC-T Countries: Panel Data Analysis", *Journal of Economic & Social Studies (JECOSS)*, Vol. 3, No. 1, pp. 199–216, Doi:10.14706/JECOSS11318.

- Muhammad, N., Islam, A. R. M., Marashdeh, H. A. (2016) "Financial development and economic growth: An empirical evidence from the GCC countries using static and dynamic panel data", *Journal of Economics and Finance*, Vol. 40, No. 4, pp. 773–791, doi: <https://doi.org/10.1007/s12197-015-9331-9>.
- Narayan, P. K., Mishra, S., Narayan, S. (2011) "Do market capitalization and stocks traded converge? New global evidence", *Journal of Banking and Finance*, Vol. 35, No. 10, pp. 2771–2781, <https://doi.org/10.1016/j.jbankfin.2011.03.010>.
- Nelson, R. R., Winter, S. G. (1974) "Neoclassical vs. Evolutionary Theories of Economic Growth: Critique and Prospectus", *Economic Journal*, Vol. 84, No. 336, pp. 886–905, <https://doi.org/10.2307/2230572>.
- Obstfeld, M. (1994) "Risk-taking, global diversification, and growth", *American Economic Review*, Vol. 84, No. 5, pp. 1310–1329, Doi: <https://www.jstor.org/stable/2117774>.
- Pan, L., Mishra, V. (2018) "Stock market development and economic growth: Empirical evidence from China", *Economic Modelling*, Vol. 68, pp. 661–673, <https://doi.org/10.1016/j.econmod.2017.07.005>.
- Patrick, H. T. (1966) "Financial Development and Economic Growth in Underdeveloped Countries", *Economic Development & Cultural Change*, Vol. 14, No. 2, pp. 174–189, <https://doi.org/10.1086/450153>.
- Pietak, T. (2014) "Review of Theories and Models of Economic Growth", *Comparative Economic Research*, Vol. 17, No. 1, pp. 45–60, Doi: <https://doi.org/10.2478/cer-2014-0003>.
- Popa, F. (2016) "Aspects Concerning Endogenous Growth in the Macroeconomic Theories", *Economics, Management & Financial Markets*, Vol. 11, No. 1, pp. 231–243, <https://search.proquest.com/scholarly-journals/aspects-concerning-endogenous-growth/docview/1783000190/se-2?accountid=141837>.
- Porter, R. C. (1966) "The Promotion of the "Banking Habit" and Economic Development", *Journal of Development Studies*, Vol. 2, No. 4, pp. 55–69, <https://doi.org/10.1016/B978-0-08-024041-1.50010-7>.
- Pradhan, R. P., et al. (2014) "Causal nexus between economic growth, banking sector development, stock market development, and other macroeconomic variables: The case of ASEAN countries", *Review of Financial Economics*, Vol. 23, No. 4, pp. 155–173, <https://doi.org/10.1016/j.rfe.2014.07.002>.
- Robinson J. V. (1962) *Essays in the Theory of Economic Growth*, Palgrave Macmillan UK, doi: <https://doi.org/10.1007/978-1-349-00626-7>.
- Ruiz, J. L. (2018) "Financial development, institutional investors, and economic growth", *International Review of Economics & Finance*, Vol. 54, pp. 218–224, <https://doi.org/10.1016/j.iref.2017.08.009>.
- Samargandi, N., Fidrmuc, J., Ghosh, S. (2013) "Is the Relationship between Financial Development and Economic Growth Monotonic for Middle Income

- Countries?? Is the Relationship between Financial Development and Economic”, *World Development*, Vol. 68, No. 13, pp. 66–81, <https://doi.org/10.1016/j.worlddev.2014.11.010>.
- Schumpeter, J.A., Opie, R. (1983) *The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle*, New Brunswick, New Jersey: Transaction Books, Translated from the 1911 original German, *Theorie der wirtschaftlichen Entwicklung*. Retrieved from <https://archive.org/details/in.ernet.dli.2015.187354/page/n1/mode/2up>, doi:10.1080/00343404.2017.1278975.
- Smaoui, H., Nechi, S. (2017) “Does sukuk market development spur economic growth?”, *Research in International Business and Finance*, Vol. 41, pp. 136–147, <https://doi.org/10.1016/j.ribaf.2017.04.018>.
- Steele, G. R. (1998) “The Money Economy: Mercantilism, Classical Economics and Keynes’ General Theory”, *American Journal of Economics & Sociology*, Vol. 57, No. 4, pp. 485–498, doi: <https://www.jstor.org/stable/3487119>.
- Tobin, J., (1969) “A general equilibrium approach to monetary theory”, *Journal of Money Credit and Banking*, Vol. 1, pp. 15–29, doi: <https://doi.org/10.2307/1991374>.
- Valliere, D., Peterson, R. (2009) “Entrepreneurship and economic growth: Evidence from emerging and developed countries”, *Entrepreneurship & Regional Development*, Vol. 21, No.5/6, pp. 459–480, <https://doi.org/10.1080/08985620802332723>.
- Wu, J., Hou, H., Cheng, S. (2010) “The dynamic impacts of financial institutions on economic growth: Evidence from the European Union”, *Journal of Macroeconomics*, Vol. 32, No. 3, pp. 879–891, <https://doi.org/10.1016/j.jmacro.2009.09.003>.

Međuovisnost razvoja burze i gospodarskog rasta: ispitivanje u više zemalja

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Sažetak

U ovom radu istražuje se veza između gospodarskog rasta i razvoja tržišta dionica u regiji GCC, a to je Vijeće za suradnju arapskih država Zaljeva, odnosno Saudijske Arabije, Bahreina, Ujedinjenih Arapskih Emirata, Omana, Kuvajta i Katara u razdoblju od 2000. do 2017. godine. Generalizirani linearni mješoviti model (GLMM) primjenjuje se kako bi se utvrdila povezanost i priroda odnosa. U usporedbi s konvencionalnim regresijskim modelima, GLMM pruža pouzdanije rezultate uzimajući u obzir podatke koji nedostaju i uklanja razlike specifične za pojedine zemlje. Ovim istraživanjem se potvrđuje značajna pozitivna povezanost između likvidnosti na burzi (SML) i realnog bruto domaćeg proizvoda (BDP) po stanovniku, kao i da je negativna povezanost između tržišne kapitalizacije (SMC) i BDP-a dugoročno beznačajna. Rezultati također ukazuju da su SML i SMC značajno i pozitivno povezani. Uzimajući u obzir da uspješne burze mogu povećati nacionalno bogatstvo, smanjiti preveliku ovisnost o nafti kao glavnom faktoru gospodarskog rasta, rezultati sugeriraju da bi kreatori politike u regiji trebali imati aktivniju ulogu u stimuliranju svojih tržišta dionica uključujući i globalnu integraciju..

Cljučne riječi: razvoj burze, gospodarski rast, financijsko tržište, kauzalnost

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The relationship between fiscal policy and economic growth in CEE countries*

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Abstract

The relationship and effects between fiscal policy and economic growth have been an important theoretical and empirical research topic. The neoclassical models imply that the economic effects of changes in government spending will be neutralised by the impact of consequent changes in private spending. Endogenous growth models, on the other hand, imply that changes in the level and composition of taxation and government expenditure can affect economic growth. This aim of the paper is to explore the relationship and effects of fiscal policy and economic growth in 21 Central and Eastern European (CEE) countries over the period 2000-2018. The results, after controlling for various common and country-specific variables, imply that an increase in taxation, but not in non-productive expenditures, can positively affect economic growth. Our main findings are: (i) there is a significant and positive contemporaneous relationship between the general level of taxation and economic growth; and (ii) there is no relationship between the government final consumption and economic growth. Therefore, our results contributed to the scientific literature by providing empirical evidence on the contemporaneous relationship between the general government tax receipt and economic growth in CEE countries.

Key words: *fiscal policy, economic growth, panel data analysis, Central and Eastern European countries*

JEL classification: *H20, H50, O47*

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1. Introduction

In line with economic theory, fiscal policy as a part of overall macroeconomic policy manages budget revenues and expenditures. By using different fiscal instruments, fiscal policy contributes to the achievements of macroeconomic objectives such as full employment, price stability, economic growth, distribution of income, improvements in the balance of payments and others. Moreover, fiscal policy measures like automatic stabilizers and discretionary measures need to be directed to achieve stimulation of economic growth, regulate unemployment and price level, and also redistribution of income and poverty. As such, fiscal policy is the use of government spending and taxation to influence the economy. In that sense, the relationship and effects between fiscal policy and economic growth have been an important theoretical and empirical research topic. Can a change in the share of government expenditure in output, or the structure of expenditure and revenue, improve economic growth, stimulate employment and affect other macroeconomic variables? Therefore, in the economic theory there are three main analytical frameworks through which the determinants of growth including fiscal policy have been analysed – neoclassical growth models, endogenous growth theory and literature that emphasizes the institutional conditions.

The neoclassical growth models (e.g. Solow, 1956) imply that the economic effects of changes in government spending will be neutralised by the effects of consequent changes in private spending. Endogenous growth models (e.g. Barro, 1990), on the other hand, imply that changes in the level and composition of taxation and government expenditure can affect economic growth. Moreover, the preconditions of this model are derived by classifying elements of the government budget into one of four categories. These are distortionary or non-distortionary taxation and productive and non-productive expenditures. Following Kneller et al. (1999) distortionary taxes have effect on agent's investment decision which affect the rate of economic growth, while non-distortionary taxes should not have any effect on investment or saving rates. If government expenditures are classified as productive in that case they have effect on growth, otherwise not. Kneller et al. (1999) find a negative relationship between distortionary taxation (e.g. income tax) and economic growth. On the other hand, they report that an increase in productive government expenditure is positively associated with economic growth. In line with other studies (Bleaney et al. 2001; Gemmell et al. 2011; Zagler and Dürnecker, 2003; Dalić, 2013; Zimčík, 2016) and for the purpose of this empirical analysis we distinguish between distortionary and non-distortionary taxes, and productive and unproductive expenditures. Therefore, taxes on income, profit and social contributions are classified as distortionary, while taxes on goods and services as non-distortionary. In productive expenditures we classified health expenditure, education expenditure, expenditure on economic affairs, expenditure on public order and safety; defence expenditure and expenditure on environment protection, while in non-productive expenditures, social security and

welfare expenditure; expenditure on general public services; expenditure on housing; and expenditure on recreation. Regarding the institutional conditions, researchers like North and Thomas (1973), Olson (1982), and Djankov et al. (2003) provide the empirical evidence that the fundamental differences in economic growth are caused by the differences in institutions.

Following economic theory and studies, our main hypothesis is that *the contemporaneous relationship between the general government tax receipts and economic growth is positive*. An examination of a panel dataset covering 21 CEE countries from 2000 to 2018 uncovers a significant positive contemporaneous relationship between the general government tax receipts and economic growth. While the contemporaneous relationship is positive, the relationship between the lagged tax receipts and economic growth is negative. Further, we find no relationship between final government consumption and economic growth. This paper contributes to the literature by examining the relationship between fiscal policy and economic growth in CEE countries from 2000 to 2018.

The paper is organised as follows. In section two, we summarise relevant findings on the relationship between fiscal policy and economic growth reported by other studies. The research methodology is presented in section three, while section four presents the data, data sources and the empirical analysis. Section five presents the results and discusses the findings. The last section provides a conclusion and recommendations for further research.

2. Literature review

Kneller et al. (1999) examine the relationship between fiscal policy and economic growth in 22 OECD countries over a period of 25 years. They find that distortionary taxation, unlike non-distortionary taxation, reduces economic growth. Moreover, increasing productive expenditure or reducing distortionary taxes by 1 percent of GDP can increase the growth rate between 0.1 and 0.2 percent per year. Similarly, to taxation, the effect of government expenditures on growth depends on the composition expenditures. An increase in productive expenditure stimulates growth. More recent studies have provided additional insights into the relationship between fiscal policy and economic growth. Saqib et al. (2014) report negative effects on economic activity in Pakistan and suggested that the taxation system should be improved by increasing government expenditures on public services. Edame and Adejumo (2013) show a positive effect of tax revenues on economic growth, while Rosoiu (2015) uncovers a positive relationship between the level of taxation and economic growth. Gupta et al. (2005) analysed whether the fiscal expansions and fiscal consolidation have positive effect for growth in 39 low-income countries with IMF-supported programs in the 1990s. They found that fiscal consolidation have

positive effect on growth. This occurs in a reduction in the domestic borrowing requirement of the government.

Ram (1986) found a strong and significant positive effect on government spending growth on output growth. On the other hand, Landau (1983, 1986), Kormendi and Meguire (1985) and Grier and Tullock (1989) report a negative correlation between government fiscal activity and output growth rates. Finally, researchers Conte and Darrat (1988) and Lindauer and Velenchik (1992) found that there is no significant relation between government consumption and economic growth. By using two multiple linear regressions, Boldeanu et al. (2015) analysed the impact of total expenditure, total revenue, deficit and mainly the effect of fiscal policy on economic growth in ten countries in Eastern Europe.

Easterly and Rebelo (1993) report a strong association between the development level and fiscal structure. According to his analysis, poor countries rely heavily on international trade taxes, while income taxes are only important in developed economies. Therefore, fiscal policy is influenced by the scale of the economy, measured by its population and investment in transport and communication is consistently correlated with growth while the effects of taxation are difficult to isolate empirically.

Kukk (2007) reports that an increase in direct taxes, indirect taxes or grants by one percentage point of the gross domestic product increases growth by around 0.1-0.15, 0.1-0.2 and 0.5-1 percentage points respectively. He also finds that changes in different revenue and expenditure categories might have the same impact on budget balance and on total government revenue and expenditure, but they have different effects on economic growth in the long run. Maşca et al. (2015) find that a reduction in government expenditures stimulates growth in the European Union.

Taxation influences economic growth mainly through its impact on variables such as capital accumulation and investment, or human capital (Kotlán et al., 2011; Macek, 2014). Zimčík (2016) finds that non-distortionary (production) taxes and unproductive expenditures have a negative impact on economic growth. On a sample of 20 selected European Union Member states over the years 1995 to 2012, Zimčík (2016) finds that most distortionary taxes (except corporate taxes) have negative relationship to economic growth. Obreja Brasoveanu and Brasoveanu (2008) find a link of negative causality between economic growth and fiscal revenues in Romania. Barro (1990) suggests that shifting from distortionary taxes to non-distortionary taxation stimulates growth. He argues that the level of budget expenditures, which can be divided into productive and unproductive expenditures, influences economic growth. Gemmell and Au (2013) found that an increase in productive expenditures financed by a rise in non-distortionary taxation led to enhanced growth. In line with this, Conte and Darrat (1988) find no correlation between government expenditures and economic growth in the OECD countries,

while Lindauer and Velenchik (1992) obtain the same result from their sample of developing countries. Dalić (2013) analysed the relationship between fiscal policy and growth in new member states and Croatia over the period 1999-2000. The empirical results showed that fiscal policy have positive effects on economic growth. This especially refers to changes in the structure of total expenditure, i.e. reductions in unproductive or current expenditure. Deskar-Škrbić (2018) found that fiscal policy has a significant impact on economic developments in Croatia. None of the existing studies focuses on the impact of the level of taxation on economic growth in CEE countries. In line with the existing literature, we hypothesise that relationship between the level of taxation and economic growth is positive.

3. Methodology

Since the data set is two-dimensional, the panel regression models with different fixed effects are used as an analytic tool. The simplest model for the analysis of this two-dimensional data set is given by:

$$\text{GDPG}_{it} = \alpha + \beta x_{it} + \varepsilon_{it}, \varepsilon_{it} \sim \text{i.i.d.} (0, \sigma^2) \quad (1)$$

where GDPG_{it} is the real GDP growth rate of country i in year t , α is the intercept, β is a $k \times 1$ parameter vector, x_{it} is a vector of k explanatory variables and ε_{it} is a disturbance term.

This model is referred to as the constant-coefficient model because it imposes the same coefficient for every country in the sample. This is the most parsimonious panel data model but is severely restricted. Most importantly, by imposing the same intercept for every country, it effectively assumes that other country-specific determinants of the GDP growth rate are the same for all countries. Other country-specific effects can be taken into account by allowing the intercept to vary in the cross-section. Consider the following model:

$$\text{GDPG}_{it} = \alpha_i + \beta x_{it} + \varepsilon_{it}, \varepsilon_{it} \sim \text{i.i.d.} (0, \sigma^2) \quad (2)$$

The subscript i for α_i indicates that each country has its own intercept or fixed effect. This feature of the model controls for time-invariant country characteristics and therefore provides the basis for the analysis of the effect of the controlled variables that vary over time.

The GDP growth rate is influenced by common factors or factors which affect every country. As with cross-sectional fixed effects, the constant coefficient panel data model can be extended to control for common factors time effects. This is particularly important since the data sample covers the recent global financial crisis. Consider the following model:

$$\text{GDPG}_{it} = \phi_t + \beta x_{it} + \varepsilon_{it}, \varepsilon_{it} \sim \text{i.i.d.} (0, \sigma^2) \quad (3)$$

where ϕ_t is the time-specific effect. This effect is common in the cross-section, so it captures all time-varying variables that affect the GDP growth rate but are constant in the cross-section.

Finally, the following model controls for both effects (country-specific and period-specific) simultaneously:

$$\text{GDPG}_{it} = \alpha_i + \phi_t + \beta x_{it} + \varepsilon_{it}, \varepsilon_{it} \sim \text{i.i.d.} (0, \sigma^2) \quad (4)$$

Following Petersen (2009), appropriate clustered standard errors are used to account for potential time-series as well as cross-sectional error correction.

4. Empirical data and analysis

We examined data from CEE countries⁴ covering the period from 2000 to 2018. The annual aggregated data is collected from 2000-2018 for 21 CEE countries. The data was obtained from the Handbook of Statistics 2019 of the Vienna Institute for International Economic Studies. The panel dataset is unbalanced as some country-year observations are not available for the entire sample period. The total number of country-year observations available is 321. The GDP growth rate is utilised as dependent variable, while the explanatory variables are the growth rate of total tax receipts-general government, growth rate of government final consumption expenditure and growth rate of total population. Growth rates of gross fixed capital formation, total employment and consumer prices are used as control variables. Table 1 depicts the descriptive statistics of the panel series.

⁴ Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Kazakhstan, Kosovo, Latvia, Lithuania, Macedonia, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey, Ukraine

Table 1: Descriptive statistics of panel series

Growth Rates in %	Mean	Std. Dev.	Min	Max
GDP	3.6	3.9	-15.1 (Ukraine)	13.5 (Kazakhstan)
Gov. Tax Receipts	3.9	8.0	-36.2 (Latvia)	84.0 (Serbia)
Gov. Final Consumption	2.0	4.3	-15.8 (Macedonia)	35.5 (Macedonia)
Employment	0.6	3.1	-14.3 (Macedonia)	21.9 (Montenegro)
Population	-0.7	4.9	-16.2 (Lithuania)	16.4 (Kazakhstan)
Capital Formation	5.2	12.3	-49.7 (Ukraine)	50.5 (Romania)
Consumer Prices	5.8	9.2	-2.4 (Kosovo)	93.3 (Serbia)

Source: Authors' calculation

The GDP growth rate is regressed on the real growth rate in gross total general government tax receipts, government final consumption expenditure, total employment, population, fixed capital formation and consumer prices. The estimated coefficients and associated t-statistics of the panel models specified in Equations 1-4 are presented in Table 2.

Table 2: The relationship between the GDP growth rate and the variables

Variable (growth rates in %)	No Effects (Eq. 1)		Country Effects (Eq. 2)		Period Effects (Eq. 3)		Two-Way Effects (Eq. 4)	
	Coeff.	T-stat	Coeff.	T-stat	Coeff.	T-stat	Coeff.	T-stat
Gov. Tax Receipts	0.16	8.87*	0.16	4.89*	0.11	6.87*	0.12	6.85*
Gov. Tax Receipts (-1)	-0.06	-3.03*	-0.04	-1.58	-0.04	-2.09*	-0.03	-2.04*
Gov. Final Consumption	0.09	2.44*	0.06	1.23	0.07	2.03*	0.05	1.35
Employment	0.16	3.20*	0.19	3.12*	0.16	4.64*	0.19	4.39*
Population	-0.03	-1.06	-0.12	-2.82*	0.00	-0.10	-0.06	-1.35
Capital Formation	0.18	15.05*	0.18	6.05*	0.13	7.01*	0.12	10.10*
Consumer Prices	-0.05	-3.41*	-0.06	-2.82*	-0.06	-3.16*	-0.08	-4.42*
GDPG(-1)	0.16	4.18*	0.11	1.56	0.26	5.24*	0.18	3.98*
C	1.43	8.43*	1.54	4.20*	1.54	8.70*	1.87	9.24*
Adjusted R ²	75%		76%		83%		84%	

Note: *significance at the 5% level; ** significance at the 10% level

Source: Authors' calculation

The explanatory power, as measured by the Adjusted R^2 , indicated that the two-way effects model (Equation 4) is the best. The country-specific effects improve the explanatory power by just one percentage point, and the year-specific effects improve the explanatory power by eight percentage points. This implies that common factors that affect the GDP growth rate of all the countries are more important than country-specific factors or differences among individual countries.

The formal tests, depicted in Table 3 (below), confirm that the cross-sectional factors are less important to the period-effects. However, both the F-test and Chi-square tests indicate that they are not redundant. Similarly, both tests strongly confirm the importance of the period effects. Therefore, the two-way effects model or the period effects model should be used. It should be noted that the coefficients in models without the period effects are biased. Using the robust errors to account for the cross-sectional correlation of errors, as in Zimčik (2016), corrects the bias in standard errors of the coefficients, but leaves the coefficients inflated.

Table 3: Fixed Effects Redundancy Tests

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.96	-20,257.00	0.01
Cross-section Chi-square	43.11	20.00	0.00
Period F	8.24	-17,257.00	0.00
Period Chi-square	131.82	17.00	0.00
Cross-Section/Period F	5.27	-37,257.00	0.00
Cross-Section/Period Chi-square	170.99	37.00	0.00

Source: Authors' calculation

The results indicate that the general government tax receipts are positively and significantly related to the GDP growth rate. The magnitude of the coefficient implies that 1 percent growth in the general government tax receipts increases GDP by 0.12 percent. On the other hand, the relationship between the lagged general government tax receipts and the GDP growth rate is negative. This implies that an increase in the general government tax receipts stimulates the growth in the period when it occurs, but negatively impacts upon growth in the subsequent period. On the other hand, there is no relationship between final government consumption and GDP growth rates. This implies that growth in taxation to finance productive expenditures boosts economic growth.

5. Results and discussion

Fiscal policy, as a part of overall macroeconomic policy, manages budget revenues and expenditures. By using different fiscal instruments, fiscal policy contributes to the achievements of macroeconomic objectives such as full employment, price stability, economic growth, distribution of income, improvements in the balance of payments etc. The relationship between fiscal policy and economic growth has been studied by many authors with no conclusive results. One branch of the literature (e.g. Ram, 1986; Gemmel et al., 2011; Sever et al., 2011; Edame and Adejumo, 2013; Šimović and Deskar-Škrbić, 2013; Mašca et al., 2015; Rosoiu, 2015; Deskar-Škrbić, 2018) finds a positive and significant relationship between fiscal policy and economic growth, while other researchers (Landau 1983, 1986; Grier and Tullock, 1989; Barro, 1990; Gwartney et al. 1998; Bajo-Rubio, 2000; Obreja Brasoveanu and Brasoveanu, 2008; Saqib et al., 2014; Zimčik, 2016) reports significantly negative or no significant relationship between fiscal policy and economic growth (Conte and Darrat, 1988; Lindauer and Velenchik, 1992). Due to the economic and financial circumstances in CEE countries, fiscal policy is an important instrument for stabilising domestic demand and output and promoting sustainable and robust growth. As one of the most important economic instrument, fiscal policy produces numerous direct as well as indirect effects on the stability of prices, employment, economic growth, the balance of payment, redistribution of income and property, aggregate demand, liquidity etc. From the traditional fiscal literature, it follows that expansionary fiscal policy can affect aggregate expenditure and, consequently, economic growth.

By observing empirical results, the results imply a positive contemporaneous relationship between the general government tax receipts and economic growth of 21 CEE countries within the period 2000 - 2018. Moreover, one percentage point increase in general government tax receipts boosts economic growth by 0.12 percentage points. Thus, the results, in general, are in line with our main hypothesis. Further, our results are in line with Deskar-Škrbić (2018) who studied one CEE country (i.e. Croatia). On the other hand, the relationship between the lagged general government tax receipts and economic growth is found to be negative. This implies the initial positive impact of an increase in tax receipts on economic growth is at least partially neutralised in subsequent periods. The results are robust to explicit controls for changes in employment, population, capital formation, consumer prices and lagged GDP growth rate as well as general fixed cross-sectional and period effects. We also find no significant relationship between final government consumption and economic growth, which is consistent with the results reported by Conte and Darrat (1988) and Lindauer and Velenchik (1992). On the other hand, Dalić (2013) found that the high volatility of government investment has its own negative direct on growth. In order to achieve positive effect of fiscal policy on growth it is necessary to improve fiscal balance. This can be achieved

by either cutting unproductive expenditure or a combination of a reduction in unproductive expenditure and an increase in non-distortionary taxes. Our results contribute to the literature in several ways. Firstly, we examine CEE countries, which are not extensively covered by the existing literature. Secondly, our results provide additional evidence on the contemporaneous relationship between the general government tax receipts and economic growth.

6. Conclusions

We hypothesise that the contemporaneous relationship between the level of taxation and economic growth is positive. An analysis of a sample of 21 CEE countries spanning 18 years leads to the acceptance of this hypothesis. An increase in taxation is associated with higher economic growth in the same period and negative economic growth in the subsequent period. This implies that the fiscal policy can be used to boost economic growth in the short term. In addition, the fiscal policy is especially perceived in connection with basic functions, such as allocation, stabilization and redistribution. The finding that there is no relationship between final government consumption and economic growth points out that the best effect is achieved when additional tax revenues are used to fund capital expenditures. All presented results have important policy implications since fiscal policy as one of the most important economic instrument produces numerous effects – direct or indirect. Moreover, expansionary fiscal policy has effects on expenditure and aggregate demand and, also with that on direct or indirect way on economic growth. We contribute to the literature by examining a sample of CEE countries not extensively studied before. The research is limited by the availability of data and can be extended by examining the relationship between economic growth and various components of government revenues and expenditures.

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References

- Bajo-Rubio, O. (2000) “A further generalisation of the Solow growth model: the role of the public sector”, *Economic Letters*, Vol. 68, No. 1, pp. 79–84.
- Barro, R. J. (1990) “Government Spending in a Simple Model of Endogenous Growth”, *Journal of Political Economy*, Vol. 98, No. 5, pp. 103–117, <https://doi.org/10.1086/261726>.

- Bleaney, M., Gemmell, N. Kneller, R. (2001) “Testing the Endogenous Growth Model; Public Expenditure, Taxation and Growth over the Long Run”, *Canadian Journal of Economics*, Vol. 34, No. 1, pp. 36–57, <https://doi.org/10.1111/0008-4085.00061>.
- Boldeanu, F. T., Tache, I., Ion Madălin, S. (2015) “The impact of fiscal policy on economic growth in the countries of Eastern Europe”, *Revista Economica*, Vol. 67, No. 5, pp. 16–32.
- Conte, M. A., Darrat, A. F. (1988) “Economic Growth and the Expanding Public Sector: A Reexamination”, *The Review of Economics and Statistics*, Vol. 70, No. 2, pp. 322–330.
- Dalić, M. (2013) “Fiscal policy and growth in the new member states of the EU: a panel data analysis”, *Financial Theory and Practice*, Vol. 37, No. 4, pp. 335–360, <https://doi.org/10.3326/fintp.37.4.1>.
- Deskar-Škrbić, M. (2018) “Dynamic effects of fiscal policy in Croatia: confronting New-Keynesian SOE theory with empirics”, *Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business*, Vol. 36, No. 1, pp. 83–102.
- Djankov, S. et al. (2003) “The New Comparative Economics”, *Journal of Comparative Economics*, Vol. 31, No. 4, pp. 595–619, <https://doi.org/10.1016/j.jce.2003.08.005>.
- Easterly, W., Rebelo, S. (1993) “Fiscal policy and economic growth: an empirical investigation”, *Journal of Monetary Economics*, Vol. 32, No. 3, pp. 417–458, [https://doi.org/10.1016/0304-3932\(93\)90025-B](https://doi.org/10.1016/0304-3932(93)90025-B).
- Edame, G. E., Adejumo, T. O. (2013) “The effects of Tax Revenue on Economic Growth in Nigeria (1970—2011)”, *International Journal of Humanities and Social Science Invention*, Vol. 2, No. 6, pp. 16–26.
- Gemmell, N., Au, J. (2013) “Government size, fiscal policy and the level and growth output: A review of recent evidence”, *Journal of the Asia Pacific Economy*, Vol. 18, No. 2, pp. 203–229, <https://doi.org/10.1080/13547860.2013.777535>.
- Gemmell, N., Kneller, R., Sanz, I. (2011) “The Timing and Persistence of Fiscal Policy impacts on Growth: Evidence from OECD Countries”, *Economic Journal*, Vol. 121, No. 55, pp. F33–F58, <https://doi.org/10.1111/j.1468-0297.2010.02414.x>.
- Grier, K. B., Tullock, G. (1989) “An Empirical Analysis of Cross-National Economic Growth”, *Journal of Monetary Economics*, Vol. 24, No. 2, pp. 259–276, [https://doi.org/10.1016/0304-3932\(89\)90006-8](https://doi.org/10.1016/0304-3932(89)90006-8).
- Gupta, S., Clements, B., Baldacci, E., Mulas-Granados, C. (2005) “Fiscal policy, expenditure composition, and growth in low-income countries”, *Journal of International Money and Finance*, Vol. 24, pp. 441–463, doi: 10.1016/j.jimonfin.2005.01.004.

- Gwartney, J., Lawson, R., Holcombe, R. (1998) *The size and functions of government and economic growth*, Joint Economic Committee Study, Washington D.C.
- Kneller, R., Bleaney, M. F., Gemmell, N. (1999) "Fiscal policy and growth: evidence from OECD countries", *Journal of Public Economics*, Vol. 74, No. 2, pp. 171–190, [https://doi.org/10.1016/S0047-2727\(99\)00022-5](https://doi.org/10.1016/S0047-2727(99)00022-5).
- Kormendi, R. C., Meguire, P. G. (1985) "Macroeconomic Determinants of Growth: Cross-Country Evidence", *Journal of Monetary Economics*, Vol. 6, No. 2, pp. 141–163, [https://doi.org/10.1016/0304-3932\(85\)90027-3](https://doi.org/10.1016/0304-3932(85)90027-3).
- Kotlán, I., Machová, Z., Janíčková, L. (2011) "Taxation Influence on Economic Growth", *Politická ekonomie*. Vol. 59, No. 5, pp. 638–658, <https://doi.org/10.18267/j.polek.812>.
- Kukk, K. (2007) *Fiscal Policy Effects on Economic Growth: Short Run vs. Long Run*, TTU Working Paper No. 167, pp. 77–96.
- Landau, D. (1983) "Government Expenditure and Economic Growth: A Cross-Country Study", *Southern Economic Journal*, Vol. 49, pp. 783–792, <https://doi.org/10.2307/1058716>.
- Landau, D. (1986) "Government and Economic Growth in the Less Developed Countries: An Empirical Study for 1960-1980", *Economic Development and Cultural Change*, Vol. 35, No. 1, pp. 35–75, <https://doi.org/10.1086/451572>.
- Lindauer, D. L., Velenchik, A. D. (1992) "Government spending in developing countries: trends, causes, and consequences", *The World Bank Research Observer*, Vol. 7, No. 1, pp. 59–78, <https://doi.org/10.1093/wbro/7.1.59>.
- Macek, R. (2014) "The Impact of Taxation on Economic Growth: Case Study of OECD Countries", *Review of Economic Perspectives*, Vol. 14, No. 4, pp. 309–328, <https://doi.org/10.1515/revecp-2015-0002>.
- Mașca, S. G., Cuceu, I. C., Văidean, V. L. (2015) "The Fiscal Policy as Growth Engine in EU countries", *Procedia Economics and Finance*, Vol. 32, pp. 1628–1637, [https://doi.org/10.1016/S2212-5671\(15\)01489-6](https://doi.org/10.1016/S2212-5671(15)01489-6).
- North, D., Thomas, R. (1973) *The Rise of the Western World: A New Economic History*, Cambridge: Cambridge University Press.
- Obreja Brasoveanu, L., Brasoveanu, I. (2008) "The Correlation between Fiscal Policy and Economic Growth", *Theoretical and Applied Economics*, Vol. 7, No. 524, pp. 19–26.
- Olson, M. (1982) *The Rise and Decline of Nations*, Yale: Yale University Press.
- Petersen, M. A. (2009) "Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches", *The Review of Financial Studies*, Vol. 22, No. 1, pp. 435–480, Available at: <<http://www.jstor.org/stable/40056916>>.
- Ram, R. (1986) "Government Size and Economic Growth: A New Framework and Some Evidence from Cross-Section and Time-Series Data", *American Economic Review*, Vol. 76, No. 1, pp. 191–203, Available at: <<https://www.jstor.org/stable/1804136>>.

- Rosoïu, I. (2015) "Uncertainty and the Transmission of Fiscal Policy", *Procedia Economics and Finance*, Vol. 32, pp. 769–776, [https://doi.org/10.1016/S2212-5671\(15\)01460-4](https://doi.org/10.1016/S2212-5671(15)01460-4).
- Saqib, S. et al. (2014) "Taxation Effects on Economic Activity in Pakistan", *Journal of Finance and Economics*, Vol. 2, No. 6, pp. 215–219, <https://doi.org/10.12691/jfe-2-6-3>.
- Sever, I., Drezgić, S., Blažić, H. (2011) "Budget spending and economic growth in Croatia – Dynamics and relationship over the past two decades", *Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business*, Vol. 29, No. 2, pp. 291–331.
- Solow, R.M. (1956) "A contribution to the theory of economic growth", *Quarterly Journal of Economics*, Vol. 71, No. 1, pp. 65–94, <https://doi.org/10.2307/1884513>.
- Šimović, H., Deskar-Škrbić, M. (2013) "Dynamic effects of fiscal policy and fiscal multipliers in Croatia", *Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business*, Vol. 31, No. 1, pp. 55–78.
- Vienna Institute for International Economic Studies (2019), *Handbook of Statistics 2019: Central, East and Southeast Europe*, Available at: <https://wiiw.ac.at/wiiw-handbook-of-statistics-2019-central-east-and-southeast-europe-p-5109.html>.
- Zagler, M., Dürnecker, G. (2003) "Fiscal Policy and Economic Growth", *Journal of Economic Surveys*, Vol. 17, No. 3, pp. 397–418, <https://doi.org/10.1111/1467-6419.00199>.
- Zimčik, P. (2016) "Economic Growth and Budget Constraints: EU Countries Panel Data Analysis", *Review of Economic Perspectives*, Vol. 16, No. 2, pp. 87–101, <https://doi.org/10.1515/revecp-2016-0007>.

Povezanost fiskalne politike i gospodarskog rasta u zemljama srednje i istočne Europe

Sabina Hodžić¹, Amer Demirović², Emira Bečić³

Sažetak

Povezanost i efekti između fiskalne politike i gospodarskog rasta važna su teoretska i empirijska tema istraživanja. Neoklasični modeli smatraju da će ekonomski učinci u državnoj potrošnji biti neutralizirani efektima posljedičnih promjena u privatnoj potrošnji. S druge strane, endogeni modeli rasta smatraju da promjene u razini i sastavu oporezivanja i državne potrošnje utječu na gospodarski rast. Cilj rada je istražiti povezanost i efekte fiskalne politike i gospodarskog rasta u 21 zemlji srednje i istočne Europe u razdoblju od 2000. – 2018. godine. Empirijski rezultati, nakon kontrole zajedničkih i specifičnih varijabli za pojedinu zemlju, ukazuju na to da povećanje oporezivanja, ali ne i neproaktivnih izdataka, može pozitivno utjecati na gospodarski rast. Glavni rezultati empirijske analize su: (i) da postoji značajna i pozitivna povezanost između opće razine oporezivanja i gospodarskog rasta; i (ii) da ne postoji povezanost između državne finalne potrošnje i gospodarskog rasta. Rezultati empirijske analize doprinjeli su znanstvenoj literaturi potvrđujući povezanost između državnih poreznih prihoda i ekonomskog rasta u zemljama srednje i istočne Europe.

Ključne riječi: *fiskalna politika, ekonomski rast, analiza panel podataka, zemlje srednje i istočne Europe*

JEL klasifikacija: *H20, H50, O47*

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Risk factors selection with data mining methods for insurance premium ratemaking*

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Abstract

Insurance companies that have adopted the application of data mining methods in their business have become more competitive in the insurance market. Data mining methods provides the insurance industry with numerous advantages: shorter data processing times, more sophisticated methods for more accurate data analysis, better decision-making, etc. Insurance companies use data mining methods for various purposes, from marketing campaigns to fraud prevention. The process of insurance premium pricing was one of the first applications of data mining methods in insurance industry. The application of the data mining method in this paper aims to improve the results in the process of non-life insurance premium ratemaking. The improvement is reflected in the choice of predictors or risk factors that have an impact on insurance premium rates. The following data mining methods for the selection of prediction variables were investigated: Forward Stepwise, Decision trees and Neural networks. Generalized linear models (GLM) were used for premium ratemaking, as the main statistical model for non-life insurance premium pricing today in most developed insurance markets in the world.

Key words: GLM, data mining methods, forward stepwise, decision trees, neural networks

JEL classification: G22

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1. Introduction

Insurance companies strive to strengthen their market position by introducing innovative solutions. The development of information technologies and the introduction of technological innovations, such as data warehousing, have enabled the development of data mining methods. Data mining is the process of discovering interesting patterns and knowledge from a large amount of data. Data mining uses a variety of methods to discover patterns and relationships between data to make valid predictions.

Data mining is a fairly new technology with great potential, which can help insurance companies focus on the most important information from the collected data in their business. Various data mining methods are used in the insurance industry, from classification, cluster analysis to regression. Data mining is used by insurance companies in various business areas, like insurance pricing, client acquisition, portfolio renewal, product development, fraud detection, reinsurance, marketing campaigns and claims assessment (SAS Institute, 2000). Insurance companies that have applied data mining methods have gained a competitive advantage in their operations. The main goal of this study was to examine the impact of the use of data mining methods for the risk factors selection on the non – life insurance premiums ratemaking. The research hypothesis states that adequate data mining methods used for risk factors selection of the non-life insurance premiums will improve the ratemaking process significantly in term of its quality.

In the paper, the impact of risk factors selected using data mining methods on the non-life insurance premium pricing is investigated. Risk factors are the characteristics of the insured, the subject of insurance and its environment that are believed to directly affect the insurance premium. Generalized linear models (GLM) as the standard for non-life insurance premium pricing in the European Union and in many other insurance markets were used for non-life insurance premium ratemaking. Data mining methods were used to select risk factors or predictors, which are included in the GLM to estimate insurance premiums.

The contribution of this paper is described through the application of the data mining method as a tool for the results' improvement in the process of non-life insurance premium ratemaking. The improvement is reflected in the choice of predictors or risk factors that have an impact on insurance premium rates.

This paper is organized in the following manner. Section 2 discusses the existing literature and gives some theoretical background. The elaborated literature covers the main findings of GLM in nonlife insurance. Also, first models for claims frequency and claims severity are presented. The data mining methods in insurance are widely used but regarding the topic of this paper authors presented data mining methods that can be used to overcome the problems of traditional GLMs, and to

improve performance of the risk premium predictive model. Section 3 provides information on data, model specification and applied methodology. The most commonly used approach in non-life insurance premium pricing is the risk premium approach. However, more accurate and flexible statistical models for premium ratemaking can be constructed by examining the claims frequency and claims severity separately. Out of GLM generally, separate GLM for claims frequency and GLM for claims severity are more efficient and practical to apply, so they have been used in this paper as well. Some of the most well-known data mining methods for variable selection were used to select risk factors in the paper: Stepwise regression, Decision trees and Neural networks. Section 4 presents empirical results and discussion. The research was conducted on motor hull insurance data set one of the leading insurance companies in Bosnia and Herzegovina. The data set contains 22 variables and consists 17,404 records on motor hull insurance policies during five consecutive years. Authors described the development and evaluation of claims frequency and claims severity models. Section 5 concludes the paper.

2. Literature review

The most popular statistical models used today in the actuarial mathematics of non-life insurance are Generalized Linear Models. GLM was introduced by Nelder and Wedderburn (1972). They show that GLM is an extension of traditional linear models, where the probability distribution of the dependent variable is a member of the family of exponential distributions (normal, Poisson, gamma, ...), and the expectation of the dependent variable is determined by a linear predictor based on nonlinear link function. The first application of GLMs in insurance premium pricing was the illustration of the application of GLM for the claim severity in motor insurance by McCullagh and Nelder (1989).

Most insurance companies in EU countries after the deregulation of the insurance market in the 1990s, took the opportunity to create their insurance tariffs based on GLM, as shown by some of the following papers. Renshaw (1994) showed how GLM can be used to analyze the claims frequency and claims severity based on individual data at the insured level. Brockman and Wright (1992) used GLIM software to statistically model the claims frequency and severity in premium pricing for motor liability insurance. Haberman and Renshaw (1996) presented a comprehensive overview of the application of GLM for various actuarial problems such as: survival models, multiple condition models, claims distribution models, insurance premium pricing and claims reserves in non-life insurance.

Over the years, many authors have made significant contributions to the development and improvement of GLM for non-life insurance premium pricing, and thus enabled the practical application of these models in the insurance

industry. A significant contribution belongs to Denuit and Charpentier (2005) who presented all aspects of insurance mathematics in a modern way. Anderson et al. (2007) is the most useful guide for actuaries for application of GLM in practice. The handbook, in addition to statistical theory and examples, provides insight into GLM construction – including data preparation and preliminary data analysis, model selection and number of iterations, model accuracy, and interpretation of model results. DeJong and Heller (2013) did an illustration of GLM for premium ratemaking on examples. Kaas et al. (2009) used GLM to determine premium motor third party liability insurance based on a bonus-malus system. Ohlsson and Johansson (2010) presented the basics of GLM theory for insurance tariff design and how to build a generalized linear model for calculating non-life insurance premium rates with example illustration, especially for multiplicative and hierarchical models. The paper presents useful extensions of GLM theory to Generalized Additive Models, with the application of interpolation of cubic and bivariate splines for modeling continuous independent variables. Goldburd et al. (2016) published a comprehensive manual for actuaries for the application of GLM in risk classification and tariff development for non-life types of insurance based on raw premium and claims data. Based on the idea of deJong and Heller (2013), Anderson et al. (2007) and Goldburd et al. (2016), we develop models for claims frequency and claims severity in this work.

In the last twenty years, data mining methods have become a useful tool in many areas of business. Industries are using data mining to achieve competitive advantage, increase efficiency, and provide better customer service (Fayyad et al. 1996). Data mining methods have also begun to be applied in the insurance industry. Sumathi and Sivanandam (2006) explored the concepts of data mining and data warehousing and presented the areas of application of data mining in the insurance industry. We used the work of Han et al. (2012) to get a basic knowledge of data mining methods. They presented a comprehensive overview of data mining methods, from classification and regression analysis to cluster analysis. Hastie et al., (2001) also systematically presented most of the statistical methods used today in data mining.

There are numerous papers on the application of data mining methods in the insurance industry. Some of the authors have attempted to use data mining methods for non-life insurance premium ratemaking. Lowe and Pryor (1996) compared the methods of neural networks and GLM and concluded that neural networks have a more general application than GLM and suggested certain possibilities of using neural networks in insurance but concluded that computationally demanding neural networks can prevent their wider application in insurance. Dugas et al. (2003) investigated the application of neural networks to motor insurance premiums ratemaking in North America. Guo (2003) described the application of the decision tree method to model claims frequency in non-life insurance. Yao (2008) used

cluster analysis methods to determine claims frequency by geographical areas. From the cited literature, it can be concluded that the inability to clearly present the results obtained on the basis of data mining models for insurance premium pricing is, at this moment, a problem which needs to be solved for the practical application of these methods in insurance companies and their acceptance by regulators.

At the same time, data mining methods can be used to overcome the problems of traditional GLMs, and to improve performance of the risk premium predictive model. Some of the authors combined data mining methods and GLM to take advantage of both approaches. The work of Kolyshkin et al. (2004) discusses the advantages of combining GLM with the Multivariate Adaptive Regression Splines (MARS) method. The results of this combined model were compared with the results of standard GLM. Williams et al. (2015) compared different data mining methods (Stepwise regression, decision tree, etc.) for the selection of predictors on the example of a household property insurance premium. Recent papers dedicated to GLM, by Makov and Weiss (2016), Coskun (2016) include Stepwise regression in variable selection. Makov and Weiss (2016), Guo (2003) used decision trees to select variables. Refaat (2007) proposes the application of a decision tree for variable selection, reduction of variable dimensionality and optimal discretization of continuous variables. Flynn and Francis (2009) used the CHAID decision tree in the data preparation process to estimate the claims frequency via GLM. Francis (2001) compared neural networks and regression models on insurance examples and used neural networks to select risk factors. The works of these authors were an incentive to explore data mining methods for the selection of variables in the data preparation phase, in order to improve the prediction performance and efficiency of the GLM risk premium predictive model.

3. Methodology

In the development of GLM for the insurance premium pricing, it is necessary to include all significant risk factors, i.e. prediction variables, which have an impact on the amount of insurance premium. Databases available to insurance companies, as well as available databases of external companies and institutions, contain hundreds of potential variables for the selection of risk factors. Manual selection of predictors i.e. risk factors takes a lot of time and therefore requires a large number of iterations during development phase of GLM. In the insurance industry, risk factors are in most cases defined on the basis of the existing insurance tariffs, research literature or statistical tests of the significance of prediction variables.

Data mining methods successfully address certain limitations of manual selection of predictors. The application of data mining methods aims to select significant predictors from the initial set of variables, which will be used to develop the

GLM for the claims frequency and claims severity. Data mining models are more accurate, faster, and more efficient in solving of business problems. The main reasons for the increasing attractiveness of data mining methods are:

- require less time required for data analysis,
- automatically selects the data to be used in pattern recognition,
- have the ability to process incomplete data and data with incorrect values,
- use test data sets to ensure the reliability of the results,
- provide a clear presentation of the results and useful feedback.

In order to improve the accuracy of risk premium predictions, this paper investigates data mining methods for the selection of risk factors or predictors.

3.1. Research methods

The most commonly used approach in non-life insurance premium pricing is the risk premium approach (Werner and Modlin, 2010). Risk premium is the average expected amount of claims under the insurance policy during the insurance period. In estimation of the risk premium, the distribution of total claims or the distribution of the claims frequency and the distribution of claim severity can be analyzed. Certain risk factors affect both the claims frequency and claims severity, while some risk factors affect only the claims severity or claims frequency. According to Klugman et al., (2004), more accurate and flexible statistical models for premium ratemaking can be constructed by examining the claims frequency and claims severity separately. Above all, separate GLM for claims frequency and GLM for claims severity are more efficient and practical to apply, so they have been used in this paper as well.

The application of data mining methods aims to select significant prediction variables from the initial set of variables, which will be used to develop GLM for claims frequency and GLM for claims severity. As the number of independent prediction variables that are the subject of research increases, there is a need to know the structure and relationships between these variables. The process of reducing the number of predictors under consideration is called data dimensionality reduction. For data dimensionality we use feature selection methods.

Feature selection (or variable selection) is the process of selecting a subset of significant predictors to be used to develop a model. Feature selection methods are useful due to:

- simplification of the model for easier interpretation,
- reducing the duration of model development,
- avoiding excessive parameterization of the model.

Some of the most well-known data mining methods for feature selection were used to select risk factors in the paper: Stepwise regression, Decision trees and Neural networks. The applied methods of data mining in the research are described in more detail below.

3.2. Generalized linear models (GLM)

Based on deJong and Heller (2013), we give only summary of the main characteristics of generalized linear models (GLMs). The purpose of GLM is to estimate the dependent response variable Y claims frequency and claims severity, based on a number of known independent predictors or risk factors X_i , where $i = 1, \dots, n$. GLM is specified with following three components:

(GLM1) Random component: The response variable Y belongs to the exponential family of distributions, if its density can be written in the form:

$$f_Y(y_i; \theta_i, \phi) = \exp \left\{ \frac{y_i \theta_i - b(\theta_i)}{a_i(\phi)} + c(y_i, \phi) \right\}, \quad i = 0, \dots, n;$$

where parameter θ_i is related to the mean $\mu_i = E[Y_i]$, the scale parameter ϕ is fixed value estimated from data, while functions $a(\cdot)$, $b(\cdot)$ and $c(\cdot)$ specifies a distribution function, suitable for solving GLM problems.

(GLM2) Systematic component: Linear predictor η_i is a linear function of independent predictors X_{ij} and unknown parameters β_j :

$$\eta_i = \beta_0 + x_{i1}\beta_1 + \dots + x_{ip}\beta_p + \xi_i, \quad i = 1, \dots, n,$$

where: n is the number of data, p is a number of model parameters, $n - p$ degree of freedom and ξ_i offset. The parameters β_j are estimated by the method of maximum likelihood.

(GLM3) Link function: The relationship between a random and a systematic component is defined through a link function $g(\cdot)$, via the equation:

$$g(\mu_i) = \eta_i = \beta_0 + \beta_1 x_{i1} + \dots + \beta_p x_{ip}$$

Link function $g(\cdot)$ provides GLM flexibility in defining the relationship between mean and the linear predictor. The Log link function $g(x) = \ln(x)$ is most often used to determine the insurance premium, due to the ability to produce multiplicative models.

Advantages of using GLM over other methods of non-life insurance premium pricing are:

- GLM has a statistical framework, which provide techniques for standard error estimation, confidence interval, testing, model selection, and other statistical functions.
- Standard statistical software for calculating GLM makes the analysis of data for determining premium rates relatively easy (e.g. SAS, SPSS, R).
- GLM can be used separately to model the claims frequency and to model the claims severity with respect to the choice of independent variables.

3.3. Stepwise regression

Stepwise regression method selects the optimal number of predictors, by adding or removing independent predictors in each step, based on defined criteria. Although the stepwise regression method was introduced by Efroymson (1960), more than 60 years ago it's still a very popular data mining method, since it's computationally less demanding than searching for all possible combinations of predictors. The most common criticism directed at the application of the Stepwise regression method is based on the fact that standard statistical tests are not suitable for use in every step of the selection of prediction variables (Harrell, 2001). Despite criticism, this method has never ceased to be used and its use has revived for data mining purposes, in cases where a large number of potential predictors are present. Namely, Famoye and Rothe (2003) found that the application of stepwise regression, if taken with the appropriate degree of caution, is acceptable in practice.

There are several procedures for selecting variables using stepwise regression, most of which are applied: Forward selection, Backward elimination and Forward Stepwise regression. In this paper, Forward Stepwise Regression with AICC criteria is used for selection of risk factors. The process of Forward Stepwise regression of variables begins with the null model, i.e. without predictors in the model, and then in each step the least significant predictor is alternately excluded and the most significant predictor is included in the model. In each step, values are calculated that must be in accordance with the criterion variable.

Corrected Akaike Information Criterion (AICC) for entering or removing an effect from the current model use value:

$$AICC = N \ln \left(\frac{(N - 1) S_{yy} \times \tilde{r}_{yy}}{N} \right) + \frac{2p^r N}{N - p^r - 1}$$

where: N is number of data, p^r is number of parameters in the resulting model (including the intercept), SS_{yy} is weighted sample variance for y , \tilde{r}_{yy} is the last diagonal element in the resulting \tilde{R} matrix.

3.4. Decision trees

Decision tree method, as the name suggests, divides data by making a decision based on certain criteria. The speed and accuracy of algorithms, the ability to work with large data sets, without special requirements regarding the quality and relationship between variables, and the simplicity of presentation of results, are just some of the advantages of this method of data mining. Decision trees have the most common application for solving predictive problems with supervised learning. Decision trees according to the response variable are divided into classification decision trees with categorical response variable and regression decision trees with a continuous response variable. Building a decision tree starts from a single starting point called the root node, which contains the entire set of data at the top of the tree. The initial division is done using a prediction variable, dividing the data into two or more child nodes. A node that no more divisions, i.e. the one that reaches the end of the branch of the tree is called the final node or leaf. Data classification or prediction is done by going through a tree, starting from the roots to the leaves. The goal is to find a decision tree such that classification or prediction error is minimal.

The first decision tree algorithm known as Iterative Dichotomiser 3 (ID3) was developed by Quinlan (1986). Breiman et al. (1984) described the generation of binary Classification and Regression Trees (C&RT). Based on these algorithms, a numerous of decision tree induction algorithms have been developed: C4.5, QUEST, Random Forest, etc. Each of these algorithms has unique qualities in building a decision tree. Since CHAID and C&RT can be used to solve regression problems, they will be considered in this paper.

The C&RT tree is a binary decision tree that is constructed by splitting a node into two child nodes repeatedly, starting from the root node that contains the whole learning sample. For regression decision tree, C&RT use an impurity measure Least squares deviation – LSD, that is suitable for continuous response variables claims frequency and claims severity:

$$LSD(t) = \frac{1}{N(t)} \sum_{i=1}^{N(t)} (y_i - \bar{y}(t))^2$$

where $N(t)$ is the number of observations at node t , y_i is the response value of observation i , $\bar{y}(t)$ is the average response of the observations in t .

The average response is defined as:

$$\bar{y}(t) = \frac{1}{N(t)} \sum_{i=1}^{N(t)} y_i$$

CHAID (χ^2 automatic interaction detector) was developed by Kass (1980). CHAID decision tree development starts with identifying the target variable, and then splits the target into two or more child nodes using statistical algorithms. If dependent variable is continuous, the F test is used, while for categorical dependent variable the χ^2 test is used. For continuous response variables claims frequency and claims severity, the worth is based on the F test for the null hypothesis that the means of the response values are identical across the child nodes. The test statistic is

$$F = \frac{SS_{between}/(B - 1)}{SS_{within}/(N(t) - 1)}$$

where

$$SS_{between} = \sum_{b=1}^B N(t_b)(\bar{y}(t_b) - \bar{y}(t))^2, \quad SS_{within} = \sum_{b=1}^B \sum_{i=1}^{N(t_b)} (y_{bi} - \bar{y}(t_b))^2$$

where t_b denotes the b -th child node and B is the number of branches after splitting, $N(t)$ is the number of data in the decision tree and $N(t_b)$ is the number of data in node t_b . y_{bi} is the response variable for the value i in n -th node, $\bar{y}(t)$ is the average value of the response variable, while $\bar{y}(t_b)$ is the average value of the response variable in node t_b .

3.5. Neural networks

Neural networks are one of the methods of artificial intelligence, which uses mathematical tools and the structure of the human brain when analyzing data. Neural networks have been successfully applied in medicine, education, banking, marketing, and other fields of social and technical sciences (Sumathi and Sivanandam, 2006). The development of neural networks began in the 1950s, when McCulloch and Pitts (1943) introduced the first model of an artificial neuron. Although the concept of artificial neural networks was introduced in the middle of the last century, they only became popular with the development of better performance databases and computers. Today, artificial neural networks are widely used in prediction, classification, optimization, image recognition, voice recognition and solving many other problems.

Numerous neural network algorithms have been developed, but the largest commercial use to date has been the error backpropagation algorithm. The backpropagation algorithm has the structure of a multilayer feedforward neural network and was first introduced by Rumelhart et al. (1986). The error backpropagation algorithm is a universal network learning algorithm applicable to prediction problems as well as to classification problems. The network structure consists of an input layer, one or more hidden layers, and an output layer. The error backpropagation algorithm starts at the input layer where the input data are presented. The inputs are weighted and received

by each node in the next layer. The weighted inputs are then summed and passed through the activation function to produce the output, which is weighted and passed to processing elements in the next layer. In this work error backpropagation algorithm is used with the network structure consists of an input layer, one hidden layers and an output layer. The neuron calculates its output based on the sigmoid activation function. For node j , this process is illustrated with equations:

$$I_j = \theta_j + \sum_{i=1}^n w_{ji}x_i,$$
$$y_j = f(I_j)$$

where: I_j is the activation level of node j , w_{ji} is the connection weight between nodes j and i , x_i is the input from node $i = 0, 1, \dots, n$, θ_j is the bias or threshold for node j , y_j the output of node j and $f(\cdot)$ is the activation function.

4. Empirical data and results

The research was conducted on motor hull insurance data set one of the leading insurance companies in Bosnia and Herzegovina. Motor hull insurance paid compensation to the insured in case of damage or loss of vehicles and/or equipment as a result of the following insured hazards: traffic accidents, burglary, fire, lightning, explosion, fall and impact, storm, hail, snow, avalanches, floods and torrents, aircraft crashes, demonstrations, malicious actions by third parties and broken glass.

The data set contains 22 variables and consists 17,404 records on motor hull insurance policies during five consecutive years. The data set were divided by random distribution: 80% for training and 20% for testing and model evaluation. The insurance data of Motor Hull one of the leading insurance companies in BiH were used for the research. Having in mind that the Motor Hull insurance product has the same insurance coverage in all companies in BiH, and that the insurance company whose data were used in the survey has a significant share in the insurance market, we believe that the data used is a representative sample for this survey. The research was conducted with the CRISP-DM methodology using the IBM SPSS Modeller software package.

In this section, various data mining methods for selecting risk factors from the total number of prediction variables are discussed. Selected risk factors were used as input variables to estimate the claims frequency and the claims severity using GLM. The following data mining methods were used for risk factors selection:

- Forward Stepwise regression,
- CHAID decision tree,
- C&RT decision tree and
- Neural networks.

These data mining methods evaluate predictors by significance for the response variable. For decision trees (C&RT, CHAID) and neural networks, the importance of the prediction variable is calculated using sensitivity analysis. Sensitivity analysis measures how much the prediction error increases when one of the predictors is excluded. For more information on sensitivity analysis, see Saltelli et al. (2004), Francis (2001).

Models have been created for each of the feature selection methods, resulting in a smaller set of prediction variables. The methods were analyzed directly on the response variables: claims frequency or claims severity. All models were developed on a training data set, and model performance comparisons were conducted on a test data set. The obtained results are presented separately for the claims frequency and the claims severity.

In addition, a model with risk factors obtained using data mining methods was evaluated to determine whether data mining methods for the risk factors selection affect the improvement in the prediction of the claims frequency and the claims severity. The model assessment was performed by comparing the GLM for the claims frequency and the claims severity based on risk factors determined using the previously mentioned data mining methods. The assessment also includes a model that did not have a previous selection of variables using data mining methods, which we call the standard approach. Based on the model assessment, the best data mining method proposed for the risk factors selection. The results of the best ranking GLM for the claims frequency and the claims severity were used to develop a predictive risk model.

The criteria for ranking and selecting the best GLM with risk factors selected using data mining methods are:

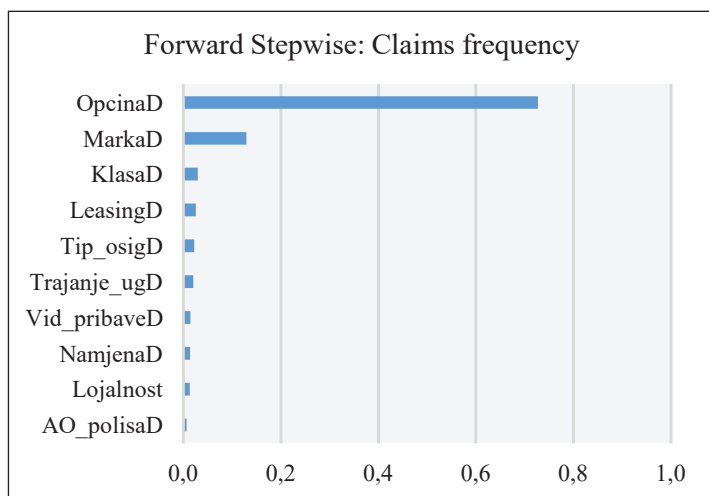
- 1) Goodness of fit of the model was done on the basis of Akaike Information Criterion (AIC), developed by Akaike (1974). Information criteria represent the ratio between the accuracy of model adaptation to data and the complexity of the model. The lower the AIC information criterion, the better the model is considered.
- 2) Predictive performance of the models was compared using the Gini coefficient (Meyers, 2007). The Gini coefficient, named after statistician and sociologist Corrado Gini, is commonly used in economics to measure national income inequality. The Gini coefficient does not quantify the profitability of a particular risk premium model but determines the model's ability to segment the best and worst risks. The higher the Gini coefficient, the better the predictive performance of the model.

4.1. Development and evaluation of claims frequency model

Risk factors selection for the claims frequency

The relative importance of each predictor in model assessment is shown using a graph of the significance of the prediction variables. The graphs of the significance of the prediction variables for the claims frequency are presented below, using each of the data mining method. Predictors relevant to the claims frequency response variable obtained from the Forward stepwise regression is shown in Figure 1.

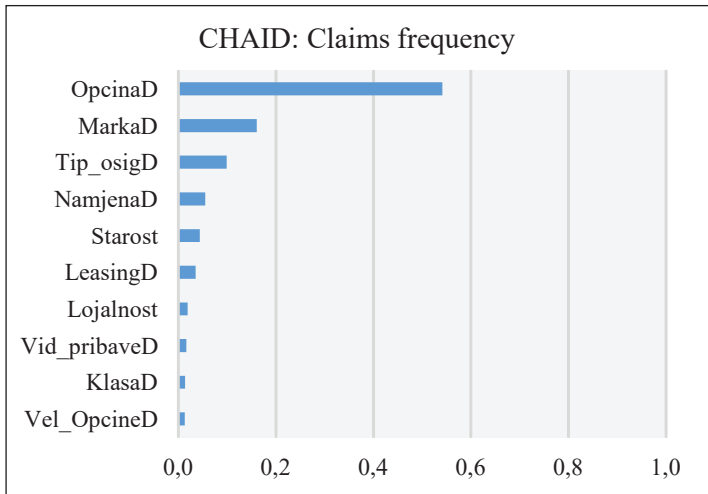
Figure 1: Predictors for claims frequency selected with Forward Stepwise



Source: Authors' calculations

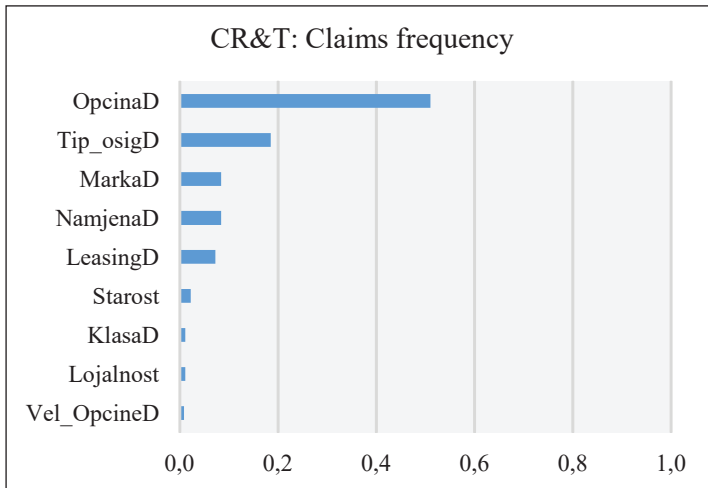
Prediction variables that affect the claims frequency of based on decision trees CHAID and CR&T are shown in Figure 2 and Figure 3. For both decision trees, no restrictions were used regarding the depth of the created tree, i.e. the number of tree levels. Tree growth is limited by defining a minimum number of nodes, in leaves 1%, and in the parent node 2%. The prediction results for both decision trees showed that the variable OpcinaD is the most significant prediction variable with over 50% significance, and the variables MarkaD, Tip_osigD and NamjenaD have the most influence on the claim frequency.

Figure 2: Predictors for claims frequency selected with CHAID



Source: Authors' calculations

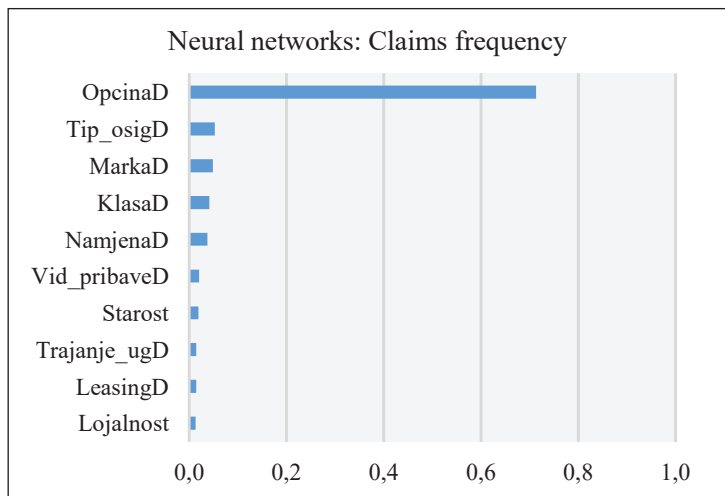
Figure 3: Predictors for claims frequency selected with CR&T



Source: Authors' calculations

Significant prediction variables for claims frequency selected, based on the neural network method are found in Figure 4. A backward error propagation algorithm was used to create the neural network model, with all prediction variables in input layer and response variable in output layer.

Figure 4: Predictors for claims frequency selected with Neural network



Source: Authors' calculations

The structure of the neural network consisted of only one hidden layer with seven neurons. Neural network prediction results show that OpcinaD with 71% is by far the most significant prediction variable for claims frequency.

GLM estimate of claims frequency

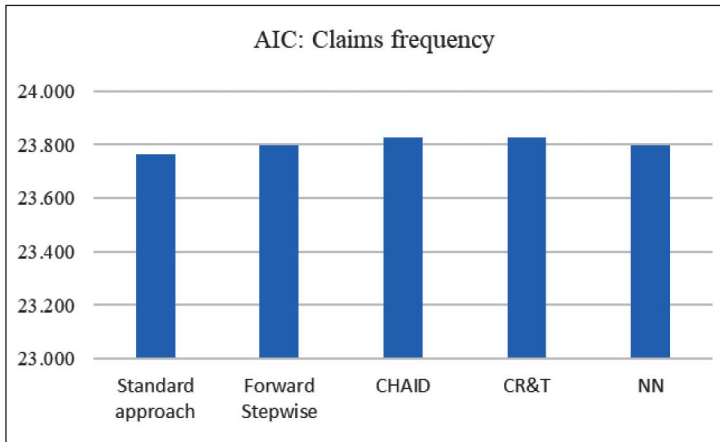
Significant predictors determined based on selected data mining methods are included in the claims frequency GLM. A Poisson GLM with a log link function was used to estimate the claims frequency. The Poisson distribution is the most common distribution for modeling the claims frequency according to Antonio and Valdez (2010), Dionne and Vanasse (1988, 1992), Denuit and Lang (2004), Flynn and Francis (2009). All insurance policies from the data set don't have the same risk exposure, *Log (Izloženosti)* is included in the model as an offset when calculating the number of claims. Statistically significant predictors using the Wald test and type III analysis were taken for risk factors. The Wald test follows a χ^2 distribution with a statistically significant value of $p \leq 0.001$.

A model evaluation was performed, i.e. a comparison GLMs with predictors selected on the basis of the previously mentioned data mining methods and GLM standard approach. In standard approach all prediction variables are included in the GLM to get significant predictors.

The AIC information criterion of the GLM Poisson model for claims frequency does not show significant differences between different risk factor selection

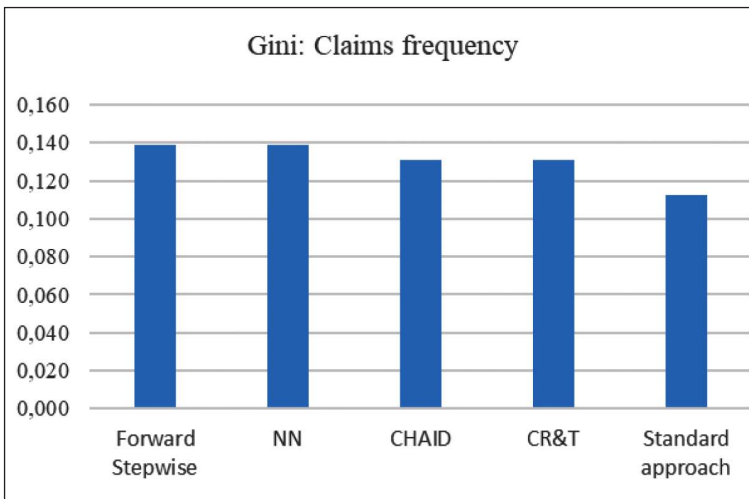
methods (Figure 5). The reason lies in the fact that all methods extract a similar number of risk factors from the total number of prediction variables. The Forward Stepwise regression and Neural networks show a better result compared to other methods.

Figure 5: AIC – Claims frequency model ranking



Source: Authors' calculations

Figure 6: Gini – Claims frequency model ranking



Source: Authors' calculations

Analysis the prediction performance of the Poisson GLM based on Gini coefficients (Figure 6), shown following conclusions:

- 1) Forward stepwise regression and Neural networks methods achieve very good results in claims frequency estimate.
- 1) Decision tree methods CHAID and CR&T achieve equal but slightly lower results for the claims frequency estimate.
- 2) Application of any of the data mining methods in the selection of risk factors for Poisson GLM, achieves better results for the claims frequency compared to the standard approach.

From the above, it can be concluded that the selection of the optimal number of prediction variables using Forward stepwise regression and Neural networks before inclusion in GLM improves the predictive performance of the model for claims frequency. Given the simplicity of application and interpretation of results, as well as the speed of execution of Forward stepwise regression has an advantage in the risk factors selection in comparison with Neural networks. The better predictive performance of the GLM Poisson model with selected risk factors using Forward stepwise regression resulted with the inclusion of additional significant predictor *OpcinaD* compared to the standard approach (Table 1). The selected predictors are statistically significant and have an impact on the claims frequency. Choosing the optimal number of risk factors using Forward stepwise regression before inclusion in GLM improves the predictive performance of the claims frequency estimate.

Table 1: Poisson GLM: Risk factors

Prediction variables	Standard approach			Forward Stepwise		
	Wald χ^2	df	p-value	Wald χ^2	df	p-value
Intercept	34.149	1	0.000	163.968	1	0.000
MarkaD	21.543	3	0.000	88.842	28	0.000
KlasaD	56.877	3	0.000	45.570	6	0.000
NamjenaD	22.559	1	0.000	19.384	1	0.000
LeasingD	45.687	1	0.000	17.578	1	0.000
Trajanje_ugD	30.758	1	0.000	26.907	1	0.000
Tip_osigD	33.209	1	0.000	20.893	1	0.000
OpcinaD				540.358	91	0.000

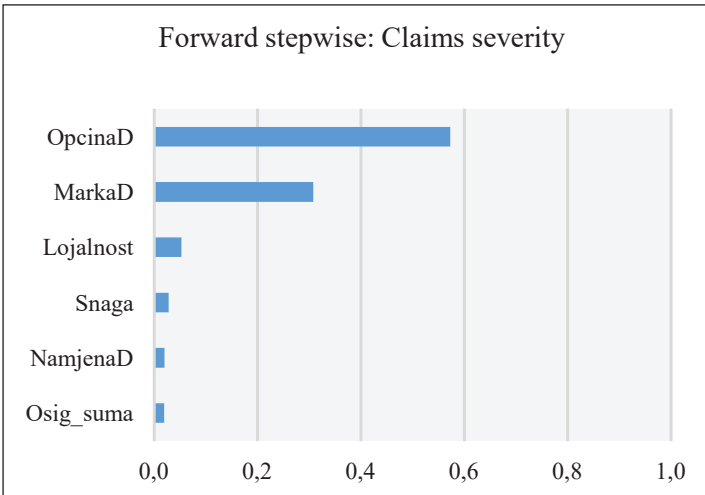
Source: Authors' calculations

4.2. Development and evaluation of a model for claims severity

Risk factors selection for claims severity

The results of the significance of the prediction variables for claims severity, using each of the data mining methods, are presented below using a significance graph. Significant prediction variables based on the Forward stepwise regression for claims severity are shown in Figure 7.

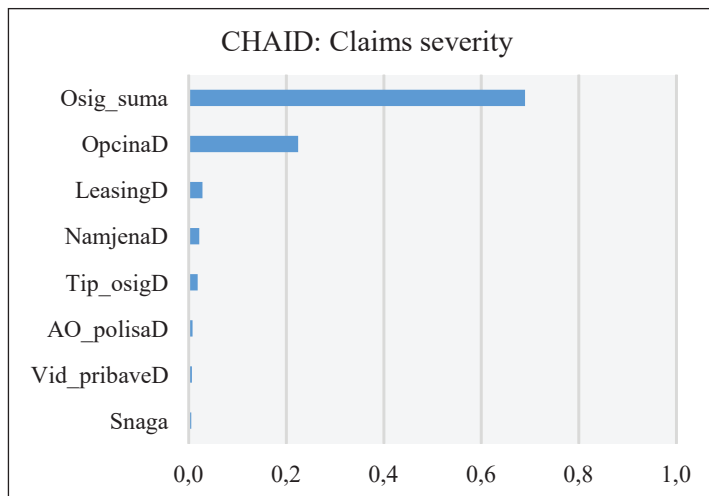
Figure 7: Predictors for claims severity selected with Forward Stepwise



Source: Authors' calculations

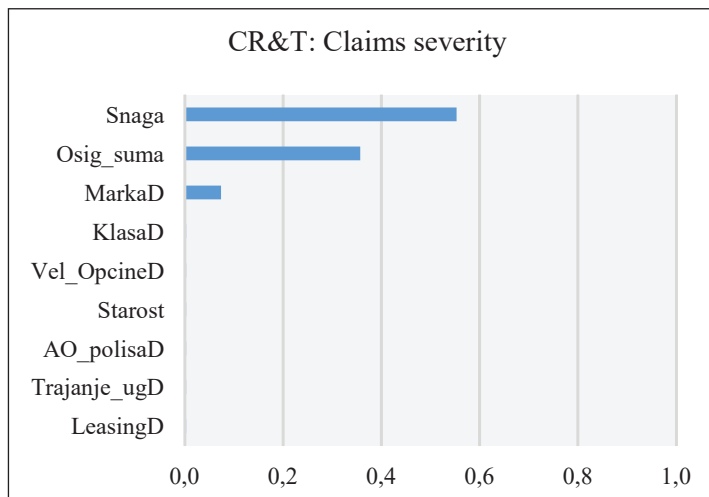
Figure 8 and Figure 9 show predictors for claims severity selected, based on the CHAID and CR&T decision tree. For the growth constraints of both decision trees, only a minimum number of nodes was defined, in leaves 1%, and in the parent node 2%. The CHAID decision tree select two variables Osig_suma and OpcinaD with over 90% impact on average claim. The CR&T decision tree select Osig_suma and SnagaD with over 90% significance for the average claim.

Figure 8: Predictors for claims frequency selected with CHAID



Source: Authors' calculations

Figure 9: Predictors for claims frequency selected with CR&T

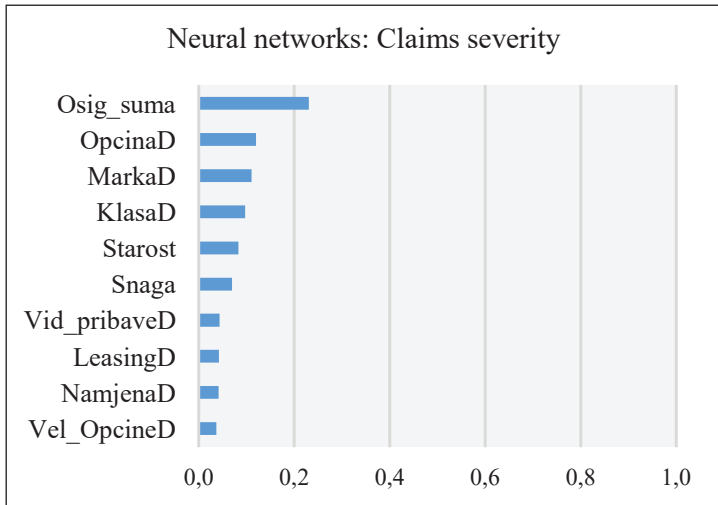


Source: Authors' calculations

Figure 10 shows significant predictors for claims severity selected, based on the Neural network method. The neural network model was created using a backpropagation error algorithm with all original prediction variables in the input layer, seven neurons in one hidden layer, and a claims severity in the output

layer. The results of the prediction via the Neural network show that *Osig_suma*, *OpcinaD* and *MarkaD* and *KlasaD* are the most significant predictors selected for claims severity.

Figure 10: Predictors for claims severity selected with Neural network



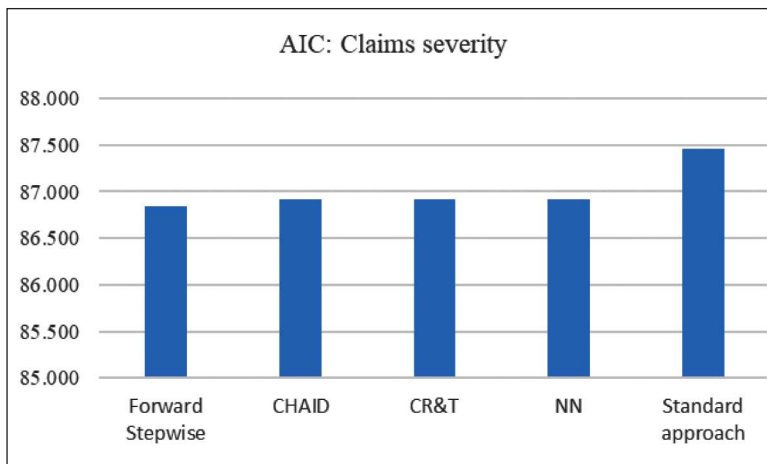
Source: Authors' calculations

GLM estimate for claims severity

Based on the data mining methods for variable selection, the optimal number of variables included in Gamma GLM with a log link function to estimate the claims severity was obtained. The Gamma distribution was used to model the claims severity as the most popular distribution for modeling the claims severity based on actuarial literature (Ohlsson and Johansson, 2010; Parodi, 2014; Kaas et al., 2009). To achieve the multiplicative model, instead of the canonical link function, the log link function was used. For scale parameter ϕ , Pearson's moment estimator was used. Most predictors are not statistically significant and have no effect on the claim severity. All variables with a p-value greater than 0.001 according to the Wald test were excluded from the model.

The AIC shows very similar results for different gamma GLM models to estimate the claims severity. GLM for the claims severity with risk factors selected based on the Forward stepwise regression and CHAID decision tree show a better result compared to other models. The ranking of methods based on AIC criteria is shown in Figure 11.

Figure 11: AIC – Claim severity model ranking

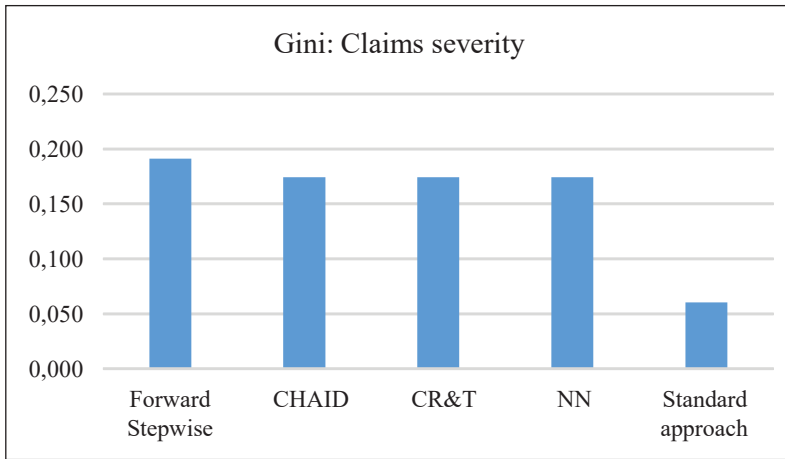


Source: Authors' calculations

The prediction performance of the Gamma GLM model was analyzed using Gini coefficients (Figure 12). Based on the Gini coefficients the following conclusions can be made:

- 1) Models with risk factors selected with Forward stepwise regression and CHAID decision tree achieve better results for the claims severity, compared to other methods.
- 2) Models with risk factors obtained using the CR&T method and the Neural Network achieve the same, but slightly worse results.
- 3) Application of any of the data mining methods in the selection of risk factors for Gamma GLM, achieves better results for the claims severity compared to the standard approach.

Figure 12: Gini – Claims severity model ranking



Source: Authors' calculations

From the above, it can be concluded that the selection of the optimal number of prediction variables using the methods of Forward stepwise regression and CHAID decision tree, before the inclusion of GLM, improves the predictive performance of the claims severity model. The results obtained based on standard approach for gamma GLM suggest that the average amount of damage to the analyzed portfolio is affected by the Loyalty of the insured (Table 2). Using the Forward stepwise regression method, three risk factors were identified, which are statistically significant for the response variable average amount of damage. Forward stepwise regression identified more risk factors than standard approach and other data mining methods and as result give more precisely assessment. The risk factor that affect the claims severity differs significantly from the risk factors that affect the claims frequency.

Table 2: Gamma GLM: Risk factors

Prediction variables	Standard approach			Forward Stepwise		
	Wald χ^2	df	p-value	Wald χ^2	df	p-value
(Intercept)	81,665.391	1	0.000	18,487.290	1	0.000
Lojalnost	20.254	2	0.000	24.436	2	0.000
NamjenaD				12.498	1	0.000
Osig_suma				178.763	1	0.000

Source: Authors' calculations

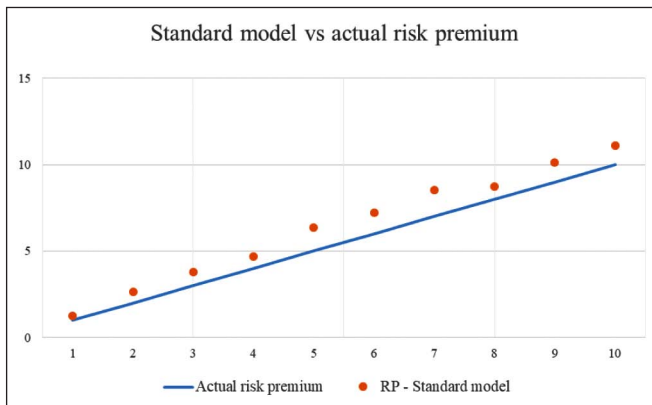
4.3. Model evaluation

From the evaluation of claims frequency and claims severity models we can conclude that Forward stepwise regression showed excellent performance and this method is the best candidate for the predictive risk model. Given the ease of application and the speed of development of Forward stepwise regression model, the time required to select risk factors can be reduced, using these methods. The based on GLM for claims frequency and claims severity predictive and standard risk models are created. The risk premium is obtained by multiplying the relativity of the claims frequency and the relativity of the claims severity.

For the predictive risk model, the GLM model for the claims frequency and the claims severity for which risk factors were selected using Forward stepwise regression were chosen. As a standard risk model, GLM was used for the claims frequency and claims severity with predictive variables that were not previously selected using data mining methods.

An evaluation of the predictive risk model in relation with to the standard risk model was performed. The simplest way to compare the predictive and standard risk models is to graphically compare the performance of the estimated risk premiums of both models, relative to the actual risk premium. Figure 13 shows a comparison of the estimated risk premium of the standard risk model in relation to the actual risk premium, on test data grouped in deciles.

Figure 13: Standard model risk premium vs actual risk premium

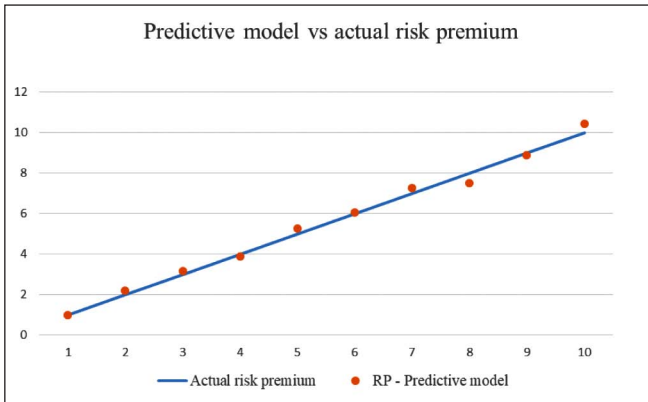


Source: Authors' calculations

Figure 14 shows a comparison of the estimated risk premium of the predictive risk model in relation to the actual risk premium on test data grouped in deciles. Prior to grouping the data, the records were sorted according to the value of the

estimated risk premiums. For each group, the average values of estimated and actual risk premiums were calculated, and the log of these values is shown in the graph. Both graphs clearly show that the estimated values of the risk premium of the predictive model have a better adjustment to the actual risk premiums compared to the standard model. Although both models meet the set business objectives, we can conclude that the predictive risk model shows better predictive performance compared to the standard model.

Figure 14: Predictive vs actual risk premium



Source: Authors' calculations

5. Results and discussion

From the evaluation of claims frequency and claims severity models we can conclude that both methods of Forward stepwise regression showed excellent performance, and are the best candidate for the predictive risk model. Above all, GLM models will be more accurate and will achieve better assessment results. Both methods select the same risk factors for the claims frequency and claims severity. It can be expected that these methods will show certain differences in the results on a larger number of prediction variables.

From the previous, we can conclude that premium rates are strongly influenced by selected risk factors. A better understanding of the real impact of all risk factors on the claims frequency and the claims severity can help insurance companies to offer adequate premium to policyholder. The adequate premium is of the utmost importance for insurance company every day operations and for the economy as well. Namely, if the calculated premium is not adequate (too low), the technical provision consequently will be lower than needed, and it is not likely that in the

case of damage it will cover the claim (and therefore the substance of insurance is ruined). On the other hand, if the calculated premium is too high, the technical provisions will be high influencing the financial result of the company, but economically wise, too high premium is not suitable for the market.

If an insurance company does not have an adequate premium ratemaking, it is likely to be subject to anti-selection. This means they will offer low prices for high risks and high prices for low risks. Better risks will leave the insurance company, attracted by the lower competition premium, which will lead to financial loss of insurance companies. Data mining methods are more efficient and comprehensive in the selection of risk factors in determining adequate non-life insurance premium rates compared to the standard approach.

Regarding the contribution to the scientific field, based on the available literature and the authors of best knowledge, the application of data mining methods in the non-life insurance premium pricing in the way presented in the paper, is presented for the first time in BiH and SEE region.

Beside the motor hull the results of this research are representative and can be applied to the motor third party liability insurance, household insurance, travel health insurance, accident insurance and other types of non-life insurance with homogeneous groups of policyholders. The research is not applicable for individual risk premiums ratemaking, such as insurance of corporate clients.

6. Conclusion

In the process of developing a predictive model for non-life insurance premium pricing, data mining methods were used for selection of risk factors that have an impact on the insurance premium. For the risk factors selection in the study, the following data mining methods were considered: Forward stepwise regression, CHAID decision tree, C&RT decision tree and neural networks. Data mining methods for variable selection aim to find the best possible combination of predictors by reducing dimensionality, which contributes to simplifying the interpretation of model results, shortening model development time, and avoiding excessive model parameterization. Models were created for each of the variable selection methods, which resulted in a smaller set of significant prediction variables. The methods were analyzed directly on the response variables: claims frequency and claims severity. Selected risk factors with data mining methods were included in the Poisson GLM for the claims frequency and the Gamma GLM for claims severity estimate. Goodness of fit of the models and predictive performance of the models were performed.

Very good results for the risk factors selection were achieved by the Forward stepwise regression, which is also the easiest to implement. Forward stepwise

regression method has identified a number of risk factors for both the claims frequency and the claims severity and thus improved the predictive performance of the GLM compared to the standard approach when method for risk factors selection wasn't use before inclusion in GLM. Other data mining methods used to select risk factors have shown satisfactory results in terms of improving forecast performance, compared to the standard approach. The use of risk factor selection methods allows actuaries more time to refine the model, while reducing the risk that some of the important risk factors are not included in the model.

The conclusions of this research are representative and can be applied other non-life insurance types. The research is not applicable for individual risk premiums ratemaking, such as insurance of corporate clients.

In this study, application some of data mining methods in insurance pricing are considered, which opens up opportunities for further research. It would be useful to investigate the results of applying data mining methods on the larger data set of risk factors or applied research on some other types of non-life insurance. We consider these to be some of the useful areas for further research.

References

- Akaike, H. (1974). A new look at the statistical model identification. *Automatic Control, IEEE Transactions*, Vol. 19, No. 6, pp. 716–723, <https://ieeexplore.ieee.org/document/1100705>.
- Anderson, D. et al. (2007) *A Practitioner's Guide to Generalized Linear Models*, CAS, https://www.aktuarai.lt/wp-content/uploads/2018/06/Anderson_et_al_Edition_3.pdf.
- Antonio, K., Valdez, E. A. (2010) 'Statistical concepts of a priori and a posteriori risk classification', *Advances in Statistical Analysis*, Vol. 96, No. 2, pp. 187–224.
- Breiman, L. et al. (1984) *Classification and Regression Trees*, New York: Chapman and Hall/CRC.
- Brockman, M.J., Wright, T.S. (1992) 'Statistical motor rating: making effective use of your data', *Journal of the Institute of Actuaries*, Vol. 119, pp. 457–543.
- Coskun, S. (2016) 'Introducing credibility theory into GLMs for Ratemaking on Auto Portfolio', Institute de Actuaries, Actuarial thesis, Centre d'Etudes Actuarielles.
- Denuit, M., Charpentier, A. (2005) *Mathematiques de l'Assurance Non-Vie. Tome II: Tarification et Provisionnement, Economica*.
- Denuit, M., Lang, S. (2004) 'Non-life rate-making with Bayesian GAMs'. *Insurance: Mathematics and Economics*, Vol. 35, No. 3, pp. 627–647, <https://www.sciencedirect.com/science/article/abs/pii/S0167668704000940>.

- Dionne, G., Vanasse, C. (1988) 'A generalization of actuarial automobile insurance rating models: The negative binomial distribution with a regression component', *ASTIN Bulletin*, Vol. 19, No. 2, <https://ideas.repec.org/p/mtl/montec/8833.html>.
- Dionne, G., Vanasse, C. (1992) 'Automobile Insurance Ratemaking in the Presence of Asymmetrical Information', *Journal of Applied Econometrics*, Vol. 7, No. 2, pp. 149–165, https://www.researchgate.net/publication/5140149_Automobile_Insurance_Ratemaking_in_the_Presence_of_Asymmetrical_Information.
- Dugas, C. et al. (2003) 'Statistical learning algorithms applied to automobile insurance ratemaking', *Casualty Actuarial Society Forum*, Vol. 1, No. 1, pp. 179–214, https://www.researchgate.net/publication/247643985_Statistical_Learning_Algorithms_Applied_to_Automobile_Insurance_Ratemaking.
- Efroymson, M.A. (1960) 'Multiple Regression Analysis. In: Mathematical Methods for Digital Computers', *New York: John Wiley & Sons, Inc.*
- Famoye, F. & Rothe, D.E. (2003) 'Variable Selection for Poisson Regression Model', *Journal of Modern Applied Statistical Methods*, Vol. 2, No. 2, pp. 380–388, <https://core.ac.uk/download/pdf/195154175.pdf>.
- Fayyad, U., Piatetsky-Shapiro, G., Smyth, P. (1996) 'From Data Mining to Knowledge Discovery in Databases', *AI Magazine*, Vol. 17, No. 3, <https://ojs.aaai.org/index.php/aimagazine/article/view/1230>.
- Flynn, M., Francis, L. A. (2009) *More Flexible GLMs: Zero-Inflated Models and Hybrid Models*, *Casualty Actuarial Society E-Forum*, pp. 148–224, <https://www.semanticscholar.org/paper/More-Flexible-GLMs-Zero-Inflated-Models-and-Hybrid-Flynn-Francis/0d195fec002e53f87255fef59c9822ca184997d1>.
- Francis, L. (2001) 'Neural Networks Demystified', *Casualty Actuarial Society Forum*, pp. 253–320, <https://www.casact.org/pubs/forum/01wforum/01wf253.pdf>.
- Goldburd, M., Khare, A., Tevet, D. (2016) 'Generalized Linear Models for Insurance Rating', *CAS*, <https://www.casact.org/pubs/monographs/papers/05-Goldburd-Khare-Tevet.pdf>.
- Guo, L. (2003) 'Applying data mining techniques in property/casualty insurance', *CAS Forum*, <https://www.casact.org/pubs/forum/03wforum/03wf001.pdf>.
- Haberman, S., Renshaw, A.E. (1996) 'Generalized linear models and actuarial science', *The Statistician*, Vol. 45, No. 4, pp. 407–436, https://www.researchgate.net/publication/271865941_Generalized_Linear_Models_and_Actuarial_Science.
- Han, J., Kamber, M., Pei, J. (2012) *Data mining concepts and techniques*, 3rd ed., Burlington, USA: The Morgan Kaufmann.
- Harrell, F.E. (2001) *Regression modeling strategies: with applications to linear models, logistic regression and survival analysis*, New York: Springer.
- Hastie, T., Tibshirani, R., Friedman, J. (2001) *The Elements of Statistical Learning*, New York, USA: Springer.

- deJong, P., Heller, G. Z. (2013) *Generalized Linear Models for Insurance Data*, 5th ed., New York: Cambridge University Press.
- Kass, G. V. (1980) 'An Exploratory Technique for Investigating Large Quantities of Categorical Data', *Journal of the Royal Statistical Society, Series C, Vol. 29*, No. 2), pp. 119–127, <https://www.jstor.org/stable/2986296?seq=1>.
- Kaas, R. et al. (2009) *Modern Actuarial Risk Theory*, using R. Berlin: Springer.
- Klugman, S.A., Panjer, H.H., Wilmot, G.E. (2004) *Loss Models, from Data to Decisions*, 2nd ed., New York, SAD: Wiley.
- Kolyshkina, I., Wong, S., Lim, S. (2004) 'Enhancing Generalised Linear Models with Data Mining', Casualty Actuarial Society, Discussion Paper Program, <https://www.casact.org/pubs/dpp/dpp04/04dpp279.pdf>.
- Lowe, J., Pryor, L. (1996) 'Neural networks v. GLMs in pricing general insurance', *General Insurance Convention*, <https://www.actuaries.org.uk/system/files/documents/pdf/0417-0438.pdf>.
- Makov, U., Weiss, J. (2016) 'Predictive Modeling for Usage-Based Auto Insurance', In E. Frees, G. Meyers, & R. Derrig (Eds.), *Predictive Modeling Applications in Actuarial Science* (International Series on Actuarial Science, pp. 290–308), Cambridge: Cambridge University Press, <https://www.cambridge.org/core/books/predictive-modeling-applications-in-actuarial-science/predictive-modeling-for-usage-based-auto-insurance/E4693E09E8FCD6A86885ABE81270B1C3>.
- McCullagh, P., Nelder, J.A. (1989) *Generalized Linear Models*, 2nd ed., London: Chapman & Hall.
- McCulloch, W.S., Pitts, W. (1943) 'A logical calculus of the ideas immanent in nervous activity', *Bulletin of mathematical biophysics*, No. 5, pp. 115–133, <https://link.springer.com/article/10.1007/BF02478259>.
- Meyers, G., (2007) 'Estimating Loss Costs at the Address Level', PowerPoint presentation at the CAS Predictive Modeling Seminar.
- Nelder, J. A., Wedderburn, R. W. M. (1972) 'Generalized linear models', *Journal of the Royal Statistical Society, Series A*, Vol. 135, No. 3, pp. 370–384, <https://www.jstor.org/stable/2344614?seq=1>.
- Ohlsson, E., Johansson, B. (2010) *Non-life Insurance Pricing with Generalized Linear Models*, Berlin: Springer-Verlag.
- Parodi, P. (2014) *Pricing in General Insurance*, 1st ed., New York: Chapman and Hall/CRC.
- Refaat, M. (2007) *Data Preparation for Data Mining Using SAS*, Morgan Kaufmann Publishers.
- Renshaw, A. E. (1994) 'Modeling the Claims Process in the Presence of Covariates', *ASTIN Bulletin*, Vol. 24, No. 2 pp. 265–285, <https://www.cambridge.org/core/journals/astin-bulletin-journal-of-the-iaa/article/modelling-the-claims-process-in-the-presence-of-covariates/144A9480B73604F1F456E8C80D27F74D>.

- Rumelhart, D., Hinton, G., Williams, R. (1986) 'Learning representations by back-propagating errors', *Nature*, No. 323, pp. 533–536, <https://www.nature.com/articles/323533a0>.
- Saltelli, A., S. et al. (2004) *Sensitivity Analysis in Practice – A Guide to Assessing Scientific Models*, John Wiley.
- SAS Institute (2000) *Data Mining in the Insurance Industry – Solving Business Problems Using SAS Enterprise Miner Software*. A SAS White Paper.
- Sumathi, S., Sivanandam, S.N. (2006) *Introduction to Data Mining and its Applications*, Berlin: Springer-Verlag.
- Quinlan, J.R. (1986) 'Induction of decision trees', *Machine Learning*, No. 1, pp. 81–106, <https://link.springer.com/article/10.1007/BF00116251>.
- Werner, G., Modlin, C. (2010) *Basic Ratemaking*, 4th ed., Casualty Actuarial Society.
- Williams, B. et al. (2015) *A Practical Approach to Variable Selection – A Comparison of Various Techniques*, Casualty Actuarial Society E-Forum, <https://www.casact.org/pubs/forum/15sumforum/Williams-Hansen-Baraban-Santoni.pdf>.
- Yao, J. (2008) 'Clustering in ratemaking: with application in territories clustering', *Casualty Actuarial Society Discussion Paper Program*, pp. 170–192, https://www.researchgate.net/publication/241526333_Clustering_in_Ratemaking_with_Application_in_Territories_Clustering.

Odabir faktora rizika metodama rudarenja podataka za izračun stopa premije osiguranja

Amela Omerašević¹, Jasmina Selimović²

Sažetak

Osiguravajuća društva koja su prva usvojila primjenu metoda rudarenja podataka u svom poslovanju postali su konkurentniji na tržištu osiguranja. Metode rudarenja podataka osiguravajućoj industriji pružaju brojne prednosti: kraće vrijeme obrade podataka, sofisticiranije metode za precizniju analizu podataka, bolje donošenje odluka itd. Osiguravajuća društva koriste metode rudarenja podataka u razne svrhe, od marketinških kampanja do sprečavanja prijevara, a među prvima je ta metoda bila u postupku određivanja premija osiguranja. Primjena metode rudarenja podataka u ovom radu ima za cilj poboljšati rezultate u procesu izračuna stope premije neživotnih osiguranja. Poboljšanje se ogleda u odabiru varijabli predviđanja ili faktora rizika koji utječu na stope premija osiguranja. Istražene su sljedeće metode rudarenja podataka za odabir varijabli predviđanja: Postepena regresija, Stabla odlučivanja i Neuronske mreže. Za izračun premijskih stopa korišteni su Generalizirani linearni modeli (GLM), koji su danas glavni statistički model određivanja premija neživotnih osiguranja u većini razvijenih tržišta osiguranja u svijetu.

Ključne riječi: GLM, metode rudarenja podataka, postepena regresija, stabla odlučivanja, neuronske mreže

JEL klasifikacija: G22

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Digital transformation and economic cooperation: The case of Western Balkan countries*

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Abstract

Digital transformation is increasingly affecting many aspects of the world economy. It is boosting economic growth, has an impact on foreign direct investments and increases international trade. Hence, the aim of the paper is to analyse digital transformation in relation with the economic cooperation between Western Balkan economies. In order to do so, we construct two indicators: the harmonised index of economic cooperation among Western Balkan economies and the indicator of digital transformation convergence. The results indicate a rising trend of economic cooperation amongst Western Balkan countries, with cooperation dominated by foreign trade. Even though Western Balkan countries have experienced an increased digital transformation convergence, they are still lagging behind the EU in the use of digital technologies. Hence, placing more emphasis on digital transformation could potentially boost the region's GDP and thus economic cooperation among them.

Key words: digital transformation, regional economic cooperation, Western Balkan countries

JEL classification: F15, F21, O33

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1. Introduction

Digital transformation has affected all the countries in the world. It has changed the way business is conducted, people's habits and it has increased the availability of products and services.⁴ At the same time the process of digitalisation is viewed as one of the drivers of economic development. It has macroeconomic, sectoral, and microeconomic effects, but it may also boost regional economic cooperation.

Western Balkan countries are still lagging behind more developed post-transition countries and they need a stronger push in order to catch up. Since existing research has indicated a positive relationship between digitalisation and GDP (e.g. Kabaklarli and Atasoy, 2019; Czernich et al., 2011; Roller and Waverman, 2001), one of the sources for a stronger development in the Western Balkans might be increased digitalisation. More precisely, an increased digital transformation across the Western Balkan region could increase their GDP growth and thus increase economic cooperation between the countries in the region (Minges, 2015; Duttaray et al., 2008; Barrell and Pain, 1996).⁵ Digital transformation should also improve the region's attractiveness and increase investments from both the EU's private sector and international financial institutions.

The goal of the paper is to analyse the digital transformation in relation with the economic cooperation between the Western Balkan economies. More precisely, we aim to analyse trends in digital convergence amongst Western Balkan economies, the dynamics of economic cooperation between them as well as to discuss the impacts of digital transformation on economic cooperation among the analysed countries. The main hypothesis of this research is that, along with the process of digital convergence between Western Balkan countries, there is a strengthening of economic cooperation between them. The research includes the following countries: Albania, Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, North Macedonia and Serbia. The reference period of the research is from 2007 to 2017. In order to achieve this, two indicators were constructed and analysed: the harmonised index of economic cooperation among Western Balkan economies and the indicator of digital transformation convergence. In order to construct the harmonised index of economic cooperation, we use data on bilateral merchandise trade flows, foreign direct investments (FDI), and tourist arrivals among Western Balkan economies, while for the calculation regarding the digital transformation convergence indicator, we use various digitalisation variables.

⁴ However, it is also affecting existing jobs, equality and resource efficiency.

⁵ Since GDP growth and economic cooperation are endogenous, there is also a reversed causality between them, meaning that increased economic cooperation also increases region's GDP (Liu et al., 2002; Hsiao and Hsiao, 2006; Gries and Redlin, 2012).

Systematic empirical research on the digital convergence for Western Balkan countries, especially those relating digitalization to economic cooperation, was not previously conducted. The contribution of this paper to literature is to gain new scientific knowledge on the digital transformation process and its contribution to economic cooperation using the sample of the Western Balkans. Despite the limited geographic scope, motivation for contributing to literature stems from the significance of digitization for small open economies and its contribution to economic cooperation among countries.

The rest of the paper is organised as follows. The next section briefly surveys the literature on the effects of digital transformation on the economy, section 3 gives an overview of the methodology applied in the research, while section 4 analyses the results. In section 5, the focus is on the discussion on the results, while the last section gives conclusions of the paper.

2. Literature review

The effects of the digitalization process on various macroeconomic variables over the last 20 years stimulated a significant interest of researchers. Along with the development of digitalisation measurement methodology (Lehr et al., 2006; Katz and Koutroumpis, 2013; Kotarba, 2017), the effects of the digitization process on inflation (Yi and Choi, 2005), employment (Katz et al., 2010; Degryse, 2016; Aubert-Tarby et al., 2018; Gómez-Plana and Latorre, 2019), productivity (Majumdar et al., 2009; Dedrick et al., 2013), foreign direct investment (Choi, 2003) and service trade (Freund and Weinhold, 2004; Choi, 2010) have been investigated. Still, most of the research has been devoted to the impact of digitalisation on economic growth and broadband penetration as one of the most frequently used proxies for the digitalisation of the economy.

The impact of digitalisation on economic growth has been found to be mostly positive, but the impact varies depending on the degree of development of the analysed countries. Minges (2015) reviews several studies on the broadband internet connectivity and concludes that, regardless of the methodology applied, broadband internet has had a positive impact on the GDP. However, the size of the impact is different for countries of different levels of development: a 10 percent increase in fixed broadband penetration would increase the GDP per capita between 1.4 and 3.2 percent in developing economies and between 0.9 and 1.5 percent in developed economies. Czernich et al. (2011) analysed OECD countries and confirmed a statistically significant correlation between the broadband penetration and economic growth. Roller and Waverman (2001) examined how the telecommunication infrastructure in 21 OECD countries and 14 non-OECD countries affected the economic growth. Their results suggest that investments in

the infrastructure of telecommunication could have a higher impact on the growth in OECD countries than in less-developed non-OECD countries. Arvin and Pradhan (2014) also showed that there is a significant impact of broadband penetration on the economic growth in G20 countries, while on the other hand, in emerging economies there is a reverse causality and higher economic growth leads to a higher broadband penetration. The empirical work that was conducted using panel data for the ASEAN countries from 1998–2011 suggests that the broadband penetration has a significantly positive relationship with GDP growth (Ng et al., 2013). On the other hand, the impact of digital technologies on the economic growth in MENA countries is very limited and the impact depends on the decision makers (Ghosh, 2017). In sub-Saharan Africa, due to the lack of ICT skills, this impact is almost negligible (Haftu, 2019). As an important determinant of the rate of economic growth in sub-Saharan Africa occurs a mobile cellular phone expansion (Lee et al., 2012). Inferior results for less developed countries might be connected with the lower penetration of broadband internet and other forms of digitalisation in those countries. Most studies argue that a certain threshold of broadband penetration is needed for the effect of fixed broadband to be noticeable (Minges, 2015). In that context, Koutroumpis (2009) suggests that for a significant impact on the growth, a critical mass in broadband penetration is 30 percent. These nonlinear effects are present in Scandinavian countries, which enjoy higher returns from their increased broadband participation. Similarly, Gruber and Koutroumpis (2011) concluded that the impact of mobile telecommunications on the economic development is smaller for countries with a low mobile penetration, which is usually the case in low-income countries. The authors find that in low-income countries the mobile telecommunications contribution to the growth of GDP is 0.11 percent, while for high-income countries the contribution is 0.20 percent.

It is not only the broadband internet but also more broadly defined information and communications technology (ICT) that have a positive impact on the GDP. Yousefi (2011) concludes that ICT plays a major role in the growth of high and upper-middle income groups, but fails to contribute to the growth of the lower-middle income group countries. The author concludes that, contrary to previous studies, such findings suggest that the level of investment in ICT is not the cause of slow growth in lower-middle income countries. Choi and Yi (2018) examine the effect of internet (the number of internet users per 100 persons) on the relationship between R&D expenditure and economic growth using the dataset covering 105 countries over the period 1994–2014. They argue that the positive effect of the R&D expenditure on economic growth is further strengthened by the internet. More precisely, the interaction between R&D expenditures and the internet proves to be an important factor for explaining the growth of GDP.

Global economic downturn in 2008 affected also investments in ICT. Since investments in ICT are related to GDP growth, Castaldo et al. (2018) argue, based

on the research of panel data of 23 OECD countries during 1996–2010, that in times of crisis decision makers should encourage investments in ICT. However, it is not only the time of crisis when researchers advocate public investments in ICT. Gruber et al. (2014) analysed costs and benefits from broadband adoption in the EU and argued that, since benefits outweighed the investment costs and since the private sector is often reluctant to invest in broadband infrastructure due to high initial costs and long payback periods, there is a rationale for the public sector to subsidize investments in the broadband infrastructure. Majumdar et al. (2009) suggested that the government support in encouraging the deployment of broadband technologies generates the potential for increased productivity for the deploying firms.

Even though research studies are mainly focused on the impact of ICT on GDP growth, some attention is devoted to the impact on employment, international trade and FDI. Kolko (2012) examined broadband expansion and local economic and employment growth in the US during 1999-2006 and compared areas with a higher and a lower growth in broadband availability. The findings indicate a positive relationship between broadband expansion and employment growth. However, the author argued that local residents do not necessarily profit from increases in employment induced by broadband expansion as areas with faster broadband expansion experienced no greater increases in employment relative to other areas. Crandall et al. (2007) estimated the effect of broadband penetration on output and employment using data for the 48 US states over the 2003-2005 period. They found that for every 1 percent increase in broadband penetration, employment was projected to increase by 0.2-0.3 percent, while the strongest effect was found for manufacturing and services industries. However, not all studies showed the positive effects of digitalisation on employment. The thing is that digitalisation, besides creating tremendous opportunities, poses new challenges to employers and employees (De Groen et al., 2017). In that context, Degryse (2016) discusses the negative impact of digitalisation on the workforce. He says that the digital revolution seems to reveal large inequalities between the low-income and the top of the market workers who are able to enjoy and profit from digital instruments much more than low-income workers.

Regarding the impact of ICT on international trade, by using the unbalanced panel of 175 countries in the period 2000–2013, Gnanngnon and Iyer (2018) show that increasing internet usage should improve countries' integration into the world trade in commercial services market. Bai (2019) argues that the increase in the adoption of the internet should boost country's exports, especially in export of ICT-enabled services. Similar results for the impact of ICT on international trade can be found in Lin (2015), Barbero and Rodriguez-Crespo (2018) and Rodríguez-Crespo and Martínez-Zarzoso (2019), while evidence of the impact of internet diffusion on FDI holdings can be found in Lee (2016).

Besides the effects on the aggregate level, ICT also has a positive impact on the micro level. Grimes et al. (2012) found that broadband adoption boosted firm productivity by 7–10 percent. Majumdar et al. (2009) also found a positive statistically significant correlation between the level of broadband deployment and the productivity of firm deploying broadband technology. In a recent study, Haller and Lyons (2019) explored the relationship between DSL broadband services and the productivity of a firm. They used firm level data from nine sub-sectors within the services and distribution sectors and did not find significant productivity effects when all sectors were taken into account. On the other hand, they found statistically significant positive effects of DLS broadband services on the firm's total factor productivity in ICT and administrative and support services sub-sectors.

Research on digitalisation in Central, Eastern and South-Eastern European countries is relatively scarce. Digital cooperation in transition countries is mainly focused on exchanging information with the help of using ICT and overcoming the cross-border barriers (Arouja, 2015). Piatkowski (2006) analysed the potential of ICT for faster convergence of the income level between eight transition economies and the EU-15 and the US. Results show that ICT contributed to a faster GDP growth and managed to augment convergence of the Czech Republic, Hungary, Poland, and Slovenia with the EU-15. On the other hand, Romania, Russia, Slovakia and Bulgaria are still lagging behind. Since more developed European countries have significantly better digital infrastructure than European post-transition countries, they are providing the technology to post-transition countries. However, living standards and the laws of a particular country can be a huge barrier for the further development of digitalisation and cooperation (Zoroja, 2011).

Countries in the Western Balkan region are lagging behind the more developed European countries when it comes to digital transformation (Mondekar, 2017). Since there are, to the best of our knowledge, no studies dealing with digitalisation convergence of Western Balkan countries, especially those relating digitalisation to economic cooperation, the rest of the paper is devoted to analysing those issues.

3. Methodology

3.1. Research instrument

In order to analyse economic cooperation and digital transformation between Western Balkan countries, we rely on the secondary data acquired from different sources. For the analysis of the economic cooperation we use international databases Eurostat COMEXT, wiiw FDI Database, World Tourism Organisation, the Kosovo Agency for Statistics and World Bank World Development Indicators, while for the

analysis of digital transformation we use International Telecommunication Union World Telecommunication/ICT Indicators (WT/ICT) database.

3.2. Statistical methods

In order to measure the extent of economic cooperation between the economies in the region, we use a harmonised index of economic cooperation. The calculation of the harmonized index is based on the methodology applied in the paper Broz et al. (2015). However, unlike their index, which measures the economic cooperation between Croatia and the economies in the region, we measure the bilateral cooperation between all the economies in the region. In our framework, economic cooperation includes regional foreign trade, FDI and tourism. By using these three fields of cooperation, we are able to analyse trends in economic cooperation between the economies in the region.

In order to construct the index of economic cooperation, it is first necessary to calculate cooperation indices for individual fields (foreign trade, FDI, and tourism), which are then incorporated into the harmonized index of economic cooperation, with the weight of each cooperation index proportional to its monetary share in total cooperation.

For the calculation of the cooperation index in the field of foreign trade, we use the values of exports from an individual economy in the region to the other economy in the region in a respective year. Then the exports from all economy pairs are added together to come up with the total regional trade in a respective year. A similar procedure is followed for other fields: for FDI we use the sum of all foreign direct inflows from one economy in the region to the other economy in the region, and for tourism we use the sum of all arrivals of tourists from one economy in the region to the other economy in the region. The calculation of the individual cooperation indices (CI) hence corresponds to the base index formula:

$$CI_t = \frac{y_t}{y_b} * 100, t = 2007, \dots, 2017 \quad (1)$$

where y_t represents the monetary value of regional trade and FDI, as well as tourist arrivals in year t , while y_b denotes the corresponding value in the base year (2007). The increase in the indices represents the increase in regional cooperation.

For the purpose of calculating the harmonized index of economic cooperation, which includes all fields, we need to construct weights for each specific field. Ideally, in order to construct weights, we should have monetary values for all the variables. However, since the data for earnings from regional tourists is not available, we had to estimate it from the total earnings from tourism using regional tourist arrivals. First, we calculated the share of regional tourists in all tourist

arrivals, and then we multiplied this share with the total earnings from tourism for all economies, which gave us the estimate of regional earnings from tourism.⁶ After we had obtained all three monetary values, we were able to construct the weights of the individual categories of economic cooperation:

$$w_{it} = \frac{m_{it}}{\sum_{i=1}^3 m_{it}}, i = 1, 2, 3; t = 2007, \dots, 2017 \quad (2)$$

where m_{it} stands for the monetary values of regional trade, FDI, and tourism. The sum of all three weights is 1.

The harmonised index of economic cooperation is then calculated as follows:

$$HIEC_t = \sum_{i=1}^3 CI_{it} * w_{it}, t = 2007, \dots, 2017 \quad (3)$$

In other words, we weighted the developments in the individual cooperation indices with their share in total regional economic cooperation. Again, the increase in the index represents the increase in the regional economic cooperation.

In order to measure the convergence of Western Balkan economies in digital transformation, we use the coefficient of variation⁷ for various proxies of digital transformation using the data for individual economies for the period from 2007 to 2016:

$$CV_t = \frac{\sigma_t}{\mu_t} * 100, t = 2007, \dots, 2016 \quad (4)$$

where σ_t stands for the standard deviation, and μ_t for the average of a variable that represents the digital transformation of the economies in the region. The coefficient of variation in our case measures to what extent individual economies differ in digital transformation indicators from the regional average. We calculated the coefficient of variation separately for every year across the economies in the sample for every variable. The decrease of the coefficient of variation through time implies that the variability between the economies in the region is reduced and hence the degree of digital convergence between them has increased. In other

⁶ The calculations are made under the assumption that tourists from all countries on average spend the same amount of money on tourist visits in the analysed countries in the region. However, countries in the region have lower GDP per capita than Western European countries, and hence it is expected that tourists from the region spend less than tourists from Western Europe, which means that we overestimated the total regional earnings from tourism. However, since tourists from the region represent on average 19 percent of all tourist arrivals in the region and tourists from the region together with other tourists from South-eastern and Eastern Europe represent the majority of tourist arrivals in most countries of the region, the bias should be negligible.

⁷ Coefficient of variation shows the extent of variability in relation to the mean of the variable and it is used when there are large differences in means (over time), which is the case in our dataset.

words, as the coefficient of variation enables us to track to what extent individual economies diverge in percentage terms from the average regional value of a certain digital transformation indicator, the lower value of the indicator thus suggests a more intense digitalisation convergence in the region. Thus, for example, in an extreme case, if the value of a coefficient of variation for the share of internet users in the population in a given year is 0, this would suggest that all Western Balkan economies have the same share of internet users in that year.

Since we are using several different variables for the analysis of digital convergence, in order to come up with a single measure of convergence, we constructed a weighted digital convergence indicator. For parsimony, weights are the same for all individual variables (since we have eight variables, the weight equals 0.125). The weighted digital convergence indicator is then calculated as:

$$DCI_t = w_i * CV_{it}, t = 2007, \dots, 2016 \quad (5)$$

where CV_{it} stands for the coefficient of variation of different digitalisation variables and w_i for weight of each variable. Again, the decrease implies that the degree of digital convergence between the economies in the region has increased.

4. Empirical data and analysis

4.1. Data

For measuring economic cooperation, we use three prominent parts of the balance of payments: foreign trade, FDI and tourism. More precisely, we use data on bilateral merchandise trade flows, foreign direct inflows and tourist arrivals among Western Balkan economies as well as total earnings from tourism. Data on bilateral merchandise trade flows come from the Eurostat COMEXT database, data on foreign direct inflows come from wiiw FDI Database, data on tourist arrivals come from World Tourism Organisation and the Kosovo Agency for Statistics, while data on earnings from tourism come from World Bank World Development Indicators. Data on foreign trade, foreign direct inflows and earnings from tourism are expressed in Euros, while the data for tourism is expressed in the number of tourist arrivals.

Variables representing digital transformation include fixed-telephone subscriptions per 100 inhabitants, mobile-cellular subscriptions per 100 inhabitants, fixed broadband subscriptions per 100 inhabitants, a percentage of the population covered by a mobile-cellular network, internet users (percentage), international internet bandwidth per internet user, estimated proportion of households with a computer and estimated proportion of households with internet access at home. The data for proxies for digital transformation are taken from the WT/ICT database.

We analysed the following countries: Albania, Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, North Macedonia and Serbia. The period of analysis is 2007–2017.

4.2. Economic cooperation of Western Balkan economies

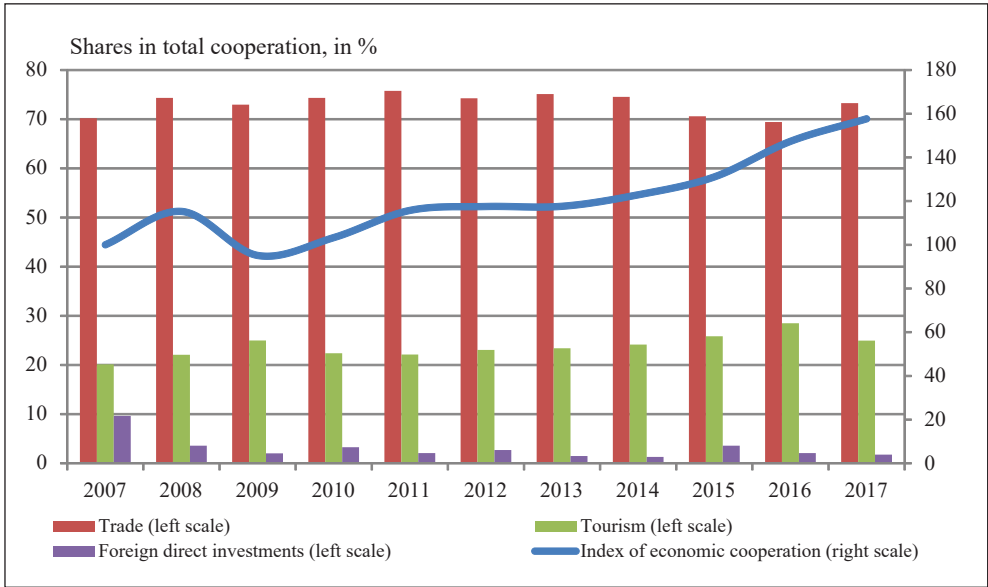
The values of the harmonised index of economic cooperation suggest an uneven, but rising trend of economic cooperation amongst Western Balkan economies (Figure 1 and Table 1 in the Appendix). The increasing cooperation in the first year was brought to a halt by the global economic downturn in 2008. After a strong decline in 2009, the economic cooperation recovered already in 2010 and continued with a gradual increase until 2017 with a halt in 2013 due to the recession which most of the countries in the region had experienced in the previous year.

As described in the previous section, the contribution of foreign trade, FDI, and tourism to the overall economic cooperation in the region was assessed using the relative weights of these three activities in the index.⁸ The cooperation amongst these economies is dominated by foreign trade, with its share in overall cooperation standing at 73.2 percent in 2017. Compared to trade, cooperation through tourism and especially through FDI in the region is relatively weak, with their share in economic cooperation amounting to 25.0 and 1.8 percent, respectively. Still, the share of tourism has been modestly rising through the years on the expense of trade, but it is a long way before tourism might close the gap with trade. On the other hand, the modest shares of tourism and FDI in the overall economic cooperation reveal a currently untapped potential for further development, which, among other things, could be further enhanced by an increased digital transformation of these economies. Since digital transformation might increase productivity and the growth of GDP (Oliner and Sichel, 2000; Yousefi, 2011) and a higher development might induce increased economic cooperation between countries (Venables, 2003), further digital development of the Western Balkan economies could boost economic cooperation between them, especially in the field of tourism.⁹

⁸ The research subject is of particular importance for encouraging the development of economic cooperation between Western Balkan countries. Although economic cooperation exists in some other areas, such as labour-related migrations, portfolio capital, and factor income flows, it is primarily reflected in the areas of foreign trade, FDI and tourism that contribute most to the creation of demand for domestic products and affect the increase of economic activity, production value and living standards. It is therefore estimated that the research on economic cooperation between Western Balkan countries in these areas is of utmost importance. In addition, it should be added that bilateral data on some other variables such as work-related migrations, portfolio capital, and factor income flows are not available, and we could not include them in the calculation of the harmonized index of economic cooperation. However, it would be reasonable to expect that they too follow the same general trend outlined by the index of economic cooperation.

⁹ Since ICT provides easier access to information about tourism destinations and products, advancement of ICT coupled with the increase in GDP might lead to an increase in regional tourist arrivals.

Figure 1: Index of economic cooperation for the economies in the region, with contributions of individual economic sectors to the index



Notes: Index of economic cooperation – 2007 = 100; shares in total cooperation – in %.

Source: Authors' calculations

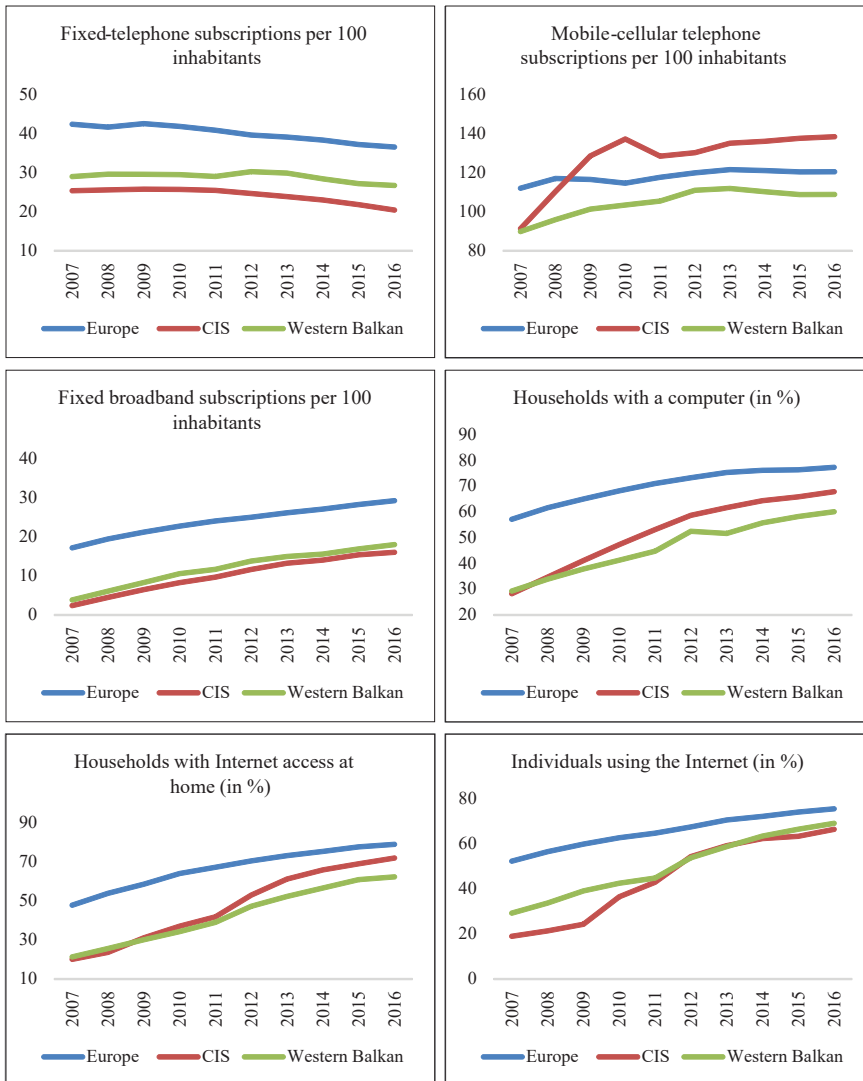
On the level of an economy, the contribution of individual economies is not equal. The largest contribution to economic cooperation among Western Balkan economies comes from Serbia (29.4 percent) and Croatia (24.7 percent). They are followed by Albania (17.7 percent)¹⁰ and Bosnia and Herzegovina (14.8 percent). North Macedonia, Montenegro and Kosovo have a relatively small contribution to the harmonised index of economic cooperation, mainly due to the smaller size of these economies. Thus, the joint share of these economies in the index of cooperation is 13.4 percent. Even though the contribution of some economies is relatively small to the index, cooperation between neighbouring countries is important, which signals the potential for the spillover effect, including a spillover of the digital transformation process. However, a potential spillover of the digital transformation process between Western Balkan countries might not be the only outcome. Increased digital transformation across the Western Balkan region could also improve the region's attractiveness and increase investments from other parts of Europe and the world.

¹⁰ It is interesting to note that a relatively high share of Albania in regional cooperation is mainly due to the estimated revenues from tourism, which mainly come from tourists from Kosovo. Tourists from Kosovo to Albania comprise the largest share of the total number of regional tourists.

4.3. Digital convergence of Western Balkan economies

Western Balkan countries, like most other regions in the world, are experiencing a digital transformation measured by the use of fixed-telephones, mobile-cellular telephones, computers and internet. While fixed-telephone subscriptions are dropping, the use of mobile-cellular telephones, computers and internet have increased over time (Figure 2 and Table 2 in the Appendix).

Figure 2: Digital transformation – comparison between regions



However, when compared with other European¹¹ and CIS¹² countries, the Western Balkan countries are still lagging behind in the use of digital technologies. CIS countries exchanged fixed-telephones with mobile-cellular telephones, while Europe is leading with the possession of computers and the access to and use of the internet. Even though Western Balkan countries are lagging behind, it is important to analyse the degree of convergence in digital transformation between them in order to assess the future prospect for the region.

Our measures of digital convergence between Western Balkan economies, which show to what extent individual economies differ in digital transformation indicators from the regional average, indicate an increase in the convergence of the region in all indicators (Figure 3 and Table 3 in the Appendix). However, there are still pronounced differences between indicators, since the intensity of the digital transformation convergence is different for each digital transformation indicator. The convergence is particularly pronounced in the percentage of the population covered by a mobile-cellular network, the share of internet users, the proportion of households with internet access at home and fixed broadband subscriptions per 100 inhabitants. Although with a somewhat lower intensity, other indicators also confirm the convergence process.

The convergence process has been especially intense in fixed broadband subscriptions per 100 inhabitants. An initial average deviation of individual economies from the regional average of fixed broadband subscriptions per 100 inhabitants amounted to more than 160 percent of the average revealing large differences between Western Balkan economies. As fixed broadband subscriptions in all Western Balkan economies increased substantially over the observed period, by 2016 this deviation decreased to just about 30 percent of the regional average. The convergence among Western Balkan economies is almost complete in the percentage of population covered by a mobile-cellular network, which means that the coverage of a mobile-cellular network is very similar in the region, regardless of the economies' individual level of development.

¹¹ Europe includes all the EU members, but also Western Balkan and other European countries. Since the data on regions are given in aggregate, it was not possible to extract Western Balkan countries and show data for the rest of European countries. However, since the EU is much larger and more advanced than countries in our sample, the bias should be minimal.

¹² CIS countries include Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Russian Federation, Tajikistan, Turkmenistan and Uzbekistan.

Figure 3: Digital transformation convergence – individual indicators, measured by the coefficient of variation

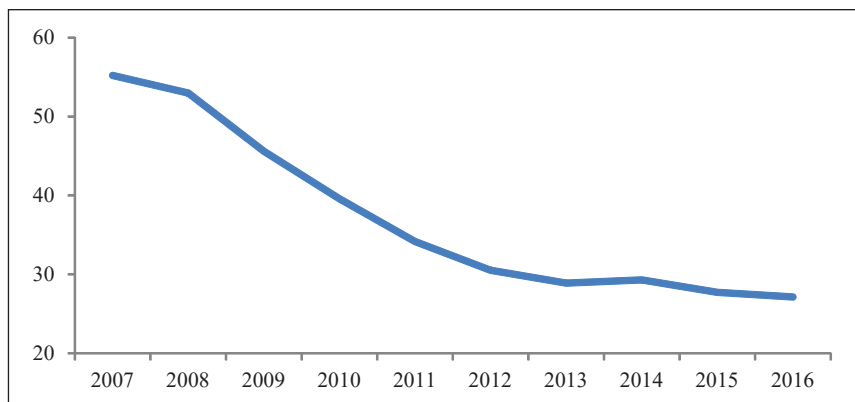


Notes: Scale is in %; 0 indicates complete convergence; the larger the coefficient of variation, the larger the divergence between Western Balkan economies in a given year.

Source: Authors' calculations

The decreasing values of the weighted digital transformation indicator over time indicate that Western Balkan economies have indeed experienced an increased digital transformation convergence (Figure 4 and Table 4 in the Appendix).

Figure 4: Digital transformation convergence in Western Balkan, measured by the coefficient of variation



Notes: Scale is in %; 0 indicates complete convergence; the larger the coefficient of variation, the larger the divergence between Western Balkan economies in a given year.

Source: Authors' calculations

5. Results and discussion

The transition period in Western Balkan countries has been marked by the processes of restructuring, privatization, liberalization and economic integration into international goods and capital flows. Despite the existence of many common features in the economic structure of the observed countries, approaches to these processes and an adaptation to new economic and market circumstances still differ significantly amongst the analysed countries. This is partly due to the existing inequalities at the level of economic development, where the dynamics and capacity for implementing structural and institutional reforms of the economies in these countries are different (Buturac, 2013). The integration and globalization processes additionally emphasize the importance of economic cooperation of the Western Balkan countries, all in order to strengthen the international competitiveness of these countries and to achieve stronger economic growth.

In this study we observed trends in economic cooperation between Western Balkan countries, as well as in digital convergence. The results show that economic cooperation between Western Balkan countries increased, with foreign trade

still being the most important contributor. Since existing research shows that economic cooperation is important for economic growth (Ng and Yeats, 2003), the advancement of economic cooperation between Western Balkan countries might draw the region towards higher levels of economic development. Trends are also similar for digital convergence – it increased significantly during the analysed period. We assume that this outcome is mainly the result of the overall technological progress in these economies, as there were no formal initiatives aimed at promoting a harmonized and standardized approach to digital transformation. Thus, as individual technologies are being deployed and used, economies exhibit more convergence both in individual value of coefficients of variation, and in the overall measure of digital transformation convergence.

However, can we claim that digital convergence of the Western Balkan economies that occurred during the analysed period is related to the increase in regional economic cooperation? By comparing Figures 1 and 4 we can state that the digital transformation convergence is positively correlated with economic cooperation. This correlation does not necessarily imply causality between these two variables. If digital transformation and economic cooperation occur simultaneously, it does not necessarily mean that one is the cause and the other is the consequence. However, the conclusions drawn are under the assumption that, at least to some extent, there is a causation between the digital transformation and economic cooperation. Thus, placing more emphasis on a harmonized cross-country approach to digital transformation could potentially boost economic cooperation in the future. The benefits of an increased digital transformation and convergence of the region would thereby not be limited just to the increased economic cooperation, but they could also be materialized in terms of an increased economic growth of individual Western Balkan economies.

This research contributes to the literature in several ways. Firstly, we augmented the methodology for calculating the harmonised index of economic cooperation. In this way we were able to analyse economic cooperation between all the economies in the region and discuss trends in cooperation and weight of each component of the index. Secondly, we used a coefficient of variation as a measure of convergence of Western Balkan economies in digital transformation and constructed a weighted digital convergence indicator in order to come up with the single measure of convergence. Hence, we were able to track to what extent individual economies diverge from the average regional value of a certain digital transformation indicator as well as to track the combined convergence of the region. Thirdly, we inferred from the developments of these two measures the possible effects of digitalisation on the economic cooperation of Western Balkan economies. And finally, due to the fact that the contributions of digitalisation are not only of a financial or economic nature, but also have social and political implications, the results obtained in this research can be a good basis for further research not only in economics but also in some other research areas. Broader social implications of the results obtained have particular significance just for Western

Balkan countries primarily because of their relative geographical proximity, language similarity, existing social-political relationships and common history.

Even though, to the best of our knowledge, there is no other research that tackles together digital transformation and economic cooperation, especially in the Western Balkan region, comparison with similar research corroborates our findings. Broz et al. (2015) show that economic cooperation between Croatia and countries in the Western Balkan region has strongly increased since the beginning of the 21st century and that the cooperation is also dominated by foreign trade. Similarly, Mondekar (2017) shows that South-East Europe is lagging behind Western economies in terms of digital transformation, but with good prospects of catching up.

6. Conclusion

In this paper we analysed mutual economic cooperation between the Western Balkan countries, examined their convergence in digital transformation and discussed the relationship between economic cooperation and digitalisation processes. The results show an increase in the economic cooperation between the Western Balkan countries, measured by the harmonised index of economic cooperation, with trade still being the most important component of the index. At the same time, Western Balkan countries exhibited strong digital transformation convergence, with the main driver of convergence being the overall technological progress in these economies. However, when compared with other European and CIS countries, the Western Balkan countries are lagging behind in the use of digital technologies.

Even though digitalisation is not the only driver of economic cooperation, the results of the trends are indicative. If, at least to some extent, there is a causality between the digital transformation and economic cooperation, the observed increase in digital transformation and convergence of Western Balkan countries might have a positive impact on the economic cooperation. This implies that increased digital convergence through the increase of the overall technological progress could strengthen regional economic cooperation and contribute to the economic stability of the region.

Still, there are some limitations of our research. Primarily due to the lack of data, the harmonised index of economic cooperation does not include all economic variables, such as remittances, portfolio capital and factor income flows. Hence, further development and upgrading the research methodology in areas of economic cooperation and digitalisation is needed. Also, other limitations of this research are primarily related to the character of the time period covered by the analysis. The lack of long-time data series disables deeper insights into the nature of relationship between digitalisation process and economic cooperation among countries. In addition, it must be highlighted that the analysis was conducted using the data only at macro level. This study could not involve a micro level analysis that would

ensure deeper insight into the reasons of strengthening economic cooperation among Western Balkan countries in the circumstances of the process of growing digital convergence among them.

Future research might also tackle the issue of how digitalisation and economic cooperation contribute to the economic growth of Western Balkan countries and especially whether the Western Balkan countries experienced different effects of the digitalisation process on economic growth due to their different economic development stages.

References

- Aruoja, K. (2015) *Digital cooperation in the Baltic sea region: A case of networked multi-level governance*, Master's thesis, University of Tartu, Estonia.
- Arvin, B.M., Pradhan, R.P. (2014) "Broadband penetration and economic growth nexus: evidence from cross-country panel data", *Applied Economics*, Vol. 46, No. 35, pp. 4360–4369, doi: <https://doi.org/10.1080/00036846.2014.957444>.
- Aubert-Tarby, C., Escobar, O.R., Rayn, T. (2018) "The impact of technological change on employment: The case of press digitisation", *Technological Forecasting and Social Change*, Vol. 128, pp. 36–45, doi: <https://doi.org/10.1016/j.techfore.2017.10.015>.
- Bai, Y. (2019) "The Nuanced Effects of Internet Use on International Trade: An Empirical Analysis of U.S. Trade Data", Available at SSRN: <https://ssrn.com/abstract=3426630>, doi: <http://dx.doi.org/10.2139/ssrn.3426630>.
- Barbero, J., Rodriguez-Crespo, E. (2018) "The effect of broadband on European Union trade: A regional spatial approach", Vol. 41, No. 11, pp. 2895–2913, doi: <https://doi.org/10.1111/twec.12723>.
- Barrell, R., Pain, N. (1996) "An Econometric Analysis of U.S. Foreign Direct Investment", *Review of Economics and Statistics*, Vol. 78, No. 2, pp. 200–207, doi: <https://doi.org/10.2307/2109921>.
- Broz, T., Buturac, G., Tkalec, M. (2015) "To what extent does Croatia really cooperate with SEE countries in the fields of foreign trade, direct investment and tourism?", *Economic research-Ekonomska istraživanja*, Vol. 28, No. 1, pp. 879–906, doi: <https://doi.org/10.1080/1331677X.2015.1092703>.
- Buturac, G. (2013) „Beyond the Global Recession: Mutual Trade and Economic Convergence“, *Ekonomski pregled*, Vol. 64, No. 4, pp. 303–326, <https://hrcak.srce.hr/106541>.
- Castaldo, A., Fiorini, A., Maggi, B. (2018) "Measuring (in a time of crisis) the impact of broadband connections on economic growth: an OECD panel analysis", *Applied Economics*, Vol. 50, No. 8, pp. 838–854, doi: <https://doi.org/10.1080/00036846.2017.1343448>.

- Choi, C. (2003) “Does the Internet Stimulate Inward Foreign Direct Investment?”, *Journal of Policy Modeling*, Vol. 25, No. 4, pp. 319–326. doi: 10.1016/S0161-8938(02)00202-8.
- Choi, C. (2010) “The Effect of the Internet on Service Trade”, *Economics Letters*, Vol. 109, No. 2, pp. 102–104. doi: <https://doi.org/10.1016/j.econlet.2010.08.005>.
- Choi, C., Yi, M.H. (2018) “The Internet, R&D expenditure and economic growth”, *Applied Economics Letters*, Vol. 25, No. 4, pp. 264–267, doi: <https://doi.org/10.1080/13504851.2017.1316819>.
- Crandall, R.W., Lehr, W., Litan, R.E. (2007) “*The effects of broadband deployment on output and employment: A cross-sectional analysis of US data*”, Retrieved from: The Brookings Institution website: https://www.brookings.edu/wp-content/uploads/2016/06/06labor_crandall.pdf.
- Czernich, N. et al. (2011) “Broadband infrastructure and economic growth”, *The Economic Journal*, Vol. 121, No. 552, pp. 505–532, doi: <https://doi.org/10.1111/j.1468-0297.2011.02420.x>.
- De Groen, W.P. et al. (2017) “*Impact of digitalisation and the on-demand economy on labour markets and the consequences for employment and industrial relations*”, Final Study, CEPS Special Report, August 2017. Retrieved from: <https://www.eesc.europa.eu/resources/docs/qe-02-17-763-en-n.pdf>.
- Dedrick, J., Kraemer, K.L., Shih, E. (2013) “Information technology and productivity in developed and developing countries”, *Journal of Management Information Systems*, Vol 30, No. 1, pp. 97–122, doi: <https://doi.org/10.2753/MIS0742-1222300103>.
- Degryse, C. (2016) “Digitalisation of the economy and its impact on labour markets”, *ETUI Research Paper-Working Paper*, No. 2016.02, ETUI: Brussels, doi: <https://doi.org/10.2139/ssrn.2730550>.
- Duttaray, M., Dutt, A.K., Mukhopadhyay, K. (2008) “Foreign direct investment and economic growth in less developed countries: an empirical study of causality and mechanisms”, *Applied Economics*, Vol. 40, pp. 1927–1939, doi: <https://doi.org/10.1080/00036840600949231>.
- Freund, C., Weinhold, D. (2004) “The Effect of the Internet on International Trade”, *Journal of International Economics*, Vol. 62, No. 1, pp. 171–189. doi: [https://doi.org/10.1016/S0022-1996\(03\)00059-X](https://doi.org/10.1016/S0022-1996(03)00059-X).
- Ghosh, S. (2017) “Broadband penetration and economic growth: Do policies matter?”, *Telematics and Informatics*, Vol. 34, No. 5, pp. 676–693, doi: <https://doi.org/10.1016/j.tele.2016.12.007>.
- Gnangnon, S.K., Iyer, H. (2018) “Does bridging the Internet Access Divide contribute to enhancing countries’ integration into the global trade in services markets?”, *Telecommunications Policy*, Vol. 42, No. 1, pp. 61–77, doi: <https://doi.org/10.1016/j.telpol.2017.08.004>.

- Gómez-Plana, A.G., Latorre, M.C. (2019) “Digitalization, Multinationals and Employment: An Empirical Analysis of Their Causal Relationships”, *Journal of Economics and Statistics*, Vol. 239, No. 3, pp. 399–439, doi: <https://doi.org/10.1515/jbnst-2017-0153>.
- Gries, T., Redlin, M. (2012) “Trade Openness and Economic Growth: A Panel Causality Analysis”, *Working Papers CIE*, No. 52, Paderborn: Paderborn University, CIE Center for International Economics, <http://groups.uni-paderborn.de/wp-wiwi/RePEc/pdf/ciepap/WP52.pdf>.
- Grimes, A., Ren, A., Stevens, P. (2012) “The need for speed: impacts of internet connectivity on firm productivity”, *Journal of Productivity Analysis*, Vol. 37, No. 2, pp. 187–201, doi: <http://dx.doi.org/10.2139/ssrn.1604247>.
- Gruber, H. et al. (2014) “Broadband access in the EU: An assessment of future economic benefits”, *Telecommunications Policy*, Vol. 38, No. 11, pp. 1046–1058, doi: <https://doi.org/10.1016/j.telpol.2014.06.007>.
- Gruber, H., Koutroumpis, P. (2011) “Mobile telecommunications and the impact on economic development”, *Economic Policy*, Vol. 26, No. 67, pp. 387–426, doi: <https://doi.org/10.1111/j.1468-0327.2011.00266.x>.
- Haftu, G.G. (2019) “Information communications technology and economic growth in Sub-Saharan Africa: A panel data approach”, *Telecommunications Policy*, Vol. 43, No. 1, pp. 88–99, doi: <https://doi.org/10.1016/j.telpol.2018.03.010>.
- Haller, S.A., Lyons, S. (2019) “Effects of broadband availability on total factor productivity in service sector firms: Evidence from Ireland”, *Telecommunications Policy*, Vol. 43, No. 1, pp. 11–22, doi: <https://doi.org/10.1016/j.telpol.2018.09.005>.
- Hsiao, F.S.T., Hsiao, M-C.W. (2006) “FDI, exports, and GDP in East and Southeast Asia – Panel data versus time-series causality analyses”, *Journal of Asian Economics*, Vol. 17, No. 6, pp. 1082–1106, doi: <https://doi.org/10.1016/j.asieco.2006.09.011>.
- Kabaklarli, E., Atasoy, B.S. (2019) “Broadband infrastructure and economic growth: a panel data approach for selected countries”, Vol. 4, No. 1, pp. 105–114.
- Katz, R.L. et al. (2010) “The impact of broadband on jobs and the German economy”, *Intereconomics*, Vol. 45, No. 1, pp. 26–34, doi: <https://doi.org/10.1007/s10272-010-0322-y>.
- Katz, R.L., Koutroumpis, P. (2013) “Measuring digitization: A growth and welfare multiplier”, *Technovation*, Vol. 33, No. 10, pp. 314–319, doi: <https://doi.org/10.1016/j.technovation.2013.06.004>.
- Kolko, J. (2012) “Broadband and local growth”, *Journal of Urban Economics*, Vol. 71, No. 1, pp. 100–113, doi: <http://dx.doi.org/10.1016/j.jue.2011.07.004>.
- Kotarba, M. (2017) “Measuring Digitalization – Key Metrics”, *Foundations of Management*, Vol. 9, No. 1, pp. 132–138, <https://content.sciendo.com/abstract/journals/fman/9/1/article-p123.xml>.

- Koutroumpis, P. (2009) "The economic impact of broadband on growth: A simultaneous approach", *Telecommunications policy*, Vol. 33, No. 9, pp. 471–485, doi: <https://doi.org/10.1016/j.telpol.2009.07.004>.
- Lee, S. (2016) "Geography of cross-border portfolio investments and ICT diffusion", *International Review of Economics and Finance*, Vol. 45, pp. 540–552, doi: [10.1016/j.iref.2016.07.01](https://doi.org/10.1016/j.iref.2016.07.01).
- Lee, S.H., Levendis, J., Gutiérrez, L. (2012) "Telecommunications and economic growth: an empirical analysis of sub-Saharan Africa", *Applied Economics*, Vol. 44, No. 4, pp. 461–469, doi: <http://dx.doi.org/10.1080/00036846.2010.508730>.
- Lehr, W.H. et al. (2006) "Measuring Broadband's Economic Impact", *ESD Working Papers, ESD-WP-2006-02*, Massachusetts Institute of Technology. <http://hdl.handle.net/1721.1/102779>.
- Lin F. (2015) "Estimating the effect of the Internet on international trade", *Journal of International Trade and Economic Development*, Vol. 24, No. 3, pp. 409–428, doi: [10.1080/09638199.2014.881906](https://doi.org/10.1080/09638199.2014.881906).
- Liu, X, Burridge, P., Sinclair, P.J.N. (2002) "Relationships between economic growth, foreign direct investment and trade: evidence from China", *Applied Economics*, Vol. 34, No. 11, pp. 1433–1440, doi: <https://doi.org/10.1080/00036840110100835>.
- Majumdar, S. K., Carare, O., Changy, H. (2009) "Broadband adoption and firm productivity: evaluating the benefits of general purpose technology", *Industrial and Corporate Change*, Vol. 19, No. 3, pp. 641–674, doi: <https://doi.org/10.1093/icc/dtp042>.
- Minges, M. (2015) "Exploring the relationship between broadband and economic growth", *World Development Report 2016: Digital Dividends*, World Bank.
- Mondekar, D. (2017) *The digital economy in Southeast Europe: Opportunities and challenges*, Zagreb: Friedrich-Ebert-Stiftung, Regional Office for Croatia and Slovenia, Zagreb.
- Ng, T.H., Lye, C.T., Lim, Y.S. (2013) "Broadband penetration and economic growth in ASEAN countries: a generalized method of moments approach", *Applied Economics Letters*, Vol. 20, No. 9, pp. 857–862, doi: <https://doi.org/10.1080/13504851.2012.754538>.
- Ng, F., Yeats, A. (2003) "Major Trade Trends in East Asia: What are their Implications for Regional Cooperation and Growth?", *World Bank Policy Research Working Paper*, No. 3084, doi: <https://doi.org/10.1596/1813-9450-3084>.
- Oliner, S.D., Sichel, D.E. (2000) "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?", *Journal of Economic Perspectives*, Vol. 14, No. 4, pp. 3–22, doi: <https://doi.org/10.1257/jep.14.4.3>.
- Piatkowski, M. (2006) "Can information and communication technologies make a difference in the development of transition economies?", *Information Technologies & International Development*, Vol. 3, No.1, pp. 39–53.

- Rodríguez-Crespo, E., Martínez-Zarzoso, I. (2019) “The effect of ICT on trade: Does product complexity matter?”, *Telematics and Informatics*, Vol. 41, pp. 182–196, doi: <https://doi.org/10.1016/j.tele.2019.05.001>.
- Roller, L.H., Waverman, L. (2001) “Telecommunications infrastructure and economic development: A simultaneous approach”, *American economic review*, Vol. 91, No. 4, pp. 909–923, doi: <https://doi.org/10.1257/aer.91.4.909>.
- Venables, A.J. (2003) “Winners and Losers from Regional Integration Agreements”, *Economic Journal*, Vol. 113, No. 490, pp. 747–761, doi: <https://doi.org/10.1111/1468-0297.t01-1-00155>.
- Yi, M.H., Choi, C. (2005) “The effect of the Internet on inflation: Panel data evidence” *Journal of Policy Modeling*, Vol. 27, No. 7, pp. 885–889, doi: <https://doi.org/10.1016/j.jpplmod.2005.06.008>.
- Yousefi, A. (2011) “The impact of information and communication technology on economic growth: evidence from developed and developing countries”, *Economics of Innovation and New Technology*, Vol. 20, No. 6, pp. 581–596, doi: <https://doi.org/10.1080/10438599.2010.544470>.
- Zoroja, J. (2011) “Internet, e-commerce and e-government: measuring the gap between European developed and post-communist countries”, *Interdisciplinary Description of Complex Systems: INDECS*, Vol. 9, No. 2, pp. 119–133.

Digitalna transformacija i gospodarska suradnja: slučaj zemalja zapadnog Balkana

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Sažetak

Digitalna transformacija utječe na mnoge aspekte svjetske ekonomije. Ona podiže gospodarski rast, utječe na inozemna izravna ulaganja te povećava trgovinsku razmjenu. Stoga je cilj ovoga rada analizirati digitalnu transformaciju i gospodarsku suradnju između zemalja zapadnog Balkana. Metodologija istraživanja zasniva se na dva pokazatelja: harmoniziranom indeksu gospodarske suradnje između zemalja zapadnog Balkana i pokazatelju konvergencije digitalne transformacije. Rezultati ukazuju na rastući trend gospodarske suradnje između zemalja zapadnog Balkana, s tim da u suradnji dominira vanjska trgovina. Iako su zemlje zapadnog Balkana iskusile povećanu konvergenciju u digitalnoj transformaciji, one i dalje zaostaju za EU u upotrebi digitalnih tehnologija. Stoga, stavljanje naglaska na digitalnu transformaciju bi potencijalno moglo povećati regionalni BDP i time gospodarsku suradnju između zemalja zapadnog Balkana.

Ključne riječi: digitalna transformacija, regionalna gospodarska suradnja, zemlje zapadnog Balkana

JEL klasifikacija: F15, F21, O33

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Appendices

Table 1: Index of economic cooperation for the Western Balkan economies and shares of individual economic sectors in the index

Year	Index of economic cooperation (2007 = 100)	Share of international trade in total cooperation (in %)	Share of tourism in total cooperation (in %)	Share of FDI in total cooperation (in %)
2007	100.0	70.2	20.1	9.6
2008	115.3	74.3	22.1	3.6
2009	95.1	73.0	25.0	2.0
2010	103.3	74.3	22.4	3.3
2011	115.7	75.8	22.1	2.1
2012	117.5	74.2	23.1	2.7
2013	117.6	75.1	23.4	1.5
2014	122.9	74.5	24.1	1.3
2015	131.1	70.6	25.8	3.6
2016	147.4	69.4	28.5	2.1
2017	157.7	73.3	25.0	1.8

Source: Authors' calculations

Table 2: Digital indicators – comparison between regions

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Fixed-telephone subscriptions per 100 inhabitants									
Europe	42.5	41.7	42.6	41.9	40.9	39.7	39.2	38.4	37.3	36.6
CIS	25.4	25.6	25.8	25.7	25.5	24.7	23.9	23.0	21.8	20.4
Western Balkan	29.0	29.7	29.6	29.5	9.1	30.3	29.9	28.4	27.2	26.8
	Mobile-cellular telephone subscriptions per 100 inhabitants									
Europe	112.1	117.1	116.6	114.7	117.7	120.0	121.7	121.1	120.5	120.5
CIS	91.4	110.4	128.7	137.3	128.6	130.3	135.2	136.2	137.7	138.5
Western Balkan	89.9	96.0	101.4	103.5	105.5	111.0	112.0	110.3	108.8	108.9
	Fixed broadband subscriptions per 100 inhabitants									
Europe	17.2	19.5	21.2	22.8	24.1	25.1	26.2	27.2	28.3	29.3
CIS	2.4	4.5	6.5	8.3	9.7	11.7	13.3	14.1	15.4	16.1
Western Balkan	3.9	6.1	8.3	10.6	11.7	13.8	15.0	15.6	16.9	18.1
	Households with a computer (in %)									
Europe	57.1	61.6	65.0	68.2	71.0	73.3	75.3	76.1	76.3	77.3
CIS	28.3	34.7	41.1	47.3	53.1	58.7	61.6	64.3	65.8	67.9
Western Balkan	29.3	33.9	37.9	41.2	44.8	52.5	51.7	55.7	58.2	60.1
	Households with internet access at home (in %)									
Europe	47.9	54.0	58.7	64.1	67.3	70.6	73.3	75.5	77.8	79.1
CIS	20.2	23.7	31.1	37.1	41.9	53.0	61.3	66.0	69.1	72.1
Western Balkan	21.4	25.7	30.2	34.3	39.1	47.4	52.4	56.7	61.0	62.4
	Individuals using the internet (in %)									
Europe	52.3	56.5	59.8	62.7	64.7	67.4	70.5	72.2	74.1	75.5
CIS	19.0	21.4	24.3	36.5	42.9	54.3	59.2	62.3	63.3	66.4
Western Balkan	29.2	33.7	39.1	42.5	44.8	53.8	58.7	63.4	66.4	69.0

Source: WT/ICT

Table 3: Digital transformation convergence – individual indicators

Internet users (%)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	37.1	28.1	22.9	22.8	20.8	11.4	10.7	7.2	5.1	4.6
Percentage of the population covered by a mobile-cellular network	1.3	0.4	0.2	1.2	1.1	0.4	0.1	0.2	0.2	0.2
Fixed broadband subscriptions per 100 inhabitants	98.6	72.1	57.7	50.6	48.4	41.9	38.8	37.9	33.7	32.9
Estimated proportion of households with internet access at home (in %)	69.3	61.9	52.8	46.1	39.5	34.4	29.4	28.2	23.3	22.0
Fixed-telephone subscriptions per 100 inhabitants	54.5	53.4	52.6	53.5	41.4	41.7	42.8	43.2	44.2	43.3
Mobile-cellular subscriptions per 100 inhabitants	38.5	46.8	48.5	42.6	28.6	19.1	18.4	20.2	20.7	22.2
International Internet bandwidth per internet user	86.6	114.2	84.6	59.9	56.4	60.1	57.7	65.6	63.6	62.2
Estimated proportion of households with a computer (in %)	55.6	46.9	45.4	39.8	37.1	35.3	33.2	31.8	31.0	29.7

Source: Authors' calculations

Table 4: Weighted digital transformation convergence in Western Balkan

Weighted digitalisation convergence	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	55.2	53.0	45.6	39.6	34.2	30.5	28.9	29.3	27.7	27.1

Source: Authors' calculations

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Review article is an article that analyzes a special scientific problem already dealt with in published scientific works, but his approach is original and new.

Professional paper is an article that deals with specific problems in some professional areas.

After receiving the reviews, the Editorial Board will give clear general instructions to the author for further work on the manuscript. The comments and suggestions made by the reviewers should be addressed and closely followed by the author prior to final recommendation on acceptance or rejection made by the Editorial Board.

Only manuscripts with two positive reviews are published.

After completion of peer review and amendment of the text of the accepted articles by the authors and editors, Editor-in-Chief, proposes the sequence of accepted papers in the table of contents.

Criteria for the order are:

- (1) categorization according to the degree of scientific excellence,
- (2) in case of two different levels of categorization of a particular article by reviewers, Editor-in-Chief proposes a decision to the Editorial Board, and as a rule, in favour of the author, i.e. a higher category,
- (3) appreciation of topical issues, authors and common interest of the Journal taking into account the competitiveness at the same level of scientific excellence (category).

In order to increase the quality and number of papers published, the Editorial Board strives to fasten the publishing process by informing the authors on the status of their papers within ten working days of the submission. Provisional deadline for finishing the reviewing process, technical revisions and online publication of the paper shall last no longer than two months. Moreover, as of 2018, the forthcoming papers that will be included within the regular biannual issues are initially published on our Journal's website.

Organization of the manuscript

The manuscript should include the research aim and tasks, with detailed methodology, the research objective, achieved results and findings, conclusions and a list of references.

The authors of the manuscript should conform to the format and documentation requirements that are given below:

The separate page should contain: the article title, the author's full name, academic affiliation (title, institution, scientific field), phone, fax, e-mail address and personal website. If there are more authors than one, full names, respective affiliations and addresses of co-authors should be clearly stated. Authors' academic affiliation should be:

- in the language of the article,
- in Croatian language,
- in English if the original language of the article is other than English.

The first page should contain: the article title, abstract, JEL classification and key words in the language of the article. At the end of the article all data should be also:

- in Croatian language,
- in English if the original language of the article is other than English.

Main body of the text should contain: introduction, headings, footnotes, references in the text, tables, figures, conclusions and references.

Technical requirements

The manuscript submitted for publication should be in Microsoft Office Word (Ver. 95+), with maximum length up to **8,000** words in length (16-20 A4 size pages), printed in font style Times New Roman (12 point), single-spaced, justified and

without any special styling. Should a word, a phrase or a sentence be highlighted, italic font style can be used and never bold. Paragraphs are divided by double spacing and all margins are at 2.5 cm. In case the paper exceeds the normal length, the Editors' consent for its publication is needed.

JEL classification should be suggested by the authors themselves according to the classification available on the Journal of Economic Literature website: http://www.aeaweb.org/journal/jel_class_system.html.

Footnotes could be used only as an additional explanatory section of the text and should be numbered consecutively in Arabic numerals.

Section headings (from Introduction to Conclusions) must be short, clearly defined and bear Arabic numerals. If there are subsection headings they are outline numbered (e.g. 1; 1.1.; 2.; 2.1.; 2.1.1. etc.)

All *tables and figures* should bear Arabic numerals and must have captions. Tables set in MS Word may be included in the text.

Note: If MS Excel or other programs are used for tables, figures or illustrations, make sure to enclose them as a separate file on disk, separately from the text.

Before submission of the manuscript, the authors of the manuscript are advised to conform to the format and documentation requirements.

Text organization and style

Authors should apply scientific methodology in presenting the contents of their papers complying with the standards of scientific publications ("Harvard style"). This implies the procedure as follows:

(1) Title and the content of the paper:

The title is the most important summary of a scientific article, which reflects the scope of investigation and the type of study. Therefore, the title should not contain words such as "analysis", "methods" and similar.

The content of the paper consists of:

- *Abstract* – below the title
- *Key words*
- *JEL classification*.

It is followed by the main body of the paper divided into sections. The section headings are as follows:

- *Introduction*
- *Literature review*
- *Methodology/method/model/conception of analysis* (the third section)
- *Empirical data (documentation background) and analysis* (the fourth section)
- *Results and discussion* (the fifth section)
- *Conclusions* (the sixth section).

(2) The content of some parts of the material presented:

a. Abstract – up to 100-250 words must contain:

- purpose and research objective,
- methodology/method/model/conception of analysis,
- main findings and results of research (analysis),
- the underlined conclusion of research.

The abstract should not be written in paragraphs!

b. Key words should disclose the essence of the article (up to 5 key words).

c. JEL classification – the author should classify the subject matter of the article according to the code of The Journal of Economic Literature (JEL).

d. Introduction – defines the problem and the subject matter of the research referring to recent bibliography and findings. However, these can more specifically be dealt with in the second section *Literature review*. The last part of the introduction is reserved for setting the hypothesis of the research that will be later on analyzed at the beginning of the conclusions. Finally, Introduction ends up by giving clues of the organization of the text.

e. Literature review – precedes a research section providing readers with a cutting-edge context of the referential literature dealing with crucial points of current knowledge based on the relevant results of the current research. Literature review should be a synthesis of previous research, justifying the theoretical and empirical contributions of the respective paper, a not a simple listing of previous scientific contributions.

f. Methodology/method/model/conception of analysis – usually in the third section of the paper, methodology/method/model/conception of the analysis should be transparently presented and pointed out in case of the research results being subjected to re-testing by interested researchers (it is one of the fundamental principles of the scientific methodology).

g. Empirical data and analysis – contain documentation background and the results of the empirical analysis. The data sample shall be elaborated and the obtained results shall be explained based on statistical and econometric features, and their economic meaning.

h. Results and discussion – explain the results, especially their economic significance and messages. In this section, the author(s) need to elaborate how their results and conclusions contribute to the scientific field and provide practical implications and recommendations.

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- Explanation of the working hypothesis – proved or not proved.
- Assessment of the results of research/analysis with the focus on what can be classified as a new contribution to economic science.
- Attention drawn to research limitations and problems.

- Guidelines to future research.
- Assessment of institutional-systemic implications of the results obtained by the research (suggestions and recommendations for direction or changes of economic system, economic and financial policy, development policy, instruments, measurements or similar).

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TABLES should be included in the text in order to present the exact values of the data that cannot be summarized in a few sentences in the text. Each column heading for numerical data should include the unit of measurement applied to all data under the heading. Large numbers can be expressed in smaller units with appropriate column headings (in thousands, millions, etc), and logical presentation of data using table grid option in MS Word for table lines (both vertical and horizontal). Each table should be self-explanatory, bearing Arabic numerals (e.g. Table 1, Table 2, etc.) with an adequate title (clearly suggesting the contents) and the source of the data should be stated below the table, if other than author's.

FIGURES (GRAPHS, DIAGRAMS, ILLUSTRATIONS) should also be included in the text. They should be numbered in sequence with Arabic numerals, followed by the figure title, and the legend to the figure that contains all the necessary explanations of symbols and findings. The source of the data presented in the figure should be stated below the figure if other than author's.

Note. The text should not simply repeat the data contained in tables and figures, i.e. the text and the data in tables and figures should be related in the text by means of reference marks.

REFERENCES. The ISI citations should be followed by all authors of *Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/ Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business* (please, refer to <http://www.isinet.com>) and references to other publications must be in Harvard style. At each point in the text that refers to a particular document, insert the author's surname and publication year in brackets: (Rowley, 1996) or (Cutler and Williams, 1986), or in the case of more than two, the first author (from the title page) followed by "et al." (Matlock et al., 1986). If the author's name is repeated no *ibid* is used but his surname is repeated. If the author's name occurs naturally in the text, the year follows in the brackets: *The work of Stevens (2001) was concerned with what they teach at Harvard Business School.* In case of direct quotations the page numbers should be added, e.g. (Jones, 1995: 122–123).

At the end of the article a list of references is organized alphabetically as follows:

- **Books:** Surname, Initials (year) *Title*, Place of publication: Publisher. See example: Callicott, J. B. (1994) *Earth's Insights: A Survey of Ecological Ethics from the Mediterranean Basin to the Australian Outback*, Berkeley: University of California Press.

If there are two or three authors you put down their surnames followed by initials:
Ridderstråle, J., Nordström, K. (2004) *Karaoke Capitalism Management for Mankind*, Harlow: Pearson Education Ltd.

If there are multiple authors (four or more) the first author's surname (from the title page) is followed by et al.:

Norton, M. B. et al. (1981) *A People and a Nation – A History of the United States*, Boston: Houghton Mifflin Company.

• **Journals:** Surname, Initials (year) "Title", *Journal*, Volume, Number, pages. See example:

Kostelich, E. (1995) "Symphony in Chaos", *New Scientists*, Vol. 146, No. 1972, pp. 36–39.

Fox, S. (1994) "Empowerment as a Catalyst for Change: An Example from the Food Industry", *Supply Chain Management*, Vol. 2, No. 3, pp. 29–33.

If there are multiple authors (four or more), the first author's surname (from the title page) is followed by et al. See example:

Di Noia, C. et al. (1999) "Should Banking Supervision and Monetary Policy Tasks be Given to Different Agencies?", *International Finance*, Vol. 2, No. 3, pp. 285–361.

If there are multiple works by the same author published in the same year, the "a, b, c" is used after the year. See example:

Quah, D. T. (1993a) "Empirical Cross-section Dynamics in Economic Growth", *European Economic Review*, Vol. 37, No. 2–3, pp. 426–434.

----- (1993b) "Galton's Fallacy and Tests of the Convergence Hypothesis", *Scandinavian Journal of Economics*, 95, Vol. 95, No. 4, pp. 427–443.

----- (1994) "Exploiting cross Section Variation for Unit Root Inference in Dynamic Data", *Economics Letters*, Vol. 44, No. 1–2, pp. 9–19.

----- (1996a) "Empirics for Economic Growth and Convergence", *European Economic Review*, Vol. 40, No. 6, pp. 951–958.

----- (1996b) "Regional Convergence Clusters across Europe", *European Economic Review*, Vol. 40, No. 6, pp. 951–958.

The author should provide **Digital Object Identifier (DOI)** for each reference that can be found whether it exists at CrossRef <http://www.crossref.org/> and DOI appears in the form such as <https://doi.org/10.5468/ogs.2016.59.1.1>.

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• **Internet sources:** Author's/editor's surname (year), "Title of the article", *Title of the journal* [type of medium], date of publication, volume number, pagination or online equivalent, <availability statement> [date of accession if necessary]:

Martin, C.L. (1998) "Relationship Marketing: a High-Involvement Product Attribute Approach", *Journal of Product and Brand Management* [Internet], Vol. 7, No. 1, pp. 6–26. Available at: <<http://www.apmforum.com/emerald/marketing-research-asia.htm>> [Accessed: October 3, 2002]

- **Chapter/section from a book of collected writings:** Author of the chapter/section (year of publication) "Title of the Chapter/section". In Author/editor of collected work, *Title of collected works*, Place of publishing: Publisher. Example:

Porter, M.A. (1993) "The modification of method in researching postgraduate education". In Burges, R.G. ed., *The research process in educational settings: ten case studies*, London: Falmer.

- **Conference papers from conference proceedings:** Author of the conference paper (year of publication) "Title of the conference paper". In *Title of conference proceedings*. Place of publication: Publisher, pagination of section referred to:

Fedchak, E. & Duvall, L. (1996) "An engineering approach to electronic publishing". In *Proceedings of the International Workshop on Multimedia Software Development*, 25–26 March, Berlin, Los Alimos, Ca: IEEE Comput. Soc. Press, pp. 80–88.

- **Theses and dissertations:** Author's name (year) *Title of doctoral dissertation*, the name of the awarding institution:

Whitehead, S.M. (1996) *Public and private men: masculinities at work in education management*, PhD thesis, Leeds Metropolitan University.

- **Official publications:** Title of publication/organisation/institution (year) *Title*, Place of publishing: Publisher. Example:

Department of the Environment (1986) *Landfilling wastes*, London: HMSO (*Waste management paper*; 26).

Guidelines for other publications

The Journal reserves the main printing space for scientific articles accepted from scientists all over the world. However, the other part is devoted to reviews of scientific achievements, which are classified by the editorial board as follows:

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- **In Memoriam.** It is a short text (not longer than 1 A4 page) written in memory of a scientist or special contributor and his works. The author's name is stated at the end of the text with his or her affiliation.
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More detailed information on the *Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/ Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business* can be obtained on the website of the Faculty of Economics University of Rijeka: <http://www.efri.uniri.hr/en/proceedings>.

EDITORIAL BOARD

*Uredništvo skreće pozornost autorima
da pažljivo pročitaju upute koje su dopunjene
detaljnom metodologijom organizacije teksta*

UPUTE AUTORIMA

Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business međunarodno je recenziran časopis, otvoren za suradnju znanstvenicima iz cijelog svijeta iz različitih područja ekonomske teorije i prakse. Tekstovi se objavljuju, u pravilu, na engleskom jeziku. Međutim, časopis može objavljivati tekstove i na ostalim svjetskim jezicima.

Politika uređivanja

Uredništvo zaprima sve rukopise. Glavni i odgovorni urednik tekstove, nakon pregleda i prihvaćanja, upućuje u postupak prosudbe (“assessment process”) članovima Uredništva, ali i ekspertnim stručnjacima izvan Uredništva u slučaju specifičnog sadržaja teksta. Poslije prosudbe, glavni i odgovorni urednik predlaže Uredništvu odluke za daljnji postupak i to: (a) koje se rukopise, u slučaju potrebe, vraća autoru sa sugestijama, preporukama i primjedbama radi poboljšanja, prije svega, metodološke prezentacije građe istraživanja; (b) koje rukopise uputiti u postupak recenzija (“reviewing process”); (c) koje rukopise odbiti, budući da:

- tema ne zadovoljava zahtijevanu znanstvenu razinu;
- autor je članak sa sličnom temom već objavio;
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Sadržaj članka

Rad treba biti relevantan za međunarodnu znanstvenu i stručnu javnost s jasno naznačenim ciljevima i rezultatima istraživanja, zaključkom, referencama u tekstu i bibliografskim jedinicama na kraju rada. Ideje u radu moraju biti originalne i trebaju značajno doprinositi razvoju predmeta istraživanja, a metodologija mora biti jasno opisana.

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- na jeziku članka,
- na hrvatskom jeziku,
- na engleskom jeziku ako izvorni jezik članka nije engleski.

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Na kraju članka isti podaci daju se na:

- hrvatskom jeziku, te
- na engleskom jeziku ako izvorni jezik članka nije engleski.

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- *Sažetak (Abstract)* – ispod naslova
- *Ključne riječi*
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- *Uvod*
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- *Metodologija/metoda/model/koncepcija analize* (treće poglavlje)
- *Empirijski podaci (dokumentacijska podloga) i analiza* (četvrto poglavlje)
- *Rezultati i diskusija* (peto poglavlje)
- *Zaključci* (šesto poglavlje).

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a. Sažetak – ispisuje se u 100–250 riječi, a obvezno treba sadržavati:

- utvrđeni cilj istraživanja,
- metodu/model/koncepciju analize,
- glavni rezultat istraživanja (analize),
- temeljni zaključak istraživanja.

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c. JEL klasifikacija – autor svoju temu mora razvrstati sukladno kodu časopisa The Journal of Economic Literature (JEL).

d. Uvod – sadrži definiranje problema i predmeta istraživanja s pozivom na recentnu literaturu odnosno rezultate istraživanja. Taj se dio može istaknuti i u posebnom, tj. 2., poglavlju kao *Literature review*. Pri kraju uvodnog dijela treba utvrditi radnu pretpostavku (hipotezu) istraživanja o kojoj se treba očitovati (kasnije) na početku poglavlja *Zaključak*. *Uvod* treba završiti s naznakom organizacije teksta.

e. Pregled literature – prethodi istraživačkom dijelu, a pruža čitateljima pregled referentne literature s ključnim točkama dosadašnjih spoznaja temeljenih na relevantnim rezultatima aktualnih istraživanja. Pregled literature ne smije biti taksativno navođenje prethodnog znanstvenog doprinosa, već autori trebaju izvršiti sintezu dosadašnjih istraživanja kako bi dokazali opravdanost teorijskog i empirijskog doprinosa vlastitog rada.

f. Metodologija/Metoda/Model/Koncepcija – obično se prezentira u trećem poglavlju; metoda/model/koncepcija analize mora biti transparentno istaknuta radi eventualnog ponavljanja testiranja rezultata od strane zainteresiranih istraživača (to je jedno od temeljnih pravila znanstvene metodologije).

g. Empirijski podaci i analiza – sadržavaju dokumentacijsku podlogu i rezultate empirijske analize. Potrebno je opisati i prikazati uzorak podataka korišten u analizi te prezentirati i objasniti statistička te ekonometrijska obilježja dobivenih rezultata uz tumačenje njihova ekonomskog sadržaja.

h. Rezultati i rasprava – autor objašnjava rezultate, osobito njihovo ekonomsko značenje i poruke. U ovom dijelu očekuje se argumentacija znanstvenog doprinosa, povezivanje rezultata rada s rezultatima te zaključcima dosadašnjih empirijskih istraživanja te preporuke za promjene javnih i drugih politika.

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