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**I. ARTICLES**

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# IS THERE "TOO MUCH FINANCE" IN CENTRAL AND EASTERN EUROPEAN COUNTRIES?[1]

In this paper, the parameters of the growth regression, including different variables measuring the degree of financial development for the Central and Eastern European countries are estimated. Next, the optimal values of specific variables measuring the level of financial development are calculated. The results of the empirical investigation indicate that countries with more stable financial markets and institutions and greater access to them grew faster in the period 2001-2015. The results reflecting the impact of the financial deepening on economic growth are more ambiguous. In the pre-crisis period, the relationship between the depth of financial institutions and economic growth turned out to be insignificant. After 2007, countries with moderate values (about 60%) of this coefficient recorded higher rates of growth in real GDP. A U-shaped relationship between the depth of financial markets and economic growth was identified. However the optimal level of development of stock markets was much higher in 2001-2007 than after the Lehman Brothers bankruptcy.

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## 1. INTRODUCTION

The last four decades have witnessed very rapid changes in economic processes. This was due to the revolution in financial industry, which was aimed at searching for efficient solutions in the field of financial systems. Therefore, governments are searching for optimal models of the development of their financial systems.

Due to the multidimensional nature of financial systems, analysis of their development should cover both financial institutions and financial markets as well as their dimensions, i.e. depth, access, efficiency, and stability. In order to

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overcome the shortcomings of using a single indicator as a proxy for financial development, a broader set of variables constituting the 4×2 matrix of financial development was considered (see: Cihak et al., 2013; Valickova et al., 2015).

Table 1

A matrix illustrating the multidimensional nature of financial systems

| | Financial institutions | Financial markets |
|---|---|---|
| Depth | X | X |
| Access | X | X |
| Efficiency | X | X |
| Stability | X | X |

Source: own study.

In research studies devoted to the evaluation of the development of financial systems across countries, attempts at creating a financial development index measuring different dimensions of the financial system were made (Sahay et al., 2015; Sethi, Acharya, 2018).

The development of a financial system is very often considered in the context of its impact on economic growth (Sethi, Sethy, 2019; Lee, Kim, 2018; Rapp, Udoieva, 2018). Most of the research devoted to the interlinkages between financial development and economic growth which were conducted in the previous century indicated that the relationship should be positive (see: King et al., 1993; Levine et al., 1998; Beck et al., 2000). The problems of the nonlinear relationship between the development of the financial system and economic growth strengthened after the outbreak of the global financial and economic crisis (see: Beck et al., 2014; Arcand et al., 2015; Próchniak et al., 2017; Panizza, 2018). A hump-shaped relationship between financial deepening and economic growth was found among others by Lee et al., 2013; Panizza, 2018; Ibrahim, Alagiede, 2018.

Although there have been many studies devoted to the impact of the financial system development on economic growth as well as the nonlinearity in this relation, and there are many empirical investigations devoted to the drivers of economic growth in Central and Eastern Europe (CEE) (see: Matkowski et al., 2007; Vojinovic et al., 2008; Próchniak et al., 2013; Gradzewicz et al., 2018), there are not many papers devoted to the impact of the financial development on economic growth for this region. This study contributes to the existing literature by comparing the relationship between financial development and economic growth for the group of 11 EU CEE countries in the pre-crisis and crisis period, trying to evaluate the impact of different dimensions of financial development and financial stability on economic growth in Central and Eastern Europe. Moreover, the authors test

the "too much finance" hypothesis for this region, and calculate the optimal (for optimizing economic growth) level of variables reflecting financial development in the analyzed group of countries, which – to the best knowledge of the authors – has not been done before. The results of this research study should help in understanding the finance-growth nexus in main economies of Central and Eastern Europe in different phases of the business cycle.

This paper has the following structure. The next section (Section 2) presents a review of the literature. In Section 3a specification of the econometric model is provided and the methodology presented. Section 4 consists in the results of the estimation of the parameters of the growth regression and testing of the "too much finance" hypothesis. The conclusions are presented in Section 5.

## 2. LITERATURE REVIEW

In a market economy, the financial system is the mechanism of the flow of purchasing power among economic operators. It consists in financial institutions, markets, instruments and the principles on which they operate. Financial systems play an important role in modern market economies and their development determines the economic development of countries.

As a result of the continuous development of financial systems in the world economy, an evolution of the traditional paradigm has been noted and the concept of an 'emerging paradigm' established. According to this concept, financial institutions (banks, insurance companies, investment funds) manage household funds. These institutions operate in the markets of debt and equity instruments, and the sector of enterprises and households is the final receiver of capital. Research devoted to the impact of the development of the banking system on long-term growth rate was initiated by Bagehot (1873) and Schumpeter (1911), who formulated the hypothesis that the services provided by the financial sector are very important elements of economic growth. Thanks to these services, savings from investments generating low income are reallocated to sectors with a higher rate of return.

Financial development affects economic growth through the capital accumulation and improvement of the productivity of production factors. As a result, the information and the transaction costs are lower and therefore resources are better allocated amid market uncertainty (see: Levine et al., 1998). An efficient banking system and effective financial markets positively affect the wealth of society, since the flow of financial means as well as their accessibility are greater. Although historically, economists have concentrated on the positive impact of the banking system development on economic growth, there also exists a very extensive literature devoted to the positive relationship between the development of stock markets and long-term economic growth.

Levine (1991) and Bencivenga et al. (1995) presented models where more liquid stock markets reduced the disincentives to invest in projects of a longer duration since investors could easily sell their stakes in the project when they needed their savings before the project matured. Obstfeld (1994) showed that greater international risk-sharing induced a portfolio shift from safe (and low-return) investments to high-return investments, thereby accelerating growth in productivity. A positive relationship between stock market liquidity and economic growth was found empirically by, among others, Levine et al. (1998) and Sahay et. al. (2015). A positive effect of the opening of a stock exchange on economic growth was found by Baier et al. (2004).

In general there is agreement in the literature that financial development affects economic growth (cf. King et al., 1993; Levine et al., 1998; Beck et al., 2000; Rioja et al., 2004; Beck et al., 2004; Próchniak et al., 2017). In line with the 'supply-leading' view, the presence of financial middlemen positively affects the effectiveness of capital accumulation and results in a greater sa-vings rate (Goldsmith, 1969; Shaw, 1973; Bencivenga et al., 1991; Greenwood et al., 1990). On the other hand, the 'demand-following' view is popular in the literature as well. According to the 'demand-following' view, enterprises are encouraged to create additional demand and financial institutions are forced to develop more advanced services (see: Friedman et al., 1963; Ireland, 1994). Bi-directional causality between economic growth and financial development was found by, among others,(Shan, et. al., 2001). However, some economists argued that there is no link between financial development and economic growth. Robinson (1952) thought that banks react passively to economic growth. A similar conclusion was reached by Solow (1956), who said that long-term growth rate resulted from technological progress. According to Lucas (1988), economists overestimate the role of the financial system in economic growth. Similar sceptical opinions about the relationship between financial development and economic growth were formulated by, among others, Stiglitz (2000) and Rodrik et al. (2009).

After the substantial increase of the financial systems in the industrialized countries, researchers started to wonder whether too large a level of development of the financial systems could hamper economic growth. Aghion et. al. (2005) and Fung (2009) argued that in poorer countries financial development helps in catching-up, while the positive effects from financial depth are limited in the case of richer economies. Conclusions from the studies that have been conducted since the outbreak of the global financial crisis indicate that financial development positively affects economic growth if the level of financial development is lower than the critical value. Above this value, an increase of the banking credit to GDP ratio negatively affects growth (e.g. Arcand et al., 2015; Cecchetti et al., 2012, 2015; Beck et al., 2014; Rousseau et al., 2011). According to the conclusions of Cournede et al. (2015), if the ratio of bank credit to GDP exceeds 100%, it has a negative impact on

economic growth. Cournede et al. (2015) mentioned the following factors of the "too dynamic" growth of financial intermediation in the economy, namely excessive deregulation of markets; relatively large percentage of credit from the banking sector in the value of all credits; larger debt guarantees by the public authorities; lower quality of credit; a relatively large ratio of loans for households compared to loans for enterprises. Philippon et al. (2010, 2012) argued that a large increase in the relationship between the average wage in the financial sector and the average wage in the economy results in the vanishing effect of finance on growth. Law et al. (2014) as well as Cecchetti et al. (2012) identified a hump-shaped relationship between financial deepening and growth. Alessi et al. (2014) showed that if the credit-to-GDP ratio exceeds 92%, then the danger of an impending financial crisis is serious.

The problem of the finance-growth nexus has not been extensively explored in transition countries. In line with the results of the study by Dawson (2003), there was no significant and positive relationship between financial development and growth in Central and Eastern Europe. According to the results of the research by Akimov et al. (2009), a positive impact of financial development on growth was found. However, weak linkages might have resulted from the low level of development of the financial system in the countries under consideration. According to the conclusions obtained by Bonin et al. (2003), in the last decade of the 20$^{th}$-century, well-functioning intermediaries significantly affected economic growth. It was noted by Atkins (2006) that in the CEE countries, banks played the most important role in promoting economic growth. Therefore, the development of the banking sector seemed to be crucial for financing investments. However, the percentage of bad loans in portfolios of commercial banks was larger compared to commercial banks in the developed countries. The results obtained by Marcinkowska et al. (2014) indicate that increasing liquidity and capital requirements may negatively affect economic growth due to limiting the supply of credit. Summing up, the CEE countries need a diversified system of financial services for further development. Moreover, the improvement of the environment for financial intermediaries and strengthening of the supervision over the financial market are strongly recommended. However, generalizations for the whole set of the CEE countries are difficult due to the large differences between the economies.

## 3. SPECIFICATION OF THE ECONOMETRIC MODEL. METHODOLOGY

Since this paper is aimed at evaluating the impact of financial development on economic growth, the variables measuring the level of financial development should be shortly described. Due to the multidimensional nature of financial

Table 2

Variables measuring the degree of financial development and stability considered in the econometric model

| Variable and unit | Name | Markets/ institutions | Dimension | Expected impact. Reference to the literature. |
|---|---|---|---|---|
| Domestic credit provided by the financial sector to the private sector (% of GDP) | *DC* | institutions | depth | The use of the domestic credit to GDP ratio is justified by the fact that a financial system lending to private firms is more likely to stimulate growth through evaluation of their risk (see: Arcand et. al., 2015). However, the results obtained by Cournede et al. (2015) indicate that this variable may have a negative impact on economic growth after it exceeds a certain level. They mentioned the following factors of the "too dynamic" growth of financial intermediation in the economy: excessive deregulation of markets; relatively large percentage of credit from the banking sector in the value of all credits; larger debt guarantees by the public authorities; lower quality of credit; a relatively large ratio of loans for households compared to loans for enterprises. |
| Stock market total value traded (% of GDP) | *SMTVT* | markets | depth | According to Bencivenga et al. (1995), there is strong evidence about the contribution of stock market liquidity in boosting economic growth, through improving a firm's information acquisition and corporate governance. This relation for stock markets in the Central and Eastern Europe was confirmed among others by Carp (2012). However, the results obtained by Pan and Mishra (2018) indicate that negative relationship between the depth of a stock market and growth may be a proof of the so-called existence of irrational prosperity in the stock market and the economic bubble in a financial sector. |
| Stock market turnover ratio ((stocks traded/ capitalization)*100%) | *SMTR* | markets | efficiency | According to the theoretical framework, efficient financial markets in the financial system can have a positive impact on capital accumulation by extending credit facilities to invest in projects positively affecting economic growth Qamruzzman and Wei (2018). The positive relation between the stock market efficiency and economic growth was found among others by Seven and Hakan (2016). |
| Stock return (%) | *SR* | markets | efficiency | |
| Bank return on equity | *ROE* | institutions | efficiency | Bank profitability might affect economic growth through two channels: financial stability and bank competition Klein and Weill (2018). Financial stability might enhance growth because profitable banks can retain earnings, offer higher returns to shareholders and raise capital in the markets (Flannery and Rangan, 2008). On the other hand, high competition alleviates credit constraints (Love and Peria, 2015; Ryan et al., 2014). |

| | | | | |
|---|---|---|---|---|
| Stock market volatility | *VOL* | markets | stability | There is much ambiguity concerning the relation between stock market volatility and economic growth. On one hand, there is a view that volatility of a stock market is positively and significantly correlated with economic growth (Levine and Zervos, 1998). However, some analysts claim that stock market volatility has a negative effect on the economy (Adjasi and Biekpe, 2006). |
| Bank Z-score | *Z* | institutions | stability | The Z-score is a measure of the stability of financial institutions. This measure has a clear relationship to the probability of insolvency of a financial institution (Beck et al., 2006; Laeven et al., 2009; Cihak et al., 2010). A higher value of this measure implies a lower probability of insolvency. The bank nonperforming loans to total gross loans ratio, as well as bank capital to assets ratio, are used by the International Monetary Fund as financial soundness indicators and provide insight into the financial health of a country's financial institutions. The positive relation between the stability of the banking sector and economic growth was found among others by Jokipii and Monnin (2013) and Jayakumar et al. (2018). |
| Bank nonperforming loans to total gross loans (%) | *BNPL* | institutions | stability | |
| Bank capital to assets ratio (%) | *BCTAR* | institutions | stability | |
| Loans requiring collateral (%)* | *LOANS_ COLL* | institutions | access | Access to financial services is one of the most important keys to alleviating poverty and achieving sustainable economic growth in post-transition countries. By increasing access to financial services, the financial sector can play an important role in stimulating economic development (Sethi and Acharya, 2018). |

* Gaps in the data were filled in using the method of linear interpolation.

Source: The Global Financial Development Database.

Table 3

Correlation coefficients among variables measuring different dimensions of financial development and stability

| | *DC* | *SMTVT* | *SMTR* | *ROE* | *SR* | *VOL* | *Z* | *BNPL* | *BCTAR* | *LOANS_COLL* |
|---|---|---|---|---|---|---|---|---|---|---|
| *DC* | 1 | -0.04 | -0.23** | -0.21** | 0.08 | -0.03 | -0.30*** | 0.05 | 0.14 | -0.36*** |
| *SMTVT* | -0.04 | 1 | 0.68*** | 0.70*** | -0.05 | 0.21** | 0.09 | -0.25*** | -0.42*** | -0.00 |
| *SMTR* | -0.23** | 0.68*** | 1 | 0.98*** | 0.03 | 0.23** | -0.00 | 0.10 | -0.16* | 0.05 |
| *ROE* | -0.21** | 0.70*** | 0.98*** | 1 | 0.25*** | 0.23** | 0.28*** | -0.10 | -0.38*** | 0.17* |
| *SR* | 0.08 | -0.05 | 0.03 | 0.25*** | 1 | -0.21** | -0.02 | -0.22** | -0.00 | 0.29*** |
| *VOL* | -0.03 | 0.21** | 0.23** | 0.23** | -0.21** | 1 | -0.08 | 0.05 | 0.01 | 0.00 |
| *Z* | -0.30*** | 0.09 | -0.00 | 0.28*** | -0.02 | -0.08 | 1 | -0.25*** | 0.19** | -0.00 |
| *BNPL* | 0.05 | -0.25*** | 0.10 | -0.10 | -0.22** | 0.05 | -0.25*** | 1 | 0.09 | -0.08 |
| *BCTAR* | 0.14 | -0.42*** | -0.16* | -0.38*** | -0.00 | 0.01 | 0.19** | 0.09 | 1 | 0.21** |
| *LOANS_ COLL* | -0.36*** | -0.00 | 0.05 | 0.17* | 0.29*** | 0.00 | -0.00 | -0.08 | 0.21** | 1 |

Note: *,**,*** denote significance at 0.1, 0.05 and 0.01 level of significance respectively.

Source: own study.

systems, analysis of their development should cover both financial institutions and financial markets as well as their different dimensions: depth, access, efficiency, and stability. Therefore in the group of determinants associated with the level of financial development different categories measuring the degree of the financial development and stability of financial markets and institutions should be taken into account. Arcand et al. (2015) considered the domestic credit to GDP ratio as an explanatory variable in order to verify whether there is non-linearity in the relationship between financial development and economic growth. On the other hand Próchniak et al. (2017) considered regression models with specific variables measuring the degree of financial development separately. In contrast to those papers, the authors consider the regression model with variables measuring different dimensions of development and stability, and using this approach were able to evaluate the impact of different aspects of financial development on economic growth. Table 2 presents the list of potential determinants. The names and definitions of the variables as well as information about the measured dimension are provided, and an explanation for using each variable in the specification with reference to literature is provided.

Calculating the optimal values of consecutive variables separately on the basis of first order conditions is appropriate when the correlations among them are low. Therefore the correlation matrix should be analysed[2]. Table 3 presents values of the correlation coefficients as well as the results of testing their significance.

The results from Table 3 indicate that the correlation between the variables measuring the depth of financial markets and institutions is very low and insignificant. This means that when these two variables are included in the regression model in level and squared values, first-order conditions may be used in order to calculate optimal levels of *DC* and *SMTVT*. In some cases, the correlations between explanatory variables are very large (for example the stock market total value traded is strongly correlated with the stock market turnover ratio and bank return on equity),which means that the variables *SMTR* and *ROE* provide almost the same information as variable *SMTVT*. Since the authors are especially interested in checking whether the impact of the stock market total value traded to GDP ratio on economic growth is linear, variables *SMTR* and *ROE* are not included in the final specification. The choice of variables in the final specification results from the analysis of the correlation matrix. The authors selected variables in order to avoid correlation coefficients exceeding 0.3 in absolute value, and finally considered the following regression model.

[2] As Maddala and Wu (1999) argue, panel unit root tests have very low power in the case of a very low (about 15) number of periods. Therefore the order of integration is not tested.

$$\begin{aligned} Growth_{it} = \; & \alpha_0 + \alpha_1 log\left(GDP_{it-1}\right) + \alpha_2 Growth_{it-1} + \alpha_3 DC_{it} + \alpha_3^* DC_{it}^2 + \ldots \\ & + \alpha_4 SMTVT_{it} + \alpha_4^* SMTVT_{it}^2 + \alpha_5 Z_{it} + \alpha_6 VOL_{it} + \alpha_7 SR_{it} + \ldots \\ & + \alpha_8 BNPL_{it} + \alpha_9 LOANS\_COLL_{it} + \beta_3 DC_{it} CR_{it} + \beta_3^* DC_{it}^2 CR_{it} + \ldots \\ & + \beta_4^* SMTVT_{it}^2 CR_{it} + \beta_5 Z_{it} CR_{it} + \beta_6 VOL_{it} CR_{it} + \beta_7 SR_{it} CR_{it} + \ldots \\ & + \beta_8 BNPL_{it} CR_{it} + \beta_9 LOANS\_COLL_{it} CR_{it} + \boldsymbol{x}_{it}\boldsymbol{\gamma} + \boldsymbol{x}_{it}\boldsymbol{\lambda} CR_{it} + \varepsilon_{it}, \end{aligned} \tag{1}$$

where $Growth_{it} = 100\left(log\left(GDP_{it}\right) - log\left(GDP_{it-1}\right)\right)$ and $GDP_{it}$ is the level of Gross Domestic Product per capita in local currency in constant prices (2015=1). $CR_{it}$ takes a value of 1 from 2008, consecutive variables are defined in Table 2, $\boldsymbol{x}_{it}$ is a vector of explanatory variables not measuring the degree of the financial development and stability. The inclusion of these variables is due to the fact that there are many factors influencing economic growth which are not associated with the degree of financial development. The choice of the economic growth determinants is based on the definition of GDP, the Cobb-Douglas production function, analysis of empirical literature devoted to economic growth models (see, among others: Baumol, 1986; Barro, 1991; Barro et al., 2003; Islam, 1995; Ciccone et al., 2008; Lee et al., 2013), and the problem of convergence in the CEECs (cf.: Kutan et al., 2004; Matkowski et al., 2007; Dogan et al., 2007; Vojinovic et al., 2008, Nannicini et al., 2011; Próchniak et al., 2013; Gradzewicz et al. 2018). Table 4 presents the list of variables that are considered in vector $\mathbf{x}_{it}$.

Table 4

Definitions of other explanatory variables used in the econometric model

| Variable | Definition |
|---|---|
| *EA_Growth* | The annual rate of growth of real GDP per capita in the 11 countries of the Euro Area which joined the EMU before 2006 (%) |
| *Capital_change* | The annual rate of growth of the level of capital (%) |
| *CG* | Final consumption expenditure (% of GDP) |
| *R&D_change* | The annual rate of growth of the level of the Research and Development expenditures (%) |
| *Labour_change* | The annual rate of growth of the labour force (%) |
| *Trade_openness* | The ratio of the value of Import + Export to GDP (%) |
| *Savings_change* | The annual rate of growth of the level of savings (%) |
| *Export_change* | The net annual rate of growth of the export (%) |
| *FDI* | Difference between FDI inflow and FDI outflow in relation to GDP (%) |
| *Life_expectancy* | Life expectancy at birth (years) |
| *Patents_change* | The annual rate of growth of patent applications (%) |
| *POP15_64* | Population aged 15-64 (% of total) |

Source: own study.

Variable $log\left(GDP_{it-1}\right)$ is included in order to check whether β-convergence occurs. Including $CR_{it}$ in the regression model is due to the fact that variables measuring the degree of financial development may have a different impact on economic growth in the pre-crisis period and after 2008. However, a structural break should be included if the following hypothesis is rejected:

$$H_0 : \beta_3 = \beta_4 = \ldots = \beta_9 = 0 \wedge \lambda = 0 , \tag{2}$$

$$H_1 : \sim H_0 .$$

The choice of levels and squares of variables *DC* and *SMTVT* is due to the fact that the derivation of the first order conditions and optimal level is very easy when they have such forms. Such specification enables testing the "too much finance" hypothesis. In order to check whether the relationship between variables *DC*, *SMTVT* and the rate of growth of real GDP take the shape of an inverted U-curve, the following hypotheses were tested for the pre-crisis period:

$$H_0 : \alpha_3 = \alpha_3^* = 0 , \tag{3}$$

$$H_1 : \alpha_3 > 0, \ \alpha_3^* < 0$$

and

$$H_0 : \alpha_4 = \alpha_4^* = 0 , \tag{4}$$

$$H_1 : \alpha_4 > 0, \ \alpha_4^* < 0 .$$

In the case of the second sub-period[3] the following hypotheses were tested in order to check whether the relationship between variables *DC*, *SMTVT* and the rate of growth of real GDP take the shape of an inverted U-curve:

$$H_0 : \alpha_3 + \beta_3 = \alpha_3^* + \beta_3^* = 0 , \tag{5}$$

$$H_1 : \alpha_3 + \beta_3 > 0, \ \alpha_3^* + \beta_3^* < 0$$

and

$$H_0 : \alpha_4 + \beta_4 = \alpha_4^* + \beta_4^* = 0 , \tag{6}$$

$$H_1 : \alpha_4 + \beta_4 > 0, \ \alpha_4^* + \beta_4^* < 0 .$$

Optimal values of consecutive variables are found on the basis of the first order conditions. After the estimation of the parameters of the regression model, they are calculated on the basis of the following formulas:

[3] Availability of data for the post-crisis period is limited. Moreover this period is very short. Therefore the authors distinguish the pre-crisis sub-period 2001-2007 and sub-period 2008-2015, encompassing crisis and years after the crisis.

$$OPT^{DC} = -\frac{\hat{\alpha}_3}{2\hat{\alpha}_3^*} \tag{7}$$

and

$$OPT^{SMTVT} = -\frac{\hat{\alpha}_4}{2\hat{\alpha}_4^*} \tag{8}$$

for the first sub-period and on the basis of formulas:

$$OPT^{DC} = -\frac{\hat{\alpha}_3 + \hat{\beta}_3}{2\left(\hat{\alpha}_3^* + \hat{\beta}_3^*\right)} \tag{9}$$

and

$$OPT^{SMTVT} = -\frac{\hat{\alpha}_4 + \hat{\beta}_4}{2\left(\hat{\alpha}_4^* + \hat{\beta}_4^*\right)} \tag{10}$$

for the second sub-period.

The Generalized Methods of Moments (GMM) estimation has become very popular in the empirical growth literature. In particular, the first-difference GMM estimator proposed by Arellano and Bond (1991) as well as the systemic GMM estimator (Blundell, Bond, 1998) has gained much attention in the empirical growth literature (cf. Dalgaard et al., 2004; Cohen and Soto, 2007; Aghion et al. 2009). The availability of data and the need to evaluate the impact of the degree of financial development and stability on economic growth for the countries of the Central and Eastern Europe have prompted the estimation of the parameters for the low number of periods and low number of units. Unfortunately, in the case of a small number of periods and units, the problem of bias in dynamic panel data models occurs (cf. Kiviet, 1995; Soto, 2009; Flannery and Hankins, 2013). Although the systemic GMM estimator (Blundell, Bond, 1998) outperforms other types of dynamic panel estimators in short panels with small numbers of units (see: Soto, 2009; Flannery and Hankins, 2013), the problem cannot be ignored. Therefore on the basis of the proposal by Zhou et al. (2014), linear bias correction is applied after using systemic GMM estimator.

## 4. RESULTS AND DISCUSSION

In the first step the parameters of model (1) were estimated without interactive terms in order to choose significant variables. Next the interactive terms were added and hypothesis (2) was tested. The results of testing indicated

that the parameters should be estimated assuming structural change. Then, hypotheses (3) to (6) were tested. Table 5 presents the results of the testing of hypotheses (2) to (6).

Table 5

Results of testing hypotheses (2)-(6)

| Hypothesis | Wald statistic | p-value |
|---|---|---|
| (2) | 13.79 | 0.000 |
| (3) | 1.13 | 0.566 |
| (4) | 21.17 | 0.000 |
| (5) | 30.82 | 0.000 |
| (6) | 28.75 | 0.000 |

Source: own study.

Table 6 presents the results of the estimation of the parameters of the dynamic panel model[4], the optimal levels of financial depth variables as well as the results of testing of the autocorrelation of order 2 and the validity of over-identifying restrictions. In the case of insignificant interactive and insignificant level variables, the authors did not include them in the final specification.

Hypothesis (3) was not rejected, which means that there was not any relationship between the domestic credit provided by the financial sector to the private sector to GDP ratio and economic growth. The findings indicating the weak role of the financial intermediaries in promoting economic growth in Central and Eastern Europe in 2001-2007 are in line with the results obtained among others by Dudian and Popa (2013) as well as Petkovski et al. (2014). However these authors obtained a significantly negative estimate of the parameter for variable measuring domestic credit to GDP ratio. The difference in estimates may be due to different periods of analysis. Dudian and Popa (2013) used data from 1996, while Petkovski et al. (2014) started their analysis from 1991. In the 1990s the efficiency of financial institutions in Central and Eastern Europe was very low (Atkins, 2006). The percentage of bad loans in these countries was much larger in comparison with developed economies. A slight increase of efficiency of financial institutions in the analysed group of countries changed the relationship between financial deepening and economic growth. This result also confirms the findings obtained by Cojocaru et al.

[4] Variables included in Tables 1 and 3 and not included in Table 4, turned out to be statistically insignificant.

Table 6

Results of the estimation of the parameters of the dynamic panel model using the systemic GMM estimator with linear bias correction

| Variable | Estimate | Standard deviation | p-value |
|---|---|---|---|
| $Growth_{it-1}$ | 0.094 | 0.032 | 0.003 |
| $log(GDP_{it-1})$ | -0.104 | 0.022 | 0.000 |
| *EA_Growth* | -0.265 | 0.220 | 0.228 |
| *EA_Growth*CR* | 0.845 | 0.224 | 0.000 |
| *Capital_change* | 0.109 | 0.012 | 0.000 |
| *RD_change* | 0.036 | 0.010 | 0.000 |
| *Trade_openness* | 0.056 | 0.013 | 0.000 |
| *CG* | -0.013 | 0.006 | 0.050 |
| *DC* | 0.022 | 0.039 | 0.565 |
| $DC^2$ | 0.003 | 0.009 | 0.732 |
| $DC^2$*CR | -0.020 | 0.002 | 0.000 |
| *SMTVT* | 0.0015 | 0.0009 | 0.091 |
| *SMTVT*CR* | -0.0008 | 0.0004 | 0.048 |
| $SMTVT^2$ | -0.0001 | 0.0000 | 0.037 |
| *BNPL* | -0.0008 | 0.0004 | 0.032 |
| *LOANS_COLL* | -0.0004 | 0.0002 | 0.085 |
| *VOL* | -0.0015 | 0.0003 | 0.000 |
| $OPT^{DC}$ for the crisis and post-crisis period | 62.37% | | |
| $OPT^{SMTVT}$ for pre-crisis period | 7.95% | | |
| $OPT^{SMTVT}$ for the crisis and post-crisis period | 3.53% | | |
| Arellano-Bond test for autocorrelation of order 2 | Statistic = 1.02<br>p-value = 0.31 | | |
| Sargan test of over-identifying restrictions | Statistic = 97.81<br>p-value = 0.23 | | |

Source: own study.

(2016), who found that in CEE countries, financial market efficiency and competitiveness were more important than market size in terms of promoting economic growth.

The relationship between the depth of financial institutions and economic growth changed significantly in the crisis and post-crisis period. Hypothesis

(5) was rejected, which means that the analysed relationship turned out to be nonlinear. Financial deepening had a positive impact on economic growth when the domestic credit provided to the private sector to GDP ratio was below the optimal level. Above this level (62.3%), further financial deepening had a negative impact on economic growth. The "too much finance" hypothesis, which was earlier considered for developed countries, turned out to be also valid in the countries of Central and Eastern Europe. However the optimal level of the domestic credit to GDP ratio appeared to differ from the level obtained in the case of OECD countries. This result is not surprising since financial institutions in the countries of Central and Eastern Europe are less developed and less efficient than their counterparts in developed economies. Higher interest rates in these countries led to greater problems of enterprises with repayment of loans. Therefore financial deepening and an increase in financial depth in the analysed group of countries positively affects economic growth if it does not exceed a certain level. The structural change of the relationship between depth of financial institutions and economic growth reflects the increase of efficiency of financial intermediaries in the analysed region. These results support the view of Arcand et al. (2015) and Creel et al. (2015) that the effect of financial deepening on economic growth depends on the level of financial development. There are a few explanations for the "too much finance" phenomenon. Firstly, information asymmetries and deregulation encouraged banks to take more risks in the period 2008-2014. Financial deepening, combined with taking more risks resulted in excessive lending and reinforced bubbles, giving rise to financial fragility (Creel, 2015). Moreover, Phillipon et al. (2010) argued that the faster growth of the financial system (compared to the real economy) resulted in attracting more young talent by the financial sector than the non-financial one, which resulted in slower productivity growth.

The different impact of variable *DC* in both sub-periods provides for interesting interpretations concerning the impact of the global financial crisis on the optimal level of the domestic credit to GDP ratio. When the global financial crisis hit, the relationship between financial development and economic growth changed significantly. These results are in line with the findings of Próchniak et al. (2017), who found that the inclusion of the post-crisis period provided new insights with respect to the relationship between financial development and economic growth. One explanation for this phenomenon may be the fact that very rapid credit growth is one of the most important factors in banking crises (see e.g. Kaminsky et al., 1999; Cihak et al., 2013). According to the IMF (2004) calculations, about 75% of credit

booms in emerging markets led to banking crises. According to the Global Financial Development Database, Latvia and Slovenia suffered from banking crises in 2008-2011. The occurrence of banking crises in these countries might be due to very fast credit growth in the period preceding the global financial crisis. Problems in the banking sector in these countries resulted in an economic downturn. A second explanation may be associated with the fact that financial system disparities subsided during the crisis, since financial sectors in low and medium-income countries were relatively more isolated from the global turmoil and as a result were less affected by the global liquidity shocks. For example, the lower level of integration of the Polish financial markets with the financial markets in developed countries (in contrast, for example, to Hungary) resulted in a lower sensitivity to external shocks during the global financial crisis (see: Bieńkowski et al., 2014). Overall, the rate of growth of real GDP in countries having a high domestic credit to GDP ratio (Estonia, Latvia, Hungary) was negative in 2008-2010, while a positive rate of growth of real GDP was recorded in such countries as Poland, Slovakia, and Romania, where the ratio of domestic credit provided to the private sector to GDP was close to 50%. These results provide an additional explanation for the positive rate of growth of real GDP in Poland during the entire crisis period, and are consistent with the results obtained by Sahay et al. (2015), who found that the level of financial development for Poland was optimal for economic growth and volatility of growth.

Hypotheses (4) and (6) were rejected. The significantly positive estimate for variable *SMTVT* and the significantly negative estimate of the parameter for variable $SMTVT^2$ indicate that the U-shaped relationship between the depth of financial markets and economic growth is valid. The optimal stock market total value traded equalled about 8% of GDP in 2001-2007. This result may be explained by phenomena observed in stock markets in the countries of Central and Eastern Europe in 2001-2007. In particular, a higher (than optimal) level of the *SMTVT* variable was observed in the case of Poland, the Czech Republic and Hungary. At the beginning of this century, the stock markets in these countries were relatively poorly integrated with their counterparts in developed economies. International investors included assets from post-transition economies in order to reduce the investment risk (Gilmore et al. 2005; Bieńkowski et al. 2014). As the results of the research conducted by Sanpado (2008) indicate, shortly after accession to the European Union the stock markets in Hungary, Poland and the Czech Republic showed an increasing number of cross-listings in international financial centres. Moreover, market activity was largely driven by foreign investors. As a result, expanding stock

markets in the analysed countries did not promote economic growth. In particular, Poland recorded low rates of economic growth and substantial rates of return on WIG in 2002-2005. The inverted U-shaped relationship between the depth of financial markets and economic growth was also valid after 2007. However, the optimal level of stock market total value traded to GDP decreased significantly. The new optimal level equalled 3.5%. Due to the global financial crisis, investors withdrew their assets especially from emerging stock markets. In general, countries with a higher level of development of stock markets recorded a lower growth rate. After 2012 the stock market total value traded to GDP decreased significantly and the recession ended. It should be stressed that these findings differ slightly from the results obtained by Bongini et al. (2017), who indicated a positive relationship between the depth of financial markets and economic growth for countries of Central and Eastern Europe. However, in the cited research study, non-linearity was not tested and the studied sample started from 1997. After excluding variable $SMTVT^2$, the depth of financial markets turned out to have a positive and significant impact on economic growth. These results are available upon request.

The *BNPL* variable turned out to have a significant impact on economic growth in the countries of Central and Eastern Europe. The higher level of bank nonperforming loans to total gross loans resulted in slower economic growth. This result is in line with expectations since financial institutions with a lower level of non-performing loans are more healthy. Especially during the recession period, when the risk of bankruptcies is larger, the higher level of performing loans makes financial institutions safer. These findings are in line with the results of other studies devoted to the impact of non-performing loans (NPLs) on the performance of the economy indicating that reducing the burden of NPLs has an unambiguously positive effect (Balgova et al. 2016). As Byrne and Kelly (2017) show, the level of quality of bank assets positively affects monetary policy pass-through.

Stock market volatility turned out to have a negative impact on the rate of growth of real GDP, which means that the stability of financial markets in Central and Eastern Europe is crucial for sustaining growth in the analysed region. This result means that governments of these countries should take care of the situation in public finances, the stability of the exchange rate and maintain a positive evaluation from investors in order to avoid rating downgrades and reduce uncertainty in stock markets. Although the level of stock market volatility in a specific country strongly depends on global and regional factors, the results of research indicate that economic environment and government policy also play a major role (Sainy, 2016).

The *LOANS_COLL* variable turned out to have a significant and negative impact on economic growth. This means that in the case of worse access to the credit provided by financial institutions, conditions for economic growth are worse. Better functioning financial systems allocate capital based more on the expected quality of the project and less on the entrepreneur's accumulated wealth and social connections. Better functioning financial institutions should overcome market frictions and be more efficient in identifying and funding the most promising firms. The authors' results confirm that better access to financial services is one of the most important drivers of economic growth in post-transition countries. Moreover, these findings are in line with the results obtained for other emerging and developing economies indicating that access is more important than depth in promoting economic growth (see: Cojocaru et al., 2016; Sethi, Acharya, 2018).

The impact of variables not reflecting the level of financial development turned out to be in line with expectations. The results of the estimation of the parameters indicate that there was strong convergence within the group of the CEECs in the period 2001-2015. This is in line with expectations, since the relatively rich (in 2001) economies of the CEE-11 group (Hungary, the Czech Republic, Slovenia) slowed down in recent years, especially during the crisis period, while poorer (in 2001) countries like Poland and Romania noted relatively high rates of growth of real GDP, especially after 2007. The significant and positive impact of variable *EA_Growth* is justified by the very strong links between the CEECs and the euro area. However, the impact of this variable differed significantly in both sub-periods. This result is in line with expectations since the participation of these countries in the European Union and the fact that five of these 11 countries joined the EMU increased the dependence of their business cycles on the business cycle of the 'old members' of the euro area. Moreover, the outbreak of the global financial crisis resulted in an increase in the synchronization of business cycles.

Estimates of the parameters for variables *Capital_change* and *RD_change* are in line with the augmented Cobb-Douglas production function. The increase in capital stock, as well as technological progress, were important drivers of growth in the countries of Central and Eastern Europe. The negative estimate of the parameter for variable *CG* indicates that savings and investments were important factors of economic growth of the CEECs in the period 2001-2015. Foreign trade turned out to be an important driver of growth in the CEECs as well. Countries recording higher ratios of trade to GDP developed faster in the analysed period. These results are in line with Nannicini et al. (2011), who found that trade openness was important for growth in the case of economies in transition.

## CONCLUSION

This study analysed the impact of different dimensions of financial development on economic growth in the countries of Central and Eastern Europe using yearly data covering the period 2001-2015. The systemic GMM estimator with the linear bias correction was applied. Moreover, the "too much finance" hypothesis was tested and the optimal level of depth of financial markets and institutions were calculated for both sub-periods (2001-2007 and 2008-2015).

The obtained results indicate that an improvement in access to financial institutions as well as an increase of their stability could help countries of Central and Eastern Europe sustain a higher level of development of their financial systems while mitigating the financial stability risks. Countries with a lower ratio of nonperforming loans to total gross loans recorded higher rates of growth of real GDP. These results have very important implications for prudent policies in the countries of Central and Eastern Europe. Increasing capital and liquidity requirements would lead to a higher level of stability of the financial system, which should positively affect economic growth, especially in times of crisis. Moreover, countries with a lower level of volatility of stock returns grew faster. This means that governments of these countries should take care of the respective public finances, and the stability of the exchange rate, whilst maintaining a positive evaluation from investors in order to avoid rating downgrades and reduce uncertainty in stock markets.

The results of the testing of the "too much finance" hypothesis are ambiguous. In the pre-crisis period, the depth of financial institutions did not affect economic growth. Following the collapse of Lehman Brothers, the optimal ratio of domestic credit provided to the private sector to GDP dropped markedly. The optimal level was about 62%, and countries having values close to this coefficient (Poland, Slovakia, Romania) grew faster than countries with much higher levels of financial deepening (Latvia, Estonia). The lower level of efficiency of financial institutions in post-transition economies (compared to developed countries) resulted in a weaker relation between the deepening of financial structure and growth at the beginning of this century, and the lower optimal level of the domestic credit to GDP ratio after the Lehmann Brothers bankruptcy.

In the case of the stock market total value traded to GDP ratio, the U-shaped relationship between this variable and economic growth turned out to be valid for both sub-periods. In 2001-2007 the optimal stock market total value traded amounted to about 8% of GDP. In most of the analysed countries, there was

space for the deepening of the stock markets. The percentage of financing with capital coming from the stock exchange was very low in many Central and Eastern European countries. After the Lehman Brothers bankruptcy, a significant decrease of the optimal level of stock market total value traded was observed. Since investors withdrew especially from stock markets in emerging and post-transition economies during the subprime crisis as well as the euro area sovereign debt crisis, too deep stock markets hampered economic growth in Central and Eastern Europe.

Monitoring the further evolution of the optimal values of the variables *DC* and *SMTVT* could be interesting. It would also be reasonable to answer the question of whether the change of the optimal ratios was permanent or temporary. This will be possible when more observations for the post-crisis period are available. Since the most intensive turbulences in the financial markets in the euro area lasted until 2012, there are not many observations for the post-crisis period. In the next research study, when more observations for the post-crisis period are available, the parameters of the model with a dummy variable for the post-crisis period will be estimated.

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