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MULTIFACETED FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH: BOOTSTRAP PANEL CAUSALITY APPROACH

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Abstract

Financial development and economic growth have been extensively studied theoretically and empirically. However, for Central Europe and Baltic countries, the existing empirical evidence is scarce. This paper revisits whether financial development stimulates economic growth in the context of eleven Central Europe and Baltic countries during the 2000-2019 period. By incorporating broad characteristics of financial institutions and financial markets into the finance-growth nexus, this paper not only points out the potential importance of financial depth for economic growth but also tests the hypothesis that financial access, efficiency, and stability promote economic growth or vice versa. This paper applies a panel bootstrap approach to Granger causality testing. The effect of financial depth and financial stability on economic growth is more pronounced than financial access and financial efficiency in the context of financial institutions. Unlike the situation in financial institutions, the impact of financial access and financial efficiency in Central Europe and Baltic countries' financial markets on economic growth appears more prominent. Empirical findings indicate little support for the supply-leading and demand-following assumptions.

Keywords: *Financial Development, Economic Growth, Panel Causality*.

ÇOK YÖNLÜ FİNANSAL GELİŞME VE EKONOMİK BÜYÜME: BOOTSTRAP PANEL NEDENSELLİK YAKLAŞIMI

Öz

Finansal gelişme ve ekonomik büyüme teorik ve ampirik olarak kapsamlı bir şekilde incelenmiştir. Ancak Orta Avrupa ve Baltık ülkeleri için mevcut ampirik kanıtlar azdır. Bu makale, 2000-2019 döneminde on bir Orta Avrupa ve Baltık ülkesi bağlamında finansal gelişmenin ekonomik büyümeyi teşvik edip etmediğini tekrar ele almaktadır. Finansal kurumlar ve finansal piyasaların ayrıntılı özelliklerini finans-büyüme ilişkisine dâhil ederek, bu çalışma sadece finansal derinliğin ekonomik büyüme üzerindeki potansiyel önemine vurgu yapmamakta, aynı zamanda finansal erişim, finansal etkinlik ve finansal istikrarın iktisadi büyümeyi teşvik ettiği (ya da tam tersi) hipotezlerini de test etmektedir. Bu çalışma Granger nedensellik testi için panel bootstrap yaklaşımına başvurmuştur. Finansal kurumlar bağlamında finansal derinlik ve finansal istikrarın ekonomik büyüme üzerindeki etkisi, finansal erişim ve finansal verimliliğe göre daha belirgindir. Finansal kurumlardaki durumdan farklı

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olarak, Orta Avrupa ve Baltık ülkelerinin finansal piyasalarında finansal erişim ve finansal etkinliğin ekonomik büyüme üzerindeki etkisi daha belirgin görünmektedir. Ampirik bulgular arz öncüllü ve talep takipli varsayımlar için kanıtın güçlü olmadığını göstermektedir.

Anahtar Kelimeler: *Finansal Gelişme, İktisadi Büyüme, Panel Nedensellik.*

Introduction

There has been much interest in the causal link between economic growth (EG) and financial development (FD) since Schumpeter's (1911) seminal work on economic development theory. Is it better to focus primarily on EG, which will facilitate FD, or should a country focus first on FD to spur EG?

Economists hold different opinions about the financial sector's role in EG and vice versa. As Levine (2005: 867) stated, "finance is not even discussed in a collection of essays by the pioneers of development economics". According to Lucas (1988: 6), even finance is overly stressed in determining EG. At the other extreme, Schumpeter (1911), Shaw (1973) and McKinnon (1973) argued that finance contributes to EG. Furthermore, Patrick (1966: 175) identified that the demand for financial services relies on real output growth. In other words, more developed economies promote financial markets.

Despite the wide acceptance of the task of financial markets in economic development, empirical and theoretical research in the field is far from complete. Clarifying the role of finance in EG or vice versa would have enormous implications for future policy-oriented research.

This study extends several aspects of the empirical literature on finance-growth. Firstly, various studies have analyzed the causal link between FD and EG.[1] A large part of the previous empirical studies on the finance-growth framework generally focuses on financial depth, i.e., credit volumes and money supply. However, it evaluates only how big the financial sector is. It is insufficient to measure financial intermediaries' effectiveness in smoothing market friction and directing funds to the most productive use(rs). (Levine, Loayza and Beck, 2000: 31). In addition to the financial depth measure, Čihák, Demirgüç-Kunt, Feyen and Levine (2013) developed three broad features of financial institutions and markets: Financial access, financial efficiency, and financial stability.[2] By incorporating these indicators into the finance-growth nexus, this study not only aims to demonstrate the significance of financial depth for EG, but also to examine whether financial access, efficiency, and

[1] For review studies see Bijlsma, Kool and Non (2018); Valickova, Havranek and Horvath (2015); Arestis, Chortareas and Magkonis (2015); Bumann, Hermes and Lensink (2013); Ang (2008a); Levine (2005).
[2] "Elements of financial development", "components of financial development", and "indicators of financial development" are interchangeable terms.

stability foster growth, or vice versa. Secondly, the experiences of industrialized and developing economies have been studied extensively in the empirical literature (Kar, Nazlıoğlu and Ağır, 2011: 686). Only a few empirical studies handle this link for transition economies and sub-regions such as Central Europe and Baltic (CEB) countries. Experts argue that these countries had problems developing financially during their transition period because of ongoing issues such as war, political instability, and economic issues (Petkovski and Kjosevski, 2014: 56). However, they have since overcome their fundamental difficulties and have experienced financial sector development over the last two decades. Therefore, there is a need for further research focusing on transition countries whose financial systems are relatively new and differ greatly (Petkovski and Kjosevski, 2014: 56). Thirdly, the majority of studies focus on financial institutions rather than financial markets. Demirguc-Kunt and Levine (1996a, 1996b) suggest that financial structure significantly impacts EG. Finally, instead of single-country time series methods, an approach based on panel causality was used to detect the causal relationship between variables since the panel data set covers both time series and cross-sectional facts.

Majority of the prevalent literature on panel data approaches checks for cross-sectional dependence among members due to the presume that cross-sectional independence is challenging to fulfill (Bai and Kao, 2006: 4). However, as a result of international trade and economic integration, shocks in one country may easily be transmitted to others. Without addressing cross-sectional dependence, the estimation will be biased and inconsistent (Bai and Kao, 2006: 4). A novel country-specific panel causality approach developed by Kónya (2006) enables contemporaneous correlation across countries. This approach is more useful and effective than a cross-sectional or country-by-country analysis because the financial sector tends to interact across borders. Over the period 2000-2019, the bootstrap panel Granger causality test is applied to investigate the causal link between FD and EG.

To my knowledge, this is the first study that applies a bootstrap panel Granger causality test to study the link between FD and EG considering each component of finance in CEB countries. The paper most similar to this study is that of Kawa, Wajda-Lichy, Fijorek and Denkowska (2020). However, they consider the overall index of financial development. Moreover, this index does not include financial stability, which is one of the most important components of finance. Additionally, they did not differentiate the effect of financial institutions and financial markets on EG. This study aims to fill the current gap in the literature on FD and EG in CEB countries.

1. THEORETICAL BACKGROUND AND BRIEF LITERATURE REVIEW

1.1. Financial Development and Economic Growth

Considerable interest had been attached to the function of finance in the economy since the 18th century. In 1911, In Schumpeter's view, financial intermediaries are essential to EG. Goldsmith (1969), Shaw (1973) and McKinnon (1973) illustrated the close links between economics and FD empirically. Since these pioneer studies, literature on the finance-growth nexus offers a variety of perspectives and insights. One of the issues debated in the finance literature is the causality relationship between FD and EG. There are basically four hypotheses/propositions that attempt to conceptualize the relationship between FD and EG.

The demand-following hypothesis shows that FD is induced by EG. With the growth of the economy, demand for financial services, modern financial institutions and their assets and liabilities increase. These are then created "in response to the demand for these services by investors and savers in the real economy" (Patrick, 1966: 174). The higher the EG rate, the greater the need of businesses for external funds (other people's savings) and hence financial intermediation. The second proposition, the supply-leading hypothesis, postulates the opposite. It assumes that EG is a function of financial development. This view emphasizes "the creation of financial institutions and the supply of their financial assets, liabilities and related financial services in advance of demand for them, especially the demand of entrepreneurs in the modern, growth-inducing sectors" (Patrick, 1966: 175). The financial system's functions in this context are twofold: (i) one is to transfer resources from the traditional sector to the modern sector, (ii) enhance and encourage an entrepreneurial response in the latter (the modern sector) (Patrick, 1966). As these two hypotheses are not mutually exclusive, the third concept concentrates on the feedback relationship between FD and EG, which means they can complement each other, producing financial deepening and real EG interdependent (Menyah, Nazlıoğlu and Wolde-Rufael, 2014: 387). The final proposition, the neutrality hypothesis, purports that EG and FD occur independently of another.

The finance-growth literature has mainly focused on financial depth to assess the causality relationship between variables. Levine (2005: 870) expresses that FD contains improvements in the "(i) production of ex-ante information about possible investments, (ii) monitoring of investments and implementation of corporate governance, (iii) trading, diversification, and management of risk, (iv) mobilization and pooling of savings, and (v) exchange of goods and services." These financial functions may affect savings and investments, and consequently, EG. Hence, based on the above discussion, this paper's first hypothesis is the following.

Hypothesis 1: An increase in the financial depth of financial institutions (or markets) causes EG in CEB countries or vice versa.

There are, however, many characteristics of the financial system that go beyond the size of financial institutions and markets. It is not a measure of quality, efficiency, or stability. To assess the functioning of financial systems, Čihák, et al. (2013) developed several measures to analyze financial institutions and markets: financial depth, financial access, financial efficiency, and financial stability.

The degree of financial access can be explained as the extent to which barriers faced by particular social groups and individuals have been removed (Haini, 2021: 695). The majority of the population in many developing countries lacks access to formal financial services. There is a persistent income gap and slow EG because of these limitations (Beck, Demirgüç-Kunt and Honohan, 2009: 120). Empirical evidence suggests that access to essential financial services like savings, payments, and credit can have an important positive effect on the lives of the poor, producing real EG (Caskey, Clémente Ruîz and Tova, 2004; Dupas and Robinson, 2009; Ardic, Heimann and Mylenko, 2011). Consequently, increasing financial access is a beneficial policy option for alleviating poverty, decreasing social exclusion, and promoting EG (Haini, 2021: 707). The second hypothesis is as follows:

Hypothesis 2: An increase in financial access regarding financial institutions' services (or markets' services) causes EG in CEB countries or vice versa.

The concept of financial efficiency is defined by meeting the prerequisite requirements in order to provide the most cost-effective, high-quality financial services possible. (Eryigit and Dulgeroglu, 2015: 262). Two main reasons explain why a more efficient financial system promotes EG (Dornbush and Reyneso, 1989; Pagano, 1993, Sanchez-Robles, 1997). An efficient financial system will allocate funds to projects with higher rates of return, whereas a less developed financial system may encourage agents to finance riskier, but less profitable projects (Saint Paul, 1992: 765; Bencivenga and Smith, 1991: 197). Moreover, an increase in financial efficiency facilitates gathering information that enables lenders and borrowers to communicate, thereby reducing the informational asymmetries in capital markets (Greenwood and Jovanovic, 1990: 1076; Diamond, 1984: 393). The third hypothesis is therefore:

Hypothesis 3: An increase in the financial efficiency of financial institutions (or markets) causes EG in CEB countries or vice versa.

A widely accepted and employed definition of financial stability has yet to emerge. The concept has been defined in various ways; however, most attempt to fit the definition into a specific theme of a paper or speech.[3] An investigation by Carbó-Valverde and Pedauga Sánchez (2013: 8) described the effect of financial instability on EG through three different channels. Firstly, investors are usually uncertain about assets' fundamental value and

[3] See the Annex in Schinasi (2004) and Allen and Wood (2006).

behavior in times of financial instability. As a result, firms are more cautious about investing till the doubt has passed. Besides, households tend to limit their spending during financial instability because doubt impacts the future value of their wealth. The result of these reactions is a decline in economic output. Secondly, tightened credit standards can negatively impact borrowing conditions. When financial institutions tighten their minimum credit standards, borrowers find it more difficult to obtain financing, negatively impacting EG. The last channel is increased financing costs for firms and households. As Hakkio and Keeton (2009: 7) have stated, "the instability of the financial markets increases interest rates on business and consumer debt in capital markets, which makes it harder for firms to raise money by issuing new equity". Increases in financial costs may drive businesses and households to reduce their expenditure, harming EG in the process. The last hypothesis is, therefore, as follows.

Hypothesis 4: An increase in the stability of financial institutions (or markets) causes EG in CEB countries or vice versa

The demand following hypothesis is confirmed by various research. For instance, Ang and McKibbin (2007: 215) supported Robinson's (1952) notion that output growth causes higher financial depth in the long run. Using cointegration and error-correction techniques, Odhiambo (2008: 704, 2010: 205) examined the dynamic causal relationship between FD and EG in Kenya (2008) and South Africa (2010). Unlike the majority of the previous studies, he recommends that countries intensify their pro-growth policies to bolster financial development. Liang and Teng (2006: 395) investigated the finance-growth nexus in China's case and suggested that uni-directional causality from EG to FD exists. Colombage (2009: 339) analyzed five industrialized economies: Canada, Japan, Switzerland, the UK and the USA. He confirmed the demand-driven hypothesis for Canada, yet only in the short run. Contrary to other studies, Kar et al. (2011: 685) applied the panel causality method and investigated the sign of causality between FD and EG in North African countries and the Middle East. The results support both the demand-following and supply-leading hypotheses. They indicated that the direction of causality depends on country and FD indicators.

Two of proponents of the supply-leading view are King and Levine (1993a, 1993b) and Shaw (1973). Using data from 80 countries over the period from 1960 to 1989, a cross-country study by King and Levine (1993a) confirms Schumpeter's notion that the financial system can stimulate EG. The study shows that various indicators of FD are strongly related to real GDP per capita (GDPPC). According to Gurley and Shaw (1955), financial intermediation is a necessary element in development, resulting in rapid growth and differentiation of financial institutions and instruments. According to Shaw (1973), a country's financial sector is crucial to its EG. More recently, Chaiechi (2012), Hsueh, Hu and Tu (2013) and Menyah, Nazlıoğlu and

Wolde-Rufael (2014) have studied the empirical ties between finance and EG and found evidence favoring the supply-leading hypothesis.

The third view focuses on bi-directional causalities. Studies such as Wolde (2009), Chow and Fung (2013) and Pradhan, Arvin, Norman and Nishigaki (2014) discussed that the causal course is a two-way relationship (Mhadhbi et al., 2020: 2820).

Apart from causality studies, many studies evaluate the impact of FD on EG in the framework of regression analyses. The most current and comprehensive studies conducted by Bijlsma et al. (2018) and Valickova, Havranek and Horvath (2015) analyze 51 estimates from 61 empirical studies and 1334 estimates from 67 empirical studies, respectively. Bijlsma et al. (2018: 6128) found evidence pointing to the positive but decreasing effect of FD on EG. Valickova et al. (2015: 506) concluded that the studies imply that there is a positive and statistically significant impact, though individual predictions differ greatly.

While there is a considerable amount of literature on the effects of FD on EG, relatively few studies have examined whether finance matters for EG or vice versa in CEB countries. Most studies applied regression analysis rather than the causality concept. Koivu (2002) and Dawson (2003) are the first studies focusing on transition countries. The former analyzed the finance-growth nexus using a fixed effect panel model for 25 transition countries during the 1993-2000 period. The study found as transition countries faced numerous banking crises and soft budget constraints, an increase in credit did not accelerate EG. The latter showed that FD had an insignificant effect on EG for 13 Central and Eastern European countries (CEECs) for the period from 1994 to 1999. Gillman and Harris (2004) estimated Dawson's model for a more extended period for the same group of countries. They decided that there is no link between FD and EG. Akimov, Wijeweera and Dollery (2009) built on Dawson's (2003) and Gillman and Harris's (2004) papers by using more extensive and up-to-date panel data, as well as a more comprehensive selection of FD indicators to analyze the finance-growth link. In contrast to the works mentioned above, they detected a robust positive link between FD and EG in transition countries. Fink, Haiss and Vukšić (2009), Cojocaru, Falaris, Hoffman and Miller (2016), Petkovski and Kjosevski (2014), Caporale, Rault, Sova and Sova (2015), Cojocaru et al. (2016), among others, have examined the empirical ties between finance and EG and found evidence of a positive link. Dudian and Popa (2013: 59) and Bongini, Iwanicz-Drozdowska, Smaga and Witkowski (2017: 335) state that increasing the provision of domestic credit to the private sector negatively affects gross domestic product (GDP) growth, and bank credit does not foster EG in transition countries, respectively. As for causality studies, the most recent paper by Kawa et al. (2020: 458) showed that statistically significant uni-directional Granger causality from FD to EG for five countries (Bulgaria,

Lithuania, Poland, Romania, and Slovenia), and reverse causality in two countries (Hungary and Slovenia).

1.2. Financial Structure and Economic Growth

Two types of financial structures exist: bank-based and market-based. Allen and Gale (1999: 4) stated that Germany and the United States could be considered polar opposites. Financial markets in the United States play a crucial role in allocating resources, whereas banks in Germany provide financial intermediation (Allen and Gale, 1999: 4). More generally, civil-law countries tended to develop bank-based financial systems, whereas common-law countries tended to develop market-based financial systems (Ergungor, 2004: 2869).

Capital markets fulfill many of the essential functions banks do in the context of financial intermediation. For instance, financial markets provide size, risk and liquidity change between savings and investments, ease efficient investments through information creation and dissemination, and enable a form of corporate control (Bijlsma and Dubovik, 2014: 21). In this respect, stock markets encourage EG along the same channel as banks. However, there are also significant differences between banks and markets. Banks have the role of delegated monitors, providing liquidity insurance, and reducing imperfections in capital markets, while, due to the fragmented nature of ownership, markets may be limited in their ability to exert corporate control (Bijlsma and Dubovik, 2014: 22).

Market versus bank-based financial systems have been debated for more than a century (Levine, 2002). Which financial system promotes EG more: a bank-based or a market-based?

Since the 19th century, many researchers have discussed that bank-based financial systems are better at "mobilizing savings, identifying good investment, and exerting sound corporate control", especially in the early phases of EG and unstable institutional conditions. However, others emphasize the advantage of markets "in allocating capital, providing risk management tools, and mitigating the problems associated with excessively powerful banks" (Levine, 2002: 31).

Most studies concentrate on the banking sector which dominates financial intermediation in transition countries. Over the past few decades, the stock market of most CEB countries has been improving and developing (Yemelyanova, 2021: 118). Nevertheless, a few studies attempt to show the effect of financial market structure on EG. For instance, in nine EU-accession countries in the early stages of their transition, Fink et al. (2009: 431) used a production function approach to examine the impact of credit, bonds, and stocks. They found that financial market segments enable transition economies to grow economically and maintain stability.

Caporale and Spagnolo (2011: 48) estimated the extent of causality between the stock market and EG. They found uni-directional causality running from stock markets to EG for the Czech Republic, Hungary, and Poland. Most recently, Yemelyanova (2021: 118) identified the causal tie among stock market development, banking sector development and EG in CEB countries. She finds that stock market development affects EG, and stock market capitalization impacts the banking sector and gross capital formation, which in turn affects EG.

2. FINANCIAL SYSTEMS in CEB COUNTRIES

An essential characteristic of CEB countries is that all have experienced a profound transformation from a socialist to market economies (Cottarelli, Dell'Ariccia and Vladkova-Hollar., 2005: 83). In the late 1980s and early 1990s, one of the primary concerns was how to establish their financial systems. A single state bank, called monobank, conducted commercial and central banking activities using central planning. Monobanks played a passive role in allocating credit, supplying book-entry loans to state enterprises for investments approved by central planners. As credit could only be created and spent with government approval, the monobank did not consider the opportunity costs of funds or the ability to repay. Furthermore, there were no securities markets, and the only non-bank financial institutions that existed were a few state-owned insurance companies (Transition Report, 1995: 153).

With the introduction of market reforms, the adjustment of the banking systems in these countries was conducted in three stages (Hermes and Lensink, 2000: 511-514): (i) the acknowledgment that a significant amount of public bank loans, mainly to state-owned firms, had to be written off and the associated loss transferred to the government; (ii) the selling banks to foreign investors; and (iii) the introduction of more conventional banking operations, such as outstanding lending to private companies. As for securities activities, the development of securities markets was primarily shaped by privatization programs. The formation of securities markets began in 1990-91 with the re-establishment of exchanges in Bulgaria, Croatia, Hungary, Poland, and Slovenia (Transition Report, 1995: 164). In the wake of their mass privatization programs, the Czech and Slovak Republics achieved the highest ratios of stock market capitalization to GNP in the region. The Czech Republic's capitalization ratio in 1994 was similar to that of France, while the Slovak Republic's was comparable to Germany, Greece, and Portugal (Transition Report, 1995: 165).

The transition processes in CEB countries were quite successful, ultimately culminating in their joining the European Union (EU) on May 1, 2004. Slovenia was the first to join the euro area in 2007, followed by the Slovak Republic (2009), Estonia (2011), Latvia (2014) and, Lithuania (2015). According to the Copenhagen Criteria, a candidate country must have a functioning market economy in order to be able to accede; it is, therefore, clear that the transition in CEB countries is complete (Harrison, 2016: 30).

Tables 1-4 summarize selected economic and FD indicators in CEB countries in 2000 and 2010. Also shown are the corresponding measures for the Russian Federation, the United Kingdom, the United States, China and Japan.

Table 1. Financial Depth in CEB Countries

Countries	Financial Depth				GDPPC Constant 2010 U.S. dollars	
	Institutions		Markets			
	2000	2010	2000	2010	2000	2010
CEB Countries						
Bulgaria	11.94	68.52	0.97	14.64	3984.6	6812.4
Croatia	31.70	68.13	12.68	42.71	10446.5	13949.3
Czech Republic	43.15	46.31	15.76	23.26	14889.0	19960.0
Estonia	35.95	92.01	29.81	12.35	10062.4	14790.8
Hungary	31.87	60.27	27.75	21.00	10480.0	13191.6
Latvia	18.95	95.01	6.01	6.25	6964.9	11383.5
Lithuania	13.06	58.60	11.96	13.53	6934.4	18609.7
Poland	26.42	48.69	18.16	39.74	8545.4	12613.0
Romania	7.12	39.15	0.97	8.53	4899.1	8214.0
Slovak Republic	50.24	44.67	1.49	4.61	10320.6	16750.7
Slovenia	35.2	85.05	15.27	19.57	18523.1	23509.5
CEB Countries Average						
	27.78	64.21	12.80	18.74	9649.9	14525.8
EU Countries Average [4]						
	62.71	93.67	64.60	44.31	29560.7	32939.9
Other Countries						
Russian Federation	15.68	39.93	-	62.38	6491.0	10674.9
United Kingdom	114.45	184.6	155.4	108.2	35672.9	39435.8
United States	48.96	52.47	147.3	115.2	44726.9	48467.5
China	111.54	127.6	30.89	66.16	1767.8	4550.4
Japan	181.70	99.10	64.59	67.15	42169.7	44507.6

Note: While financial depth and financial access regarding financial institutions are measured in terms of private credit provided by deposit money banks as a share of GDP (%) and commercial bank branches per 100.000 adults, in financial markets. they are measured by stock market capitalization as a share of GDP and the number of publicly listed companies per 10.000 population[5], respectively.

[4] Unweighted average. Author's calculation. See Appendix Table A1.

[5] Number of domestically incorporated companies listed on the country's stock exchanges at the end of the year per 10.000 people (does not include investment companies. mutual funds. or other collective investment vehicles) (World Bank).

Table 2. Financial Access in CEB Countries

Countries	Financial Access				GDPPC Constant 2010 U.S. dollars	
	Institutions		Markets			
	2004[6]	2010	2000	2010	2000	2010
CEB Countries						
Bulgaria	82.92	91.9	281.5	5273.4	3984.6	6812.4
Croatia	29.73	36.18	1409.9	5587.3	10446.5	13949.3
Czech Republic	20.99	22.61	555.8	152.7	14889.0	19960.0
Estonia	18.41	19.47	1431.6	1126.5	10062.4	14790.8
Hungary	13.79	16.78	568.0	479.9	10480.0	13191.6
Latvia	31.58	34.18	2660.9	1573.2	6964.9	11383.5
Lithuania	23.76	29.05	1514.4	1259.1	6934.4	18609.7
Poland	26.61	32.19	588.1	1498.3	8545.4	12613.0
Romania	-	35.44	485.6	360.5	4899.1	8214.0
Slovak Republic	23.21	26.29	129.9	1669.3	10320.6	16750.7
Slovenia	40.96	38.76	7491.4	3514.6	18523.1	23509.5
CEB Countries Average						
	31.19	34.80	1556.1	2044.9	9649.9	14525.8
EU Countries Average						
	40.68	39.94	2639.4	2656.2	29560.7	32939.9
Other Countries						
Russian Federation	26.75	35.06	14.3	389.	6491.0	10674.9
United Kingdom	29.02	24.69	4122.7	3353.7	35672.9	39435.8
United States	32.69	35.41	2451.4	1383.3	44726.9	48467.5
China	-	-	86.0	154.2	1767.8	4550.4
Japan	34.60	33.81	1620.1	1781.0	42169.7	44507.6

Table 3. Financial Efficiency in CEB Countries

Countries	Financial Efficiency			
	Institutions		Markets	
	2000	2010	2000	2010
CEB Countries				
Bulgaria	5.50	4.52	3.18	5.11
Croatia	4.30	3.44	6.89	4.10

[6] There is no data for the period before 2004.

Czech Rep.	2.67	2.98	68.2	29.2
Estonia	4.18	2.67	19.25	13.3
Hungary	4.12	3.81	92.9	95.5
Latvia	4.43	1.55	26.35	1.82
Lithuania	5.33	1.49	14.78	5.96
Poland	4.38	3.24	65.4	36.4
Romania	8.51	5.51	15.5	11.8
Slovak Rep.	3.68	3.03	122.4	7.41
Slovenia	4.64	2.20	20.61	5.13
CEB Countries Average				
	4.70	3.13	41.40	19.61
EU Countries Average				
	2.82	2.13	71.83	128.27
Other Countries				
Russian Federation	5.25	4.27	-	53.28
United Kingdom	1.26	2.12	71.14	119.58
United States	3.82	3.80	197.13	208.43
China	2.41	3.05	-	205.01
Japan	1.48	1.11	78.58	111.56

Note: While financial efficiency and stability in financial institutions are measured in terms of the net interest margin (%)[7] and the Z-score[8], they are measured by turnover ratio[9] and stock price volatility[10] in financial markets, respectively.

Table 4. Financial Stability in CEB Countries

Countries	**Financial Stability**			
	Institutions		**Markets**	
	2000	**2010**	**2000**	**2010**
CEB Countries				
Bulgaria	13.04	7.85	81.2	29.3
Croatia	4.45	7.54	23.0	30.2

[7] Accounting value of bank's net interest revenue as a share of its interest-bearing (total earning) assets (Beck et al., 2009; Čihák et al., 2013).
[8] The Z-score is (ROA (return on assets) +equity/assets)/sd(ROA), where ROA is the average annual return on end-year assets (net income/total assets) and sd(ROA) is the standard deviation of ROA (Beck et al., 2000; Beck et al., 2009; Čihák et al., 2013). A higher Z-score implies a lower probability of insolvency (Čihák et al., 2013).
[9] Total value of shares traded during the period divided by the average market capitalization for that period (World Bank).
[10] Stock price volatility is the average of the 360-day volatility of the national stock market index (World Bank).

Czech Rep.	8.19	10.83	22.8	32.8
Estonia	10.85	8.73	26.3	28.3
Hungary	5.88	6.33	35.6	38.9
Latvia	5.21	3.72	17.7	33.4
Lithuania	6	4.23	16.7	27.6
Poland	8.21	8.60	33.5	33.7
Romania	16.43	9.28		
Slovak Rep.	23.36	21.56	28.6	27.4
Slovenia	3.85	3.03	15.0	19.8
CEB Countries Average				
	9.58	8.33	30.04	30.14
EU Countries Average				
	12.35	11.82	24.90	29.27
Other Countries				
Russian Federation	12.74	7.18	-	35.57
United Kingdom	15.29	8.33	17.05	22.77
United States	26.81	32.96	20.48	27.34
China	19.18	19.74	24.89	35.03
Japan	15.47	15.25	21.30	31.70

As of 2000, financial depth in financial institutions ranged from just 7.1 percent of GDP in Romania to 50.2 percent in the Slovak Republic. While there were significant differences across countries in 2000, disparities in financial depth were smaller in 2010. By that time, CEB countries had put into practice considerable improvements in their legal and financial structures and institutions. From 2000-2010 their credit markets grew rapidly.

By the end of the decade, the average credit level in these countries had increased from 27.7 to 64.2 percent. For financial markets, there was a marked increase in stock market capitalization as a share of GDP (financial depth) from 2000 to 2010 in all countries except Hungary and Estonia. For instance, in Bulgaria the size of the stock market as a share of GDP increased by 1.400 percent. As for financial access to financial institutions, Table 2 illustrates the wide variance in access to finance across countries. The average for CEB countries was 31.1 per 100,000 adults in 2004 and 34.8 in 2010. Bulgaria, Croatia, Romania, and Slovenia had more commercial bank branches than the average CEB country in 2010. Considering financial access in financial markets, Croatia is particularly noteworthy. Although Croatia and Poland exhibited similar degrees of financial depth in financial markets in 2010, they differed markedly in terms of the number of companies offering their services on the financial market.

GDPPC grew considerably, but significant differences within and between CEB countries and the EU remain. For instance, GDPPC in 2010 in Slovenia was $23,509, whereas in Bulgaria it was less than $7000 per capita. Moreover, EU countries' average GDPPC ($32,939) was more than twice that of CEB countries ($14,525) in 2010.

Table 3 shows that the financial efficiency values in financial institutions were positive for all countries in 2000 and 2010. Positive values in the net interest margin indicate a bank's profitability and the extent of its income growth. Countries exhibited relatively small differences in this regard, with Romania reporting the highest net interest margin, at 8.51 and 5.51 percent in 2000 and 2010, respectively. Considering financial efficiency in financial markets, the average turnover ratio in CEB countries was 19.6 percent in 2010, but the country-by-country ratios ranged from less than 2 percent to 95 percent. The Slovak Republic and Hungary scored the highest, at 122.4 and 95.5 percent in 2000 and 2010, respectively, while Bulgaria and Latvia scored the lowest, at 3.1 and 1.8 percent in 2000 and 2010, respectively. The market is more efficient when turnover is higher, as it creates more liquidity (Čihák et al., 2013: 17). As can be seen in Table 4, the Slovak Republic exhibited the highest degree of financial stability in financial institutions in 2000 and 2010. This may be due to the fact that compared to other countries it has made more gradual changes across every FD indicator from 2000 to 2010 in financial institutions. As for financial market stability, most countries have relative stock price volatility except for Slovenia. Compared to other FD indicators, financial stability in markets shows a more precise pattern.

Given the high degree of variation within and between FD indicators in the financial institutions and financial markets of CEB countries and the particular issues related to the reform of their financial sectors, it is essential to investigate whether the relationship between FD and EG exists in CEB economies and detect which elements of financial system have a significant role in the development of these economies. Therefore, it is essential to consider finance as a whole and focus on both quantity and quality.

3. DATA and VARIABLES

In this study, the relationship between FD and EG is examined using panel data covering 11 CEBs classified by the World Bank from 2000 to 2019. GDPPC is used to measure the latter. As we analyze financial institutions and financial markets separately, we apply eight different FD indicators. The definition and descriptive statistics of the variables used in this paper are shown in Table 5 and Table 6.

Table 5. Financial Development Indicators

Indicators	Variables	Definitions
Financial Institutions		
Financial Depth	PC	Private credit by deposit money banks to GDP (%)
Financial Access	CBB	Commercial bank branches per 100,000 adults
Financial Efficiency	NIM	Net interest margin (%)
Financial Stability	Z-score	Z-score
Financial Markets		
Financial Depth	SMC	Stock market capitalization to GDP
Financial Access	NOC	Number of publicly listed companies per 10,000 population
Financial Efficiency	TR	Turnover ratio
Financial Stability	SPV	Stock price volatility

Table 6. Descriptive Statistics

Variables	Mean	Median	Max	Min	Std. Dev.	Observations
GDPPC	14005.78	13682.44	27426.79	3984.66	5107.88	220
PC	47.91	47.79	100.78	7.12	17.68	220
CBB	30.19	26.81	92.34	8.53	16.56	220
NIM	3.40	3.23	9.48	1.24	1.30	220
Z-Score	8.62	7.68	27.50	1.69	4.71	220
SMC	17.51	14.62	116.89	-8.77	13.93	220
NOC	1933.17	1291.75	8329.04	123.51	1865.45	220
TR	20.13	8.73	175.38	-29.44	28.14	220
SPV	19.48	17.44	81.27	6.81	9.59	200

Although there are other variables that represent each FD indicator, the most commonly used and widely available ones are applied in this context (Čihák et al., 2013: 17). The variables other than indices and ratios are processed in logarithmic form. Data for EG and FD indicators are taken from the World Development Indicator and the Global Financial Development in the World Bank, respectively.[11]

4. EMPIRICAL METHODOLOGY and RESULTS

An analysis of Granger causality between EG and FD is shown in this study by utilizing the bootstrap panel causality method presented by Kónya

[11] Data available on request from the author.

(2006). A novel bootstrap panel data causality view has the following advantages: It enables contemporaneous correlation across the members of a panel, and heterogeneity in estimated parameters for each individual country (Kónya, 2006: 978). In addition, apart from lag structure, it does not require pretesting for unit root and cointegration because these tests undergo low power (Kónya, 2006: 978).

4.1. Preliminary Analysis

Causality restrictions and the choosing of a convenient estimator are important issues in the bootstrap panel causality approach. It is important to consider the error term properties when selecting an estimation method. In the case of no contemporaneous correlation, the ordinary least-squares (OLS) method can be used to estimate each equation. (Kónya, 2006: 982). Due to an increase in financial and economic integration in the wake of globalization cross-sectional dependency is very likely in these systems. However, if there is cross-sectional dependence, the SUR approach is more efficient for estimating panel data causality than the OLS technique (Zellner, 1962: 363).[12] The variance-covariance matrix of the error should therefore be tested to see if it is diagonal (Kónya, 2006: 983). The empirical approach begins by examining cross-country cross-sectional dependency.

Models of panel data are generally assumed to have independent disturbances across sections. This is particularly true of panels with large cross-section dimensions (N) (Pesaran, 2004: 4). In cases where N is small (for instance, 10 or less) and the time dimension of the panel (T) sufficiently large, Breusch and Pagan (1980) proposed a Lagrange multiplier (LM) test to determine the characteristics of cross-sectional dependency. However, in cases where N is large and T is small, this test is not applicable since it will likely exhibit substantial size distortions (Pesaran, 2004: 5). Recognizing the shortcomings of the Breusch and Pagan's LM test, Pesaran (2004) proposed an alternative which is based on pair-wise correlation coefficients rather than their squares used in the LM test, called the CD_{lm} test (Pesaran, 2004). However, the CD_{lm} test has a significant disadvantage. It lacks power in some cases where "the population average pair-wise correlations is zero although the underlying individual population pair-wise correlations are non-zero" (Pesaran, Ullah and Yamagata, 2008: 106). Pesaran et al., (2008) suggested a bias-adjusted revision of LM tests, which use "the exact mean and variance of the LM statistic in the case of panel data models with strictly exogenous regressors and normal errors" (Pesaran et al., 2008: 120).

Apart from cross-sectional dependence, another important issue in the bootstrap panel causality approach is to determine the characteristics of cross-country heterogeneity. If it is assumed that the slope coefficients are homogeneous, then the analysis of panel data could not grab the heterogeneity

[12] Pesaran (2006) carried out a Monte Carlo experiment and stated that if error cross-section dependence is not regarded, considerable bias and size distortions would be the consequence.

because of country's unique features, and incorrectly ignoring slope heterogeneity leads to biased results (Pesaran and Smith, 1996). In order to test for homogeneity in parameter estimates, this study applied the slope homogeneity tests of Pesaran and Yamagata (2008). A detailed explanation of the procedure used for cross-sectional dependency and slope homogeneity tests are as follows.

4.1.1. Cross-Sectional Dependence Tests

To test for cross-sectional dependency, the LM test requires the estimation of the following panel data model:

$$y_{it} = \alpha_i + \beta'_i \mathbf{x}_{it} + u_{it} \quad \text{for } i = 1,2,\dots,N; t = 1,2,\dots,T. \quad (1)$$

In Eq. (1), y_{it} is a dependent variable, $\mathbf{x}_{it}$ is a kx1 vector of independent variables, i and t are the cross-sectional and time dimension, respectively. α_i and β_i are individual intercepts and slope coefficients, respectively. The null hypothesis of no cross-sectional dependence is tested in the LM test against the alternative hypothesis of cross-sectional dependence. For a given k, the null and alternative hypotheses are as follows:

$$H_0 = \mathrm{Cov}\left(u_{k,i,t}, u_{k,j,t}\right) = 0$$

and

$$H_A = \mathrm{Cov}\left(u_{k,i,t}, u_{k,j,t}\right) \neq 0$$

for at least one pair of $i \neq j$.

The LM test statistic for cross-sectional dependence of Breusch and Pagan (1980) is given by:

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{i-1} \hat{\rho}_{ij}^2$$

where $\hat{\rho}_{ij}^2$ is the ijth residual correlation coefficient obtained from individual OLS estimation of Eq. (1). Test statistics is distributed χ^2 [d], where d=N (N – 1)/2, under the null hypothesis of cross-sectional independence (Pesaran, 2004).

For the large panels where $T \to \infty$ first and then $N \to \infty$, Pesaran (2004) proposed the scaled version of the LM test as follows (Pesaran, 2004):

$$CD_{lm} = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right)$$

CD_{lm} test will lack power in certain situations in which the population average pair-wise correlations are zero, but underlying individual population pair-wise correlations are non-zero (Pesaran et al., 2008). Pesaran, Ullah and

Yamagata (2008) proposed a bias-adjusted LM test of cross-section independence. For the bias- adjustment, they derived the exact mean and variance of the LM statistics. The biased adjusted LM test is (Pesaran et al., 2008, p.108):

$$LM_{adj} = \sqrt{\frac{2}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \frac{(T-k)\hat{\rho}_{ij} - \mu_{Tij}}{\upsilon_{Tij}}$$

where k is the number of regressors, μ_{Tij} and υ_{Tij} are the exact mean and variance of $(T-k)\hat{\rho}_{ij}$, respectively.

4.1.2. Slope Homogeneity Test

Standard F and Swamy's (1970) slope homogeneity tests require panel data models where N is relatively small (around 5-10) compared to T (around 80-100) (Pesaran and Yamagata, 2008). However, in our case, either N is reasonably small or T is sufficiently large. To overcome this problem, Pesaran and Yamagata (2008) proposed a dispersion type test (so-called Δ) based on the early work of Swamy (1970). Δ tests use of Swamy statistic ($\hat{S}$) and modified version of Swamy statistic ($\tilde{S}$) denoted by $\hat{\Delta}$ and $\tilde{\Delta}$, respectively. They showed that "in the case of models with strictly exogenous regressors, but with non-normal errors, both versions of Δ test tend to be standard normal distribution as $(N,T) \overset{j}{\rightarrow} \infty$, subject to certain restrictions on the relative expansion rates of N and T." However, they also showed that "when the errors are normally distributed mean-variance biased adjusted versions of the Δ tests, denoted by $\hat{\Delta}_{adj}$ and $\tilde{\Delta}_{adj}$, are valid as $(N,T) \overset{j}{\rightarrow} \infty$ without any restriction on the relative expansion rates of N and T".

Modified version of Swamy's test is as follows:

$$\tilde{S} = \sum_{i=1}^{N} (\widehat{\boldsymbol{\beta}}_i - \widetilde{\boldsymbol{\beta}}_{WFE})' \frac{\mathbf{X}_i' \mathbf{M}_\tau \mathbf{X}_i}{\tilde{\sigma}_i^2} (\widehat{\boldsymbol{\beta}}_i - \widetilde{\boldsymbol{\beta}}_{WFE})$$

here $\widehat{\boldsymbol{\beta}}_i$ is the estimator matrix from pooled OLS, $\widetilde{\boldsymbol{\beta}}_{WFE}$ is the weighted fixed effect pooled estimator matrix, M_τ is an identity matrix, and $\tilde{\sigma}_i^2$ is the estimator of σ_i^2. Mean and variance biased adjusted versions of $\hat{\Delta}$ and $\tilde{\Delta}$ are as follows:

$$\hat{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\hat{S} - E(\hat{z}_{iT})}{\sqrt{Var(\hat{z}_{iT})}}\right)$$

and

$$\tilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - E(\tilde{z}_{iT})}{\sqrt{Var(\tilde{z}_{iT})}}\right)$$

where $E(\hat{z}_{iT}) = \frac{k(T-k-1)}{T-k-3}$, $Var(\hat{z}_{iT}) = \frac{2k(T-k-1)^2(T-3)}{(T-k-3)^2(T-k-5)}$, $E(\tilde{z}_{iT}) = k$, $Var(\tilde{z}_{iT}) = \frac{2k(T-k-1)}{T+1}$

4.2. Panel Granger Causality Analysis

The Wald principle imposes zero restrictions on causality by estimating the system through SUR, followed by bootstrapping critical values (Chang, Cheng, Pan and Wu, 2013: 1193). It does not require joint hypotheses for all panel members as country-specific Wald tests are used with country-specific bootstrap critical values. In a country-by-country analysis the possibility of Granger causality between EG and FD can be studied using the following SUR model (Kónya, 2006: 981):

$$y_{1,t} = \alpha_{1,1} + \sum_{l=1}^{mly_1} \beta_{1,1,l} y_{1,t-1} + \sum_{l=1}^{mlx_1} \gamma_{1,1,l} x_{1,t-1} + \varepsilon_{1,1,t}$$

$$y_{2,,t} = \alpha_{1,2} + \sum_{l=1}^{mly_1} \beta_{1,2,l} y_{2,t-1} + \sum_{l=1}^{mlx_1} \gamma_{1,2,l} x_{2,t-1} + \varepsilon_{1,2,t}$$

.
.
. (1)

$$y_{N,t} = \alpha_{1,N} + \sum_{l=1}^{mly_1} \beta_{1,N,l} y_{N,t-1} + \sum_{l=1}^{mlx_1} \gamma_{1,N,l} x_{N,t-1} + \varepsilon_{1,N,t}$$

and

$$x_{k,1,t} = \alpha_{2,1} + \sum_{l=1}^{mly_2} \beta_{2,1,l} y_{1,t-1} + \sum_{l=1}^{mlx_2} \gamma_{2,1,l} x_{k,1,t-1} + \varepsilon_{2,1,t}$$

$$x_{k,2,t} = \alpha_{2,2} + \sum_{l=1}^{mly_2} \beta_{2,2,l} y_{2,t-1} + \sum_{l=1}^{mlx_2} \gamma_{2,2,l} x_{k,2,t-1} + \varepsilon_{2,2,t}$$

.

. (2)

.

$$x_{k,N,t} = \alpha_{2,N} + \sum_{l=1}^{mly_2} \beta_{2,N,l} y_{N,t-1} + \sum_{l=1}^{mlx_2} \gamma_{2,N,l} x_{k,N,t-1} + \varepsilon_{2,N,t}$$

In the equation systems (1) and (2), y denotes the EG, x_k refers to FD indicators that subscripts k presents PC, CBB, NIM, Z, SMC, NBC, TR and SPV, N is the number of the countries in panel, t is the time period, and l is the lag length. Each equation in (1) and (2) has different predetermined variables and the only possible link among individual regressions is cross-section dependence within the systems (Kónya, 2006: 981). As regards SUR systems, Kónya (2006: 980) indicates that

" in country i there is one-way Granger causality running from X to Y if in (1) not all $\gamma_{1,i}$'s are zero but in (2) all $\beta_{2,i}$'s are zero, there is one-way Granger causality from Y to X if in (1) all $\gamma_{1,i}$'s are zero but in (2) not all $\beta_{2,i}$'s are zero, there is two-way Granger causality between Y and X if neither all $\beta_{2,i}$'s nor all $\gamma_{1,i}$'s are zero, and there is no Granger causality between Y and X if all $\beta_{2,i}$'s and $\gamma_{1,i}$'s are zero."

As remarked by Kónya (2006: 982), determining the optimal lag length is a critical phase as the causality test findings may rely on the lag structure. Very few lags could lead to an omitted variable problem, specification error and hence, biased estimation results. In other respects, too many lags induce wasting observations, specification error, and hence increasing standard errors of the estimated coefficients and less precise results (Kónya, 2006). In line with Kónya, (2006), maximal lags are permitted to vary across variables, however not across countries. This study chooses the criterion of minimizing SBC (Schwartz Bayesian information criterion) to determine the lag period. The largest lag period is set at 3, and optimal lag is 1 for each regression.[13]

4.3. Empirical Results

Firstly, cross-sectional dependence and slope homogeneity are tested across countries before conducting a panel Granger causality analysis. The presence of cross-sectional dependence was examined using three different tests. The findings are presented in Table 7 and Table 8.

Table 7. Preliminary Tests for Financial Institution Indicators

Tests	**DV: GDPPC**			
	PC	**CBB**	**NIM**	**Z-Score**
Cross-sectional dependence test				

[13] The results are shown in Appendix in Table A2.

LM	591.3 (0.000)***	477.9 (0.000)***	346.8 (0.000)***	724.8 (0.000)***
CD_{lm}	23.14 (0.000)***	19.39 (0.000)***	17.52 (0.000)***	26.49 (0.000)***
LM_{adj}	123.7 (0.000)***	97.72 (0.000)***	67.58 (0.000)***	157.1 (0.000)***
Homogeneous test				
$\tilde{\Delta}$	6.906 (0.000)***	11.683 (0.000)***	4.008 (0.044)***	4.789 (0.000)***
$\tilde{\Delta}_{adj}$	7.491 (0.000)***	12.671 (0.000)***	4.347 (0.029)***	5.194 (0.000)***
Tests	**DV: Financial Indicator**			
Cross-sectional dependence test				
LM	578 (0.000)***	507.1 (0.000)***	148.8 (0.000)***	134.4 (0.000)***
CD_{lm}	16.65 (0.000)***	20.92 (0.000)***	2.917 (0.003)***	1.907 (0.056)*
LM_{adj}	119 (0.000)***	102.7 (0.000)***	20.24 (0.000)***	16.92 (0.000)***
Homogeneous test				
$\tilde{\Delta}$	1.603 (0.10)*	16.351 (0.000)***	5.430 (0.000)***	4.756 (0.000)***
$\tilde{\Delta}_{adj}$	1.739 (0.08)*	17.735 (0.000)***	5.890 (0.000)***	5.159 (0.000)***

LM, CD_{lm}, and LM_{adj} are cross-sectional dependence tests of Breusch and Pagan (1980), Pesaran (2004), and Pesaran et al. (2008), respectively. $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ are slope homogeneity tests of Pesaran and Yamagata (2008). DV refers to dependent variable. ***,**, and * denote statistical significance at .01, .05, and .1, respectively.

Table 8. Preliminary Tests for Financial Market Indicators

Tests	DV: GDPPC			
	SMC	NOC	TR	SPV
Cross-sectional dependence test				
LM	622.6(0.000)***	306.8 (0.000)***	472.8 (0.000)***	558.7 (0.000)***
CD_{lm}	23.94 (0.000)***	15.15 (0.000)***	15.15 (0.000)***	23.21 (0.000)***
LM_{adj}	131.9 (0.000)***	58.12 (0.000)***	97.31 (0.000)***	131.7 (0.000)***
Homogeneous test				
$\tilde{\Delta}$	6.322 (0.000)***	18.511 (0.000)***	5.474 (0.000)***	2.978 (0.003)***
$\tilde{\Delta}_{adj}$	6.857 (0.000)***	20.078 (0.000)***	5.938 (0.000)***	3.230 (0.001)*
Tests	DV: Financial Indicator			
Cross-sectional dependence test				
LM	552.5 (0.000)***	218.9 (0.000)***	181.8 (0.000)***	319.7 (0.000)***
CD_{lm}	22.96 (0.000)***	-2.066 (0.03)**	5.535 (0.000)***	16.16 (0.000)***
LM_{adj}	113.1 (0.000)***	36.37 (0.000)***	27.86 (0.000)***	68.69 (0.000)***
Homogeneous test				

$\tilde{\Delta}$	6.654 (0.000)***	19.159 (0.000)***	7.748 (0.000)***	2.720 (0.007)***
$\tilde{\Delta}_{adj}$	7.218 (0.000)***	20.781 (0.000)***	8.404 (0.000)***	2.950 (0.003)***

Note: Cross-sectional dependence test and homogeneous test for SPV variable are applied to 10 CEB countries since Romania does not have data regarding SPV.

As shown in Table 7 and Table 8, all three tests reject the null hypothesis of no cross-sectional dependence across countries, which provides strong evidence supporting cross-sectional dependency across CEB countries. This result indicates that a shock in one of the eleven CEB countries will be transferred to other countries. Moreover, the results indicate that it is appropriate to use the SUR method instead of a country-by-country OLS prediction as postulated in the bootstrap panel causality perspective. Furthermore, Table 7 and Table 8 also show the result of slope homogeneity and suggest that $\tilde{\Delta}$ tests reject the null hypothesis of slope homogeneity. The rejection of slope homogeneity implies that the direction of the causal linkages between FD and EG may differ across the eleven CEB countries.

The presence of cross-sectional connection and slope diversity among CEB countries implies that using the bootstrap panel causality approach is appropriate. The findings are summarized in Table 9.[14] This study uses the same notation as in Kar et al. (2011) to simplify the presentation of results: "→" and "←" represent the causal direction. The former denotes the direction of causality from FD to EG, and the latter the direction of causality from EG to financial development. Findings summarized in Panel A in Table 9 indicate the causality from FD to EG.

Table 9. Summary for the Direction of Causality

	Financial Institutions				**Financial Markets**			
Countries	**PC**	**CBB**	**NIM**	**Z**	**SMC**	**NOC**	**TR**	**SPV**
Panel A: From financial development to economic growth								
Bulgaria	→							
Croatia	→	→		→		→	→	→
Czech Rep.								
Estonia								
Hungary	→	→	→	→		→	→	
Latvia								
Lithuania								
Poland				→		→	→	

[14] Details of the results are shown in the Appendix in Tables A3- A10

Romania									
Slovak Rep.					→		→		
Slovenia	→								→
Panel B: From economic growth to financial development									
Bulgaria					←			←	
Croatia									
Czech Rep.	←	←							
Estonia		←							
Hungary			←						
Latvia						←		←	
Lithuania						←		←	
Poland								←	
Romania									
Slovak Rep.	←								
Slovenia									

Financial Institutions: Results indicate that Bulgaria, Croatia, Hungary, and Slovenia show a significant one-way Granger causality from financial depth (PC) to EG, supporting strong evidence of the supply-following hypothesis. Thus, for these countries, an increase in financial depth leads to an increase in EG, but for the other countries, financial depth has no significant effect on EG. A unidirectional causality runs from financial access (CBB) to EG in Croatia and Hungary. With regard to the causality direction from financial efficiency (NIM) to EG, only Hungary rejects the null hypothesis, and other ten countries do not reject the null hypothesis of no Granger causality from financial efficiency to EG. As for financial stability (Z-score), in Croatia, Hungary, Poland, and the Slovak Republic, there exists a significantly positive causality from financial stability to EG, indicating that an increase in financial stability leads to an increase in EG in these countries.

Financial Markets: The Slovak Republic is the only country where EG is sensitive to financial depth (SMC). Empirical evidence suggests that stock market capitalization does not contribute materially to EG for most CEB countries. Granger causality from financial access (NOC) and financial efficiency (TR) to EG exists in Croatia, Hungary and Poland. Financial stability (SPV) is a significant factor for EG in Croatia and Slovenia. Results depicted in Panel B in Table 9 show the causality from EG to financial development.

Financial Institutions: Results indicate that the Czech Republic and the Slovak Republic exhibit a significant one-way Granger causality from EG to financial depth, delivering strong evidence in favor of the demand-following hypothesis. Thus, for these countries, an increase in EG leads to an increase in financial depth, but for the other countries, EG has no significant effect on financial depth. Unidirectional causality runs from EG to financial access in the Czech Republic and Estonia. There is bidirectional causality between financial efficiency and EG in Hungary. With regard to the causality direction from EG to financial stability, only Bulgaria rejects the null hypothesis, and the other ten countries cannot reject the null hypothesis of no Granger causality from EG to financial stability.

Financial Markets: EG is a significant factor in terms of financial depth in Latvia and Lithuania. However, empirical evidence suggests that EG does not contribute materially to financial depth for most CEB countries. Financial access and financial stability are not sensitive to EG in any CEB countries. Granger causality from EG to financial efficiency exists in Bulgaria, Latvia, Lithuania and Poland.

The evidence presented in this paper seems to indicate that there is hardly any causality in any direction between FD and EG in the majority of the 11 CEB countries, which supports the neutrality hypothesis. For instance, there is no causality evidence from each of the FD indicators to EG in the Czech Republic, Estonia, Latvia, Lithuania and Romania both in the financial institutions and the financial markets. This study also highlights that the finance-growth nexus varies across indicators, financial structures and countries.

Conclusion

This paper examines the causal relationship between FD and EG in 11 CEB countries during the 2000-2019 period within a bivariate bootstrapped panel causality analysis. For this aim, each of the elements (depth, access, efficiency, and stability) of FD are broken down, whereafter their impact on EG is presented in turn. Furthermore, this comprehensive analysis is conducted for financial institutions and financial markets. Based on this research, several conclusions concerning CEB countries can be drawn.

The effect of financial depth and financial stability on EG is more pronounced than financial access and financial efficiency in the context of financial institutions. For instance, financial efficiency only plays a significant role in EG in Hungary, whereas financial stability is crucial in Croatia, Hungary, Poland, and the Slovak Republic. Still, it seems that the effect of any FD element on EG in the financial institution is not valid in the majority of CEB countries.

Unlike the situation in financial institutions, the impact of financial access and financial efficiency in CEB countries' financial markets on EG

appears more prominent. For example, financial depth is only an important FD element in the Slovak Republic, while financial access or financial efficiency affects EG in Croatia, Hungary, and Poland. Still, it seems that the effect of any FD element on EG in financial market is not valid in the majority of CEB countries as is the case with financial institutions.

There is no one-way causality from any element of FD to EG in the Czech Republic, Estonia, Latvia, and Lithuania. Overall, FD does not impact EG in these countries.

Regarding one-way causality from EG to financial development, EG does not influence FD in the financial institutions of most CEB countries (i.e., Croatia, Latvia, Lithuania, Poland, Romania, and Slovenia). In other words, an increase in EG does not promote any element of FD in financial institutions.

EG leads to progress in stock market capitalization (financial depth) and the turnover ratio (financial efficiency) in financial markets (i.e., Bulgaria, Latvia, Lithuania, and Poland).

The feedback (or complimentary) hypothesis has been proven for NIM and TR in Hungary and Poland, respectively.

It has been presented that supply-leading and demand following hypotheses hold for several CEB countries. However, as Patrick (1966: 176) stated, it cannot be said that supply-leading finance (demand-following EG) is a necessary condition or precondition for self-sustained EG (financial development). Rather, it presents an opportunity to induce real growth (financial development) by financial (economic) means.

CEB countries are largely bank-based financial systems. The stock markets of most CEB countries have been developing and improving over the past decades. However, according to Transition Report (2021: 111), despite notable improvement since 2014 in terms of financial market development, substantial challenges remained at the end of 2020. According to Morgan Stanley Capital Information (MSCI)'s market classification, none of the CEB countries are considered developed markets. Given the low level of stock market development in these countries, it is important to note that several FD elements in financial markets have a positive impact on EG or vice versa.

In conclusion, while it is clear that a strong empirical link exists between FD and EG for several CEB countries, the link varies with regard to different indicators of FD and financial structure.

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APPENDIX

Table A1. EU Countries Average

Note: Countries do not have financial development indicators excluded from the average calculation.

	2000	**2010**
Financial Institution		
Financial Depth	27 EU Countries	26 EU countries, except for Cyprus
Financial Access	26 EU Countries, except for Romania	26 EU Countries, except for Romania
Financial Efficiency	26 EU Countries, except for Greece	26 EU Countries, except for Ireland
Financial Stability	26 EU Countries, except for Greece	27 EU Countries
Financial Market		
Financial Depth	23 EU countries, except for Cyprus, Estonia, Latvia and Lithuania	20 EU countries, except for Czech Rep., Denmark, Estonia, Finland, Latvia, Lithuania and Sweden
Financial Access	27 EU Countries	21 EU Countries, except for Denmark, Estonia, Finland, Latvia, Lithuania and Sweden
Financial Efficiency	21 EU countries, except for Cyprus, Estonia, Greece, Hungary, Latvia and Lithuania	20 EU countries, except for Czech Rep., Denmark, Estonia, Finland, Latvia, Lithuania and Sweden
Financial Stability	20 EU countries, except for Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Romania and Slovenia	26 EU Countries, except for Romania

Table A2. The Determination of the Optimal Lag

	Lag 1	**Lag 2**	**Lag 3**
Financial Institutions			
PC → GDPPC	13.40	13.43	13.46
GDPPC → PC	4.26	4.301	4.304

CBB → GDPPC	13.38	13.41	13.42
GDPPC → CBB	-4.43	-4.35	-4.26
NIM → GDPPC	13.49	13.56	13.62
GDPPC → NIM	-0.50	-0.44	-0.35
Zscore → GDPPC	13.45	13.52	13.59
GDPPC → Zscore	2.19	2.12	2.08
Financial Markets			
SMC → GDPPC	13.53	13.59	13.66
GDPPC → SMC	5.58	5.66	5.77
NOC → GDPPC	13.50	13.59	13.65
GDPPC → NOC	-0.66	-0.56	-0.42
TR → GDPPC	13.62	13.65	13.66
GDPPC → TR	5.87	5.95	6.30
SPV → GDPPC	13.46	13.53	13.59
GDPPC → SPV	4.02	4.04	4.08

Table A3. Panel Granger Causality Test Results (PC vs. GDPPC)

H_0 : PC does not cause GDPPC				
Countries	Statistics	1%	5%	10%
Bulgaria	18.859***	16.396	8.932	6.293
Croatia	46.597 ***	36.849	18.918	12.560
Czech Rep.	4.289	62.869	34.781	24.371
Estonia	10.727	52.902	27.234	18.803
Hungary	56.216***	34.838	21.566	17.061
Latvia	1.453	17.919	9.571	6.850
Lithuania	7.212	19.323	12.479	9.280
Poland	6.263*	16.227	7.659	4.914
Romania	3.960	11.508	6.121	4.244
Slovak Rep.	1.865	22.251	10.829	6.893
Slovenia	35.536***	28.670	15.880	11.344
H_0 : GDPC does not cause PC				
Bulgaria	0.831	19.088	12.299	9.462
Croatia	0.070	8.192	4.661	3.262
Czech Rep.	35.496**	37.884	23.694	19.279
Estonia	4.142	14.527	8.424	6.018
Hungary	0.931	5.822	3.174	2.236

Latvia	1.021	5.493	3.032	2.089
Lithuania	1.857	17.002	11.540	9.193
Poland	0.741	53.041	31.949	24.341
Romania	0.981	18.401	11.617	8.852
Slovak Rep.	63.999***	30.977	19.532	15.791
Slovenia	1.292	9.616	5.426	3.883

Note: ***, ** and * indicate significance at the .01, .05 and .1 levels, respectively. Bootstrap critical values are obtained from 10,000 replications.

Table A4. Panel Granger Causality Test Results (CBB vs. GDPPC)

H_0 : CBB does not cause GDPPC				
Countries	Statistics	1%	5%	10%
Bulgaria	2.810	62.735	38.182	28.826
Croatia	54.108***	38.701	20.648	14.513
Czech Rep.	1.689	29.457	14.167	8.930
Estonia	6.357	17.655	10.792	7.953
Hungary	25.935***	24.430	15.070	11.605
Latvia	8.341	51.380	31.275	24.000
Lithuania	9.045	46.315	30.685	24.682
Poland	4.219	17.301	9.478	6.336
Romania	7.080	78.554	51.787	41.636
Slovak Rep.	0.016	56.777	33.496	24.691
Slovenia	19.297	42.357	27.113	21.500
H_0 : GDPC does not cause CBB				
Bulgaria	3.152	28.628	17.394	13.530
Croatia	0.308	14.220	7.684	5.259
Czech Rep.	13.656***	11.626	5.939	3.846
Estonia	37.377***	13.062	8.539	6.443
Hungary	0.711	13.188	8.724	6.747
Latvia	1.322	11.194	6.523	5.083
Lithuania	6.198	13.043	8.969	7.118
Poland	2.713	8.844	5.236	3.794
Romania	0.074	9.596	5.598	3.999
Slovak Rep.	11.431	30.927	18.262	13.288
Slovenia	0.584	6.634	3.653	2.460

Table A5. Panel Granger Causality Test Results (NIM vs. GDPPC)

H_0 : NIM does not cause GDPPC				
Countries	Statistics	1%	5%	10%
Bulgaria	0.946	79.813	42.057	29.285
Croatia	7.380	88.828	46.997	32.979
Czech Rep.	3.556	60.375	35.825	27.240
Estonia	7.809	39.747	21.134	14.585
Hungary	8.587*	23.503	11.871	8.215
Latvia	0.776	66.497	31.573	19.476
Lithuania	4.710	43.489	22.567	15.417
Poland	0.075	55.921	27.834	18.669
Romania	13.703	170.381	90.737	67.918
Slovak Rep.	4.309	89.604	47.946	34.269
Slovenia	6.170	103.325	59.388	44.703
H_0 : GDPC does not cause NIM				
Bulgaria	3.738	14.616	8.653	6.609
Croatia	11.747	34.053	18.422	13.137
Czech Rep.	0.853	16.589	9.852	7.543
Estonia	0.534	6.668	3.566	2.489
Hungary	28.519**	29.106	19.868	16.105
Latvia	0.955	18.895	10.552	7.839
Lithuania	0.119	19.813	12.112	9.005
Poland	4.030	24.992	12.162	7.993
Romania	3.269	87.379	53.010	41.809
Slovak Rep.	0.180	11.419	6.047	4.158
Slovenia	16.378	64.244	39.960	30.477

Table A6. Panel Granger Causality Test Results (Z-score vs. GDPPC)

H_0 : Z-score does not cause GDPPC				
Countries	Statistics	1%	5%	10%
Bulgaria	2.402	21.785	9.710	6.176
Croatia	122.499***	65.148	33.080	23.040
Czech Rep.	1.905	55.695	28.252	19.708
Estonia	5.318	42.219	23.208	16.659
Hungary	11.178 *	38.723	17.598	10.884
Latvia	41.759	135.204	82.671	65.920
Lithuania	1.513	182.789	117.292	91.771

Poland	11.157*	40.376	18.228	11.720
Romania	0.043	20.786	10.101	6.731
Slovak Rep.	24.131*	54.619	27.311	17.550
Slovenia	34.976	112.839	61.351	43.797
H_0: GDPC does not cause Z-score				
Bulgaria	2.539*	6.124	3.417	2.379
Croatia	13.323	42.499	26.161	19.774
Czech Rep.	0.652	6.624	3.586	2.480
Estonia	1.533	12.432	6.146	4.155
Hungary	0.436	15.891	7.807	5.134
Latvia	0.355	10.851	6.148	4.430
Lithuania	0.001	12.688	6.608	4.381
Poland	1.558	15.093	7.950	5.534
Romania	0.030	13.852	7.748	5.628
Slovak Rep.	3.448	17.060	8.658	5.826
Slovenia	1.459	13.709	7.285	4.935

Table A7. Panel Granger Causality Test Results (SMC vs. GDPPC)

H_0: SMC does not cause GDPPC				
Countries	Statistics	1%	5%	10%
Bulgaria	16.801	51.178	30.064	22.044
Croatia	0.041	65.500	35.157	26.229
Czech Rep.	2.753	18.279	9.684	6.798
Estonia	0.007	43.495	22.002	14.720
Hungary	0.016	23.905	11.822	7.896
Latvia	0.223	17.770	9.089	5.964
Lithuania	0.486	27.210	15.962	11.762
Poland	5.813	32.509	16.973	11.628
Romania	4.346	25.756	14.517	10.349
Slovak Rep.	20.422*	45.389	24.502	16.572
Slovenia	9.276	71.227	39.783	28.163
H_0: GDPC does not cause SMC				
Bulgaria	13.331	34.316	21.386	16.155
Croatia	11.564	43.587	23.667	16.321
Czech Rep.	0.296	10.446	5.526	3.873
Estonia	8.681	22.911	15.406	12.290

Hungary	0.213	18.504	9.268	6.216
Latvia	20.249**	21.460	15.124	12.727
Lithuania	17.805**	22.010	15.408	12.629
Poland	5.094	30.331	18.173	12.972
Romania	0.051	14.513	7.778	5.295
Slovak Rep.	0.011	22.062	10.844	7.110
Slovenia	0.701	22.385	11.443	7.528

Table A8. Panel Granger Causality Test Results (NOC vs. GDPPC)

H_0 : TR does not cause GDPPC				
Countries	Statistics	1%	5%	10%
Bulgaria	9.889	70.817	37.372	26.050
Croatia	47.199***	19.147	9.921	6.749
Czech Rep.	1.323	31.019	16.652	11.307
Estonia	0.149	48.376	23.240	14.767
Hungary	103.190***	87.136	48.922	36.288
Latvia	2.038	59.244	34.649	25.171
Lithuania	20.883	172.237	95.636	67.987
Poland	16.770***	22.312	11.813	7.923
Romania	0.034	54.356	28.075	18.865
Slovak Rep.	8.409	34.330	17.901	13.028
Slovenia	11.218	46.466	24.888	17.673
H_0 : GDPC does not cause TR				
Bulgaria	35.519***	19.847	9.110	5.937
Croatia	0.858	24.907	12.218	8.074
Czech Rep.	10.218	44.612	30.037	24.577
Estonia	2.829	21.209	11.558	8.128
Hungary	0.620	14.076	6.365	4.112
Latvia	40.488***	22.543	13.268	9.984
Lithuania	15.025*	30.790	18.522	14.457
Poland	7.456*	19.811	10.431	6.926
Romania	1.957	11.356	6.050	4.317
Slovak Rep.	0.630	53.289	32.058	24.429
Slovenia	9.517	43.307	23.290	16.840

Table A9. Panel Granger Causality Test Results (TR vs. GDPPC)

H_0 : NOC does not cause GDPPC				
Countries	Statistics	1%	5%	10%
Bulgaria	1.520	31.583	15.346	10.148
Croatia	77.248***	69.448	36.112	24.271
Czech Rep.	1.049	70.492	36.091	25.755
Estonia	0.902	26.134	13.626	9.426
Hungary	9.382*	23.738	9.642	5.827
Latvia	1.296	104.356	61.231	46.222
Lithuania	0.763	93.963	53.982	40.404
Poland	30.971***	22.977	11.461	7.335
Romania	0.006	14.540	7.186	4.809
Slovak Rep.	6.008	92.288	52.648	39.311
Slovenia	2.308	43.677	27.371	20.617
H_0 : GDPC does not cause NOC				
Bulgaria	19.390	12.097	6.870	4.928
Croatia	0.349	41.052	24.425	18.152
Czech Rep.	1.875	20.091	12.915	9.927
Estonia	48.029	31.294	19.532	15.869
Hungary	1.758	14.712	8.871	6.567
Latvia	20.291	66.586	41.969	32.891
Lithuania	3.002	25.393	14.639	10.809
Poland	12.087	44.779	30.611	25.231
Romania	73.748	32.159	16.602	12.181
Slovak Rep.	1.843	27.714	16.100	12.131
Slovenia	2.810	17.039	10.724	8.202

Table A10. Panel Granger Causality Test Results (SPV vs. GDPPC)

H_0 : SPV does not cause GDPPC				
Countries	Statistics	1%	5%	10%
Bulgaria	11.284	30.040	18.548	13.935
Croatia	9.708*	19.205	11.080	7.673
Czech Rep.	7.842	38.886	24.648	18.576
Estonia	2.213	95.761	60.505	48.531
Hungary	2.352	54.478	33.317	26.438
Latvia	4.814	96.722	58.802	44.689
Lithuania	0.045	83.090	52.776	42.649

Poland	0.014	7.958	4.155	2.787
Slovak Rep.	0.439	48.863	23.467	15.989
Slovenia	37.769**	45.485	27.272	19.152
H_0 : GDPC does not cause SPV				
Bulgaria	0.553	16.172	10.187	7.579
Croatia	0.882	22.008	12.865	9.293
Czech Rep.	0.072	22.628	12.777	8.346
Estonia	0.743	29.004	16.652	12.486
Hungary	0.437	33.064	16.415	10.677
Latvia	1.238	16.546	7.633	5.209
Lithuania	0.010	21.441	10.843	7.181
Poland	0.395	35.507	20.581	14.720
Slovak Rep.	0.500	21.167	11.110	7.462
Slovenia	1.024	11.457	6.382	4.142