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Financial and economic development link in transitional economies: a spectral Granger causality analysis 1991–2017

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Abstract

Research background: The relationship between financial development and economic growth has been attracting attention in the field of economics since the times of the "great moderation". Previous empirical studies still fail to put forward a general conclusion on whether and how financial development affects economic growth. This is particularly true due to the lack of empirical research on the matter in question for countries in transition.
Purpose of the article: This study aims to contribute to bridging the gap in the financial development-growth nexus in transitional economies. Understanding the mechanism behind financial development and economic growth should assist policymakers in the design of efficient economic policies or avoiding/alleviating financial cycles.
Methods: Using Granger causality test in frequency domain, which shows to have more power over standard time domain Granger causality test, as well as gross domestic product (GDP) and the monetary base (M2 — intermediate money), we investigated the finance-growth relationship in 19 Central, East, and Southeast European countries (CESEE) from 1991 to 2017.
Findings & Value added: Study results show that financial development is important for growth in CESEE countries, thus supporting the "supply-leading" theories in general for countries in the sample. Our findings indicate that the relationship between financial development and economic

growth exists in CESEE countries (with one exception — the Czech Republic) ranging from unidirectional (Albania, Bosnia and Hercegovina, Belarus, Estonia, Macedonia, Russia, Turkey), to bi-directional spectral Granger causality (Bulgaria, Croatia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Slovenia, Slovakia, Ukraine).

Introduction

Financial development and economic growth nexus attracted general research in the field of finance. This paper investigates the link between financial development and economic growth in transitional economies using spectral Granger causality technique. Results show the existence of the long-run relationship between financial development and economic growth in most transitional countries. The question on the causal relationship between the two is important particularly for transitional economies trying to converge with advanced economies. From the start, transitional economies had to reset their economic systems in general (price and market liberalization, fiscal and monetary policy, institutional background) including the restructuring of their financial system. Different transitional economies adopted other restructuring policies for financial markets. Consequently, financial development in any of the transitional economies followed a different evolutionary path. This path, in turn, was mainly defined by the monetary policy (monetary sovereignty) role in economic growth. The choice of the monetary policy role determines the relationship between financial development and economic growth for transitional economies. For example, in Croatia the main target of the monetary policy was the introduction of monetary sovereignty. Restructuring and privatization of the financial system driven by high demand for lending had an important role in the future economic growth of the Croatian economy. Changing economic growth dynamics of the economy demanded similar changes in the lending policies of financial institutions. Therefore, in Croatia financial development had a "supply leading" (Schumpeter, 1934/2010; Patrick, 1966) role at the beginning of transition, due to the lack of financial sources for economic activities on the market. Economic growth rates after 2000 averaging around 5% annually required more advanced loan policy leading to the development of financial sectors turning to the "demand following" side (Robinson, 1979). This could be the case for most of the transitional economies except for the ones with strong inward foreign direct investments like the Czech Republic.

Understanding the relationship between financial development and economic growth is important for policymakers and financial institutions managers. Policy makers, central bank governors in countries where financial

development has a "supply leading" role should closely monitor banks' lending policies. Failure to do so can result in financial cycles triggering business cycles in the economy. Previous studies (Koivu, 2004) show the efficiency of the banking sector has beneficial effects on economic growth, but the link between credits and economic growth is more ambiguous. Studies on the financial development-growth link usually take panel data to analyze the relationship, (Gaffeo & Garalova, 2013) find positive links between them in the long run and negative in the short run. The appropriate choice of indicators as a proxy for financial development also affects potential empirical results (Cojocaru *et al*., 2015).

Since the choice of the proxy for financial development show a large impact on different studies empirical results and there is still no consensus on using monetary indicators (M2) or debt indicators (private credit share in the GDP) we focus on the modeling issue. We decide to use the monetary base index (M2) as a proxy for financial development based on the historical experience for transitional economies. Prior to the transition, monetization in countries in transition was directly influenced by central banks and not through bank intermediation. Moving to free markets economy resulted in the limited impact of the central banks (inflation targeting policies) shifting the importance to bank intermediation. Therefore, increasing monetary base (M2) in the case of countries in transition after 1990 is mostly a direct consequence of growing bank intermediation. To capture the nonbiased empirical relationship between financial development and economic growth, more effort should be on the methodology used in the analysis. The choice of the proper linear and non-linear models highly impacts the empirical results of studies. Spectral methods (Harvey, 1975) show to have advantages over standard linear and non-linear methods in the studies of long time series (financial data). For this reason, we use Granger spectral causality method developed by (Breitung & Candelon, 2006) to analyze the causality between financial development and economic growth in the frequency domain spectrum.

The remainder of the article is structured as follows. Section II provides an analysis of the degree of monetization and economic growth in transitional economies. Section III discusses the methodology and main variables used in the Granger spectral causality model. Section IV presents the results and Section V provides some concluding remarks on the financial development-growth nexus.

Literature review

The review of empirical studies that focus on financial development and economic growth highlights the following taxonomy of research perspective: causality relationship, cross-country/multi-country, time series, and methodology. Most of the previous research on the relationship between financial development and economic growth relates to multinational studies, less to individual economies. The presented research review refers only to European countries, especially limited transition economies. The results presented below include especially those from the last decade.

Drakos (2002), using data regarding 185 banks from a number of transition countries such as: Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovakia from 1993 to 1999, explored whether the entry of foreign banks had any significant effect on net interest margins. The empirical findings confirm that margins have significantly decreased across time for the group taken as a whole.

With reference to the above results, Koivu (2004) investigated the relationship between efficiency, the size of the banking sector (using interest rate margin and amount of credit allocated to the private sector) and economic growth by using panel data for 25 transition countries over the period 1993–2001. The obtained result led to the conclusion that an efficient banking sector, where interest rate margins are low, accelerates GDP growth.

Poland, as an example of transition economy, was subject to research conducted by Kenourgios and Samitas (2007). The aim of the research was to focus on the long-lasting relationship between finance and economic growth using quarterly data from 1994:Q1 until 2004:Q4. It was found that in the long run, credits to the private sector have been one of the main forces in the Polish economic growth. It also confirms that financial development, not economic development, is not driven by endogenously determined variables. Those results are not convergent with the results for Poland obtained by Skare *et al*. (2019a) by employing data regarding the period from 1990 to 2018, which stated that financial development plays a significant role in both economic growth and credit growth, and, in turn, favours more rapid development of the financial sector (bi-directional causal relationship). Moreover, Poland was studied by Folwarski (2016). He analyzed the relationship between credits and economic growth in Poland during the period 2005–2015. Folwarski found that both kinds of credits significantly foster economic growth.

Caporale *et al.* (2009), by investigating 10 new EU members over the period 1994–2007, found that the causality of the finance-growth relation-

ship is unidirectional (financial development to economic growth). Próchniak (2011) analyzed the determinants of economic growth in 10 CCE countries over the period 1993–2009. It was found that the most important economic growth determinants in CEE countries are investment rate (including FDI), human capital measured by the education level of the labor force, financial sector development, good fiscal stance (low budget deficit and low public debt), economic structure (high services share in GDP), low interest rates and low inflation, population structure (high share of working age population), development of information technology and communications, high private sector share in GDP and favorable institutional environment (economic freedom, progress in market and structural reforms).

On a panel of 27 countries in transition, Akimov *et al.* (2009) fond a positive and strong empirical link between financial development and economic growth.

Using a sample of 16 transition economies from Central and South Eastern Europe over the period 1991–2011, Petkovski and Kjosevski (2014) studied whether the banking sector (bank credit to private sector, interest rates and ratio of quasi money RQM) influences economic growth. The results show that economic growth is triggered negatively by credit to private sector and interest margin, and positively by ratio of quasi money.

Research with similar aim was carried out by Sassi and Gasmi (2014). Using a sample of 27 European countries over the period 1995–2012, the authors examined the effects of household and corporate credit on economic growth. It was found that corporate credit has positive effect on economic growth in contrast to household credit. Using smaller sample of thirteen transition economies over the period 1995–2007, Angjelkovska *et al*. (2016) also confirmed that corporate credits accelerate economic growth, while the results regarding the household credits are ambiguous. By setting the same research goal, Bahadir and Valev (2017) investigated 30 European countries over the period 1995–2013, to find that the process of financial convergence may slow down over time, as well as that it is stronger in the case of transition economies and mostly related to household credit. Skare *et al.* (2019b) carried research on individual economy, i.e. Croatia, over the period 1990–2018. They found that more robust and valid results are obtained when using the credit structure as a proxy variable for finance. It shows that credits to firms versus loans to household have a different impact on economic growth. Credits to household are more sensitive to economic crises and have a negative long-term impact on economic growth. On the other hand, credit to firms has a positive impact on economic

growth, and in the long run, increases export and openness thus leading to a rise in investments and employment.

Gaffeo and Garalova (2014) used sample studies of the finance-growth nexus. The obtained results confirm that the long-run positive relationship between financial development and economic growth is positive, whereas short-run relationship is negative. Cojocaru *et al*. (2016) empirically investigated the effect of financial sector development on economic growth that concerned ten CIS countries and fifteen CEE countries over the period 1990–2008. The research results confirm that financial system efficiency and competitiveness is more important than the amount of private sector credit provided by the banking system.

The above research goal is similar to the one set by Bongini *et al*. (2017). They used sample of Central, Eastern and South-Eastern European (CESEE) countries in the post-communist era over the period 1995–2014. Their findings question the current results, stating that bank credit fosters economic growth. The aspect of financial crisis with regard to the relationship between financial development and economic growth was the subject of research conducted by Asteriou and Spanos (2018). They used a panel dataset of 26 European Union countries over the period 1990–2016. Their results led to a conclusion that in the period before the crisis, financial development accelerated economic growth, while after the crisis it had an opposite effect. At the same time, growth was triggered in both periods, especially by the degree of international trade openness in the economy of a country.

Although there is no consensus on the obtained results regarding the relationship between financial development and economic growth in European countries, or more specifically, transition economies, on average this relationship was confirmed. The presented literature review clearly shows that individual economy study brings closer the specificity of results. This knowledge allows for more detailed consideration of the results of surveys regarding many countries, especially transition economies as a group, which in this case is a valuable set of information.

Data and empirical modeling

To study the effects of financial development and economic growth in transitional economies, we use quarterly data on the gross domestic product (GDP) and the monetary base (M2 — intermediate money) from 1991–2017 from the Vienna Institute for International Economic Studies (WIIW) annual and monthly database (“WIIW Databases Central, East and South-

east Europe", 15.11.2018.). Data not available (prior to 1993) from the WIIW database were replaced with the data from the European bank for reconstruction and development (EBRD) — selected economic indicators database, 2010 ("European bank for reconstruction and development selected economic indicators", 01.12.2018.). Data on the GDP are available as annual data and transformed to quarterly data using low frequency to high-frequency conversion method in Eviews 10.0 using quadratic match average method. Intermediate money data (M2) are available as monthly data, and we convert it to quarterly data using high to low-frequency conversion method (quadratic match average method).

Countries used in the sample are Albania (AL), Bulgaria (BG), Bosnia and Hercegovina (BA), Belarus (BY), Croatia (HR), Czech Republic (CZ), Estonia (EE), Hungary (HU), Kazakhstan (KZ), Lithuania (LT), Latvia (LV), Macedonia (MK), Poland (PL), Romania (RO), Russia (RU), Slovenia (SI), Slovakia (SK), Turkey (TU), Ukraine (UA) from 1991–2017.

Economic growth is best approximated using quarterly GDP growth rate in percent compared to the same quarter of the previous year. Seasonal adjustments, in this case, are not necessary, since possible seasonal bias is eliminated through the low/high-frequency data conversion methods. Among a large selection of proxy indicators for financial development, ranging from conventional measures of the banking sector as the ratio of M2 to GDP and the ratio of private credit to GDP. Instead of using conventional proxies, which in turn each have advantages and flaws, we use data on intermediate money (logarithm of M2) as a proxy for financial development in transitional economies. The reason for such a choice lies in the nature of the monetary and banking system for countries in transition. Prior to 1990, monetization of the system in transition economies depended only on the central bank money printing machines to deal with rising debts and budget deficits. After the transition to market economy, transitional economies abandoned the money printing policy and soft budget constraint policy, although not to the same extent, a large difference between transitional economies exists. Consequently, all transitional economies adopted the inflation targeting policy, not the same targeted inflation level, however. Under the inflation targeting policy in place, increase/decrease in the intermediate money flow (M2) was directed through the banking system and banks intermediation. For this reason, (M2) is a more appropriate proxy of financial development for countries in transition. This particularly holds since countries in transition experienced diverging economic growth paths. Therefore, using relative indicators (share in the GDP) could result in statistical bias during empirical modeling.

Empirical results

Frequency domain Granger causality test show more power handling statistical issues when modeling financial data. Statistical issues involved include stationarity/non-stationarity, linearity/non-linearity, spurious non-causality (Hiemstra & Jones, 1994), inverse causality effects, trending data (Corbae, 2002). Spectral analysis modelling shows advantages over using traditional econometric techniques when modeling high-frequency data, specifically financial data. Therefore, to study the relationship between financial development and economic growth in transitional economies underlying many statistical issues (divergence in data collection), we use the frequency domain (spectral) Granger causality. Spectral Granger causality test is based on the work of (Breitung & Candelon, 2006) and adapted by (Pulido, 2016) for using in Eviews 10.0. Using spectral Granger causality test eliminates the problem of possible non-causality bias in the presence of cointegration and both "supply and demand following hypothesis".

To avoid possible non-causality bias, first, we test all the series for stationarity/non-stationarity using standard unit root tests. We use augmented Dickey-Fuller test (ADF), (Dickey, 1979), Phillips and Perron (PP) (Phillips & Perron 1988) and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test (Kwiatkowski, 1992). Test results are visible in Table 1. Plots of the series (not presented here) show data are non-stationary in level and stationary in their difference. Same plots show that variables exhibit a trend indicating the presence of a possible co-integration relationship.

Table 1 shows series (M2) to be integrated of order 1, that is, I (1). The results of the stationarity test for the GDP show stationarity, except in the case of Hungary, Kazakhstan, Slovenia, and Ukraine. Because unit root test results for the GDP series exhibit mixed results (stationary for some countries and nonstationary for other likely because the presence of long memory), we proceed with the testing for possible co-integration. We test the relationship between the GDP growth rate and (M2) growth rate by applying the Johansen co-integration test (Johansen, 1991; Johansen, 1995), (Johansen & Juselius, 2009). Test results of the co-integration test are displayed in Table 2.

Trace test and Max-Eigen test reject the null hypothesis of no co-integrating relations (r=0) and fail to reject the null of one (1) co-integrating relation ($r \leq 1$) at 5% significance level. The only exception is Macedonia, for which no linear or nonlinear causality is found between financial development and economic growth. After testing for the presence of the unit root and co-integration, we perform linear Granger causality test to identify causal links between financial development and economic

growth in transitional economies (Granger, 1969). We present linear Granger causality test results in Table 3.

Table 3 shows the presence of "supply leading" relationship, meaning financial development affect economic growth for a majority of the transition economies in our sample. The only two exceptions are the Czech Republic and Poland showing the non-causality relationship between financial development and economic growth. The feedback loop between economic growth and financial development "demand following" hypothesis between financial development and economic growth) is not rejected for Croatia, Hungary, Kazakhstan, Latvia, Makedonia, Romania, Russia, and Ukraine. Bidirectional Granger causality, both supply leading and demand following theories hold in the case of Croatia, Hungary, Kazakhstan, Latvia, Russia, and Ukraine. In order to check for spurious Granger causality in the linear Granger causality test, we proceed with the nonlinear (frequency domain) Granger spectral causality test with the results presented in the graphical form (see figures below). We use Breitung (2006) and adapted by Pulido (2016) in the form:

$$F[2, T-K] = \frac{(Rb-q)'\left(R\left[s^2(X'X')^{-1}R'\right]^{-1}\right)(Rb-q)}{2} \qquad (1)$$

under the null hypothesis of H_0: $Rb = q$.

where:

- R – restriction matrix (of size 2k),
- k – number of estimated coefficients in a vector autoregression (VAR) model,
- b – estimated coefficients in the respective equation,
- q – 2x1 zero vector,
- s^2 – corresponding equation error of variance,
- X – T x k independent variables observations matrix.

Co-integration test results show a long-run relationship between financial development and economic growth in many countries in our sample, so the spectral Granger causality under co-integration: assumption takes the form of (Pulido, 2016):

$$\triangle\ z_t = \Theta(L) z_{t-q} + e_t \tag{2}$$

where:
$z_t = [x_t, y_t]$ – vector of financial development and economic growth variables,
L – lag operator,
e_t – error term.

Figure 1 shows test results of Granger spectral causality analysis for Albania, Bosnia and Hercegovina and Bulgaria.

From Figure 1 we can see that the results of linear Granger causality test differ from the spectral Granger causality test results inferring possible spurious results in linear Granger causality tests. Linear Granger causality test results show unidirectional Granger causality, financial development cause economic growth in Albania. Spectral Granger causality test results confirm the test results of the linear Granger causality test. Financial development causes economic growth at frequency 0.3 and 2.5, which corresponds to a cycle with a frequency of 3 quarters and half a quarter. Money supply in Albania affects the economic growth in the short run. Both time and frequency domain Granger causality test find no causality between economic growth and financial development in Albania. Time domain Granger causality for Bosnia and Hercegovina find financial development cause economic growth. Frequency (spectral) causality test confirm the time domain test results at a frequency of 0.08 corresponding to a cycle with a frequency of 13 quarters (long-run effects). Time domain causality test for Bulgaria finds financial development affect economic growth while loop feedback is statistically significant at 10% level. Spectral causality test results confirm financial development cause economic growth under a cycle from 0.7 to 17 quarters. Frequency domain test results contrast that of time domain since economic growth cause financial development over a cycle from 0.7 to 1 quarter.

Supply leading theory is confirmed by the time domain causality test both for Belarus and Croatia (see table 3). Spectral Granger causality test supports the time domain test results, proving that financial development affects economic growth in Belarus and Croatia under different cycles regimes. In Belarus, financial development affects economic growth in the short run (from 1 to 2 quarters), while in Croatia the cycle lasts around half a quarter. For Belarus, we don't find causality from economic growth to financial development and find it in Croatia corresponding to frequency 2.8, which is a cycle of 0.33 quarters. In the case of the Czech Republic, which is interesting, both time and frequency domain find no causality between financial development and economic growth and vice versa (see Figure 2).

Time domain causality test for Estonia finds a weak Granger causality between financial development and economic growth, and no causality between economic growth and financial development (see Figure 3). Spectral causality test supports the time domain causality test finding a weak spectral causality at a frequency of 3.05 corresponding to a cycle of 0.3 quarters. Financial development in Hungary affects economic growth as validated by the time domain causality test and no feedback causality from economic growth to financial development. Frequency domain causality test find financial development affects economic growth in Hungary with a cycle of 0.7–16. quarters. Spectral causality test contrasts the linear Granger causality test, finding economic growth to affect financial development in the long run (from 3 to 16 quarters). In Kazakhstan, financial development and economic growth show a bidirectional linear Granger causality. The same results hold also under a spectral Granger causality test.

Time domain causality test show financial development weakly affect economic growth while economic growth, in turn, significantly affects financial development in Lithuania. Spectral Granger causality test shows a strong bidirectional causality link between financial development and economic growth in Lithuania. Bidirectional causality link in Lithuania holds both in the short and long run. In the case of Latvia, time domain causality test finds a bidirectional causality link between financial development and economic growth. Same test results are confirmed by the frequency domain causality test results with economic growth affecting financial development in the long run and cyclical impact of financial development on the economic growth (regular cycles). Demand following theory holds for Macedonia, with time domain causality test finding economic growth to affect financial development both in the short and long run. Spectral Granger causality test results for Macedonia support the findings of the time domain test (see Figure 4).

Linear Granger causality test finds no short/long-run relationship between financial development and economic growth in Poland. This could be a case of spurious non-causality since co-integration test shows one co-integration vector exist between financial development and economic growth in Poland. In fact, frequency domain causality test shows the existence of bi-directional spectral Granger causality between financial development and economic growth in Poland. Financial development affects economic growth under the 5 quarters cycle regime (see Figure 5). Demand following theory is proved by spectral causality test with economic growth affecting financial development in Poland under 1.6–16 quarters regime cycle. Time domain causality test show demand following theory also holds

for the case of Romania, with no sign of occurrence of supply leading. Spectral Granger causality test (as in the case of Poland) reveals spurious non-causality, since test results show the presence of bi-directional spectral causality between financial development and economic growth in Romania. Financial development impacts economic growth in the short run 1–4 quarters with demand following theory holding both in the short run (1.6 quarters) and long run (14 quarters). Spectral causality test results endorse time domain causality test results with supply leading hypothesis holding for Russia and rejecting the supply leading hypothesis. Financial development affects economic growth in Russia corresponding to a 1–4 quarters cycle.

Linear Granger causality test results show no relationship between financial development and economic growth in Slovenia, rejecting both supply leading and demand following theory. Frequency domain causality test contrast with the time domain test results, showing evidence of weakly supply leading and weakly demand following behavior in Slovenia. Time domain causality test results point to the weakly supply leading behavior in Slovakia, with results not supporting the demand following assumptions. Again, spectral Granger causality test results detect spurious non-Granger causality, with test results supporting the bi-directional causality between financial development and economic growth in Slovakia. Financial development affects economic growth in Slovakia corresponding to a cycle of 2–14 quarter. Test results show economic growth influence financial development in Slovakia in the short run — under a 1–year cycle (see Figure 6). Supply leading theory holds for Turkey under the time domain Granger causality test results. Spectral causality test results support the time domain causality results, proving that financial development in Turkey impacts economic growth over a 2–14 quarters cycle.

Linear Granger causality test results for Ukraine show both supply-leading and demand-following hypothesis hold for Ukraine. The same results are supported by the test results of the frequency domain causality test. Financial development affects economic growth in Ukraine under the cycle of 9 quarters and economic growth influence financial development corresponding to a 0.7 and 4 quarters cycles. We can observe that spectral Granger causality test results mainly support the time domain Granger causality test results, but also discover some spurious non-Granger causality as in the case of Poland, Romania, Slovenia, Slovakia. Spectral Granger causality test shows more power in relation to the time domain Granger causality test in the search for the financial development — economic growth link.

Discussion

The study results contrast with the ones of Dawson (2003), Djalilov and Piesse (2011), and support findings in Gaffeo and Garalova (2013), Cojocaru *et al*., 2015), Akimov *et al*. (2009), Oskonbaeva (2018), Graff, (2003), Simionescu *et al.* (2018), Próchniak (2011). Our findings indicate that financial development and economic growth link exists in (CESEE) countries, ranging from non-, through unidirectional, to bi-directional spectral Granger causality (see Table 4).

From Table 4 we can see that the supply-leading hypothesis holds for the majority of countries except for the Czech Republic and Macedonia. The demand-following theory holds for Bulgaria, Croatia, Hungary, Kazakhstan, Latvia, Lithuania, Macedonia, Poland, Romania, Slovenia, Slovakia, Ukraine. Bi-directional Granger causality is present in Bulgaria, Croatia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Slovenia, Slovakia, and Ukraine. The absence of causality link between financial development and economic growth in the Czech Republic can be attributed to large FDI inflows in the country and a strong industrial base not depending on banks' financial lendings. Another possible explanation is the gradualist approach in the macroeconomic transition policies, as well as the selected model of voucher privatization.

Conclusions

This study investigates the relationship between financial development and economic growth in 19 Central, East and Southeast European countries (CESEE) from 1991–2017. This research contributes to the financial literature by studying the supply-leading and demand-following theories for countries in transition using frequency domain causality test (spectral Granger causality test). Previous limited studies on the link between financial development and economic growth use time domain (linear models) having important statistical issues and drawbacks.

Our study empirically validates the importance of financial development for economic growth for countries in transition using non-linear estimation models (spectral Granger causality). We observe that frequency domain Granger causality test show more power in relation to the time domain Granger causality test. Spectral Granger causality also detects spurious non-Granger causality when present. Consequently, researchers willing to study the financial development and economic growth link (not only for

countries in transition) should be aware of this fact and use frequency domain causality tests.

Empirical results in this study show policymakers should direct more of their attention to channels and models of bank intermediation since they affect economic growth. Policymakers not aware of this fact could overview the importance of bank intermediation for economic growth resulting in the faulty design of economic policy and future financial and business cycles. This study provides strong empirical support of the importance of financial development for future growth of an economy.

Sample data present one of the main limitations of this research. The causal relationships were tested under possible long memory presence in the GDP series demanding more appropriate Granger causality techniques for fractionally integrated series. The confidence in this study results could be strengthened with access to additional financial development proxy variables (efficiency variables versus monetization indicators as in this study) and by applying regime changes modeling techniques. Future research on financial development and economic growth link should use fractionally integrated and regime switching models.

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Annex

Table 1. Unit Root Test

Series	***ADF***	***ADF***	***PP***	***PP***	***KPSS***	***KPSS***
	Level	*Difference*	*Level*	*Difference*	*Level*	*Difference*
AL						
LM2	*-3.162379***	*-6.451632****	*-1.620538*	*-6.993415****	*0.956994****	*0.097710*
GDP	*-2.393614*	*-4.551578****	*-3.020805***	*-4.519207****	*0.442127**	*0.029719*
BA						
LM2	-	-	-	-	-	-
GDP	*-2.787420**	*-2.570335**	*-1.725104*	*-3.634618****	*0.674997**	*0.060321*
BG						
LM2	*-7.188689****	*-7.665762****	*-2.898707***	*-6.467384****	*0.613748***	*0.023303*
GDP	*-3.218322***	*-2.996828***	*-3.212174***	*-5.246964****	*0.120722*	*0.076149*
BY						
LM2	*-4.040507****	*-1.768903*	*-5.763771****	*-5.727708****	*1.130640****	*1.008920****
GDP	*-2.842995**	*-3.405396***	*-3.051798***	*-3.818406****	*0.266519*	*0.291422*
HR						
LM2	*-2.984449***	*-5.548744****	*-2.176108*	*-5.487230****	*0.835920****	*0.052529*
GDP	*-3.127942***	*-2.551256**	*-2.068246*	*-4.168753****	*0.517233***	*0.082775*
CZ						
GDP	*-3.912538****	*-3.862397****	*-2.408291*	*-4.184833****	*0.114081*	*0.051469*
LM2	*-3.601565****	*-8.171379****	*-3.389235***	*-7.477441****	*0.159693*	*0.067164*
EE						
GDP	*-4.212249****	*-3.324369***	*-2.697763**	*-3.989534****	*0.235867*	*0.049668*
LM2	*-1.553803*	*-5.373456*	*-2.574064*	*-6.020468****	*0.440801**	*0.047388*
HU						
GDP	*-2.070958*	*-2.507021*	*-2.106310*	*-4.543773****	*0.219751*	*0.070850*
LM2	*-1.721466*	*-2.540767**	*-1.738887*	*-6.809980****	*0.919312****	*0.123557*
KZ						
GDP	*-2.256547*	*-2.260970*	*-3.215096***	*-3.217120***	*0.290402*	*0.370411**
LM2	*-2.271786*	*-6.511549****	*-4.781348****	*-10.11237****	*0.452414**	*0.176820*

Table 1. Continued

Series	***ADF***	***ADF***	***PP***	***PP***	***KPSS***	***KPSS***
	Level	*Difference*	*Level*	*Difference*	*Level*	*Difference*
LV						
GDP	*-2.567855**	*-2.677679**	*-2.359479*	*-3.323405***	*0.201446*	*0.050603*
LM2	*-1.135999*	*-5.939029****	*-3.460776***	*-6.090028****	*0.294901*	*0.036498*
LT						
GDP	*-4.360212****	*-3.328117***	*-3.270254***	*-4.248598****	*0.164199*	*0.097193*
LM2	*-1.564263*	*-8.268216****	*-3.546346****	*-6.285584****	*0.703026***	*0.087273*
MK						
GDP	*-3.222535***	*-3.271289***	*-2.702304**	*-4.310019****	*0.211323*	*0.141825*
LM2	*-2.486588*	*-6.650330****	*-5.399075****	*-10.17482****	*0.526570***	*0.264531*
PL						
GDP	*-2.853457**	*-2.690208**	*-2.239196*	*-4.154878****	*0.375759**	*0.072488*
LM2	*-3.155212***	*-5.481722****	*-10.10967****	*-50.42116****	*0.323122*	*0.200392*
RO						
GDP	*-2.924230***	*-3.153235***	*-2.194486*	*-4.228236****	*0.098463*	*0.075057*
LM2	*-1.946214*	*-7.790090****	*-5.759456****	*-24.80522****	*1.165765****	*0.098957*
RU						
GDP	*-2.869299**	*-3.310465***	*-3.069800***	*-4.543585****	*0.251869*	*0.209581*
LM2	*-1.065387*	*-4.571639****	*-7.390857****	*-21.36194****	*0.620596***	*0.318829*
SI						
GDP	*-2.044359*	*-2.824687**	*-2.335436*	*-4.387424****	*0.470012**	*0.074656*
LM2	*-2.306576*	*-5.310313*	*-3.627861****	*-5.240913****	*1.073774****	*0.227166*

Note: ***, ** and * denote significance at 1%, 5% and 10% respectively. Maximum lag length for the test was selected based on the lag length criteria (lag length test) considering loss in the degrees of freedom.

Table 2. Johansen-Juselius Cointegration Test Results

HYPOTHESIZED NO. OF CE(S)	*TRACE STATISTICS*	*MAX-EIGEN STATISTICS*	*CRITICAL VALUES*	
			Trace	*Max-Eigen*
		AL		
R = 0	*36.38678**	*34.14191**	*15.49471*	*14.26460*
R ≤ 1	*2.244867*	*2.244867*	*3.841465*	*3.841465*
		BA		
R = 0	*18.41420**	*13.18226**	*15.49471*	*14.26460*
R ≤ 1	*3.231946*	*3.231946*	*3.841465*	*3.841465*
		BG		
R = 0	*121.2552**	*118.2232**	*15.49471*	*14.26460*
R ≤ 1	*3.031987*	*3.031987*	*3.841465*	*3.841465*
		BY		
R = 0	*10.32219*	*10.28617*	*15.49471*	*14.26460*
R ≤ 1	*0.036021*	*0.036021*	*3.841465*	*3.841465*
		HR		
R = 0	*16.28172**	*14.34892**	*15.49471*	*14.26460*
R ≤ 1	*3.532794*	*3.532794*	*3.841465*	*3.841465*
		CZ		
R = 0	*23.33301**	*14.87576**	*15.49471*	*14.26460*
R ≤ 1	*3.457246*	*3.457246*	*3.841465*	*3.841465*
		EE		
R = 0	*27.44810**	*21.13517**	*20.26184*	*15.89210*
R ≤ 1	*6.312928*	*6.312928*	*9.164546*	*9.164546*
		HU		
R = 0	*17.74587**	*16.53915**	*15.49471*	*14.26460*
R ≤ 1	*1.206715*	*1.206715*	*3.841465*	*3.841465*
		KZ		
R = 0	*15.64945**	*13.48142*	*15.49471*	*0.0662*
R ≤ 1	*2.168034*	*2.168034*	*3.841465*	*0.1409*
		LV		
R = 0	*16.11123**	*13.98027*	*15.49471*	*14.26460*
R ≤ 1	*2.130955*	*2.130955*	*3.841465*	*3.841465*
		LT		
R = 0	*20.47853**	*18.70249*	*15.49471*	*0.0093*
R ≤ 1	*1.776045*	*1.776045*	*3.841465*	*0.1826*
		MK		
R = 0	*9.909273*	*7.719656*	*15.49471*	*14.26460*
R ≤ 1	*2.189617*	*2.189617*	*3.841465*	*3.841465*
		PL		
R = 0	*24.15134**	*20.31993**	*15.49471*	*14.26460*
R ≤ 1	*3.831410*	*3.831410*	*3.841465*	*3.841465*
		RO		
R = 0	*43.44951**	*40.37627**	*15.49471*	*14.26460*
R ≤ 1	*3.073241*	*3.073241*	*3.841465*	*3.841465*
		RU		
R = 0	*62.45062**	*54.72304**	*25.87211*	*19.38704*
R ≤ 1	*7.727579*	*12.51798*	*7.727579*	*12.51798*
		SI		
R = 0	*16.16399**	*12.43264*	*15.49471*	*14.26460*
R ≤ 1	*3.731349*	*3.731349*	*3.841465*	*3.841465*
		SK		
R = 0	*21.89075**	*19.38727**	*15.49471*	*14.26460*
R ≤ 1	*2.503485*	*2.503485*	*3.841465*	*3.841465*

Table 2. Continued

HYPOTHESIZED NO. OF CE(S)	*TRACE STATISTICS*	*MAX-EIGEN STATISTICS*	*CRITICAL VALUES* *Trace*	*Max-Eigen*
		SK		
R = 0	*21.89075**	*19.38727**	*15.49471*	*14.26460*
R ≤ 1	*2.503485*	*2.503485*	*3.841465*	*3.841465*
		TR		
R = 0	*18.43148**	*15.24454*	*15.49471*	*14.26460*
R ≤ 1	*3.186944*	*3.186944*	*3.841465*	*3.841465*
		UA		
R = 0	*15.75637**	*15.54980**	*15.49471*	*14.26460*
R ≤ 1	*0.206571*	*0.206571*	*3.841465*	*3.841465*

Note: Trace test and Max-Eigen test reject the null hypothesis of no cointegrating relations (r=0), fail to reject the null of one (1) cointegrating equation at 5% significance level.

Table 3. Linear Granger Causality Test Results

Granger causality	*F-stat*	*P-value*
	AL	
LM2 to GDP	*3.90665****	*0.0004*
GDP to LM2	*0.84740*	*0.5858*
	BA	
LM2 to GDP	*2.74992***	*0.0201*
GDP to LM2	*0.17616*	*0.9823*
	BG	
LM2 to GDP	*3.28197****	*0.0015*
GDP to LM2	*1.89310**	*0.0591*
	BY	
LM2 to GDP	*2.23565***	*0.0257*
GDP to LM2	*1.08031*	*0.3945*
	HR	
LM2 to GDP	*2.30950***	*0.0355*
GDP to LM2	*2.14805***	*0.0497*
	CZ	
LM2 to GDP	*0.31196*	*0.9288*
GDP to LM2	*1.57814*	*0.1657*
	EE	
LM2 to GDP	*2.02762**	*0.0712*
GDP to LM2	*1.16108*	*0.3429*
	HU	
LM2 to GDP	*2.05406***	*0.0426*
GDP to LM2	*1.78712**	*0.0822*
	KZ	
LM2 to GDP	*3.48315****	*0.0020*
GDP to LM2	*3.23063****	*0.0036*
	LV	
LM2 to GDP	*1.97218**	*0.0674*
GDP to LM2	*2.73359***	*0.0130*
	LT	
LM2 to GDP	*2.43778***	*0.0290*
GDP to LM2	*0.84186*	*0.5573*

Table 3. Continued

Granger causality	*F-stat*	*P-value*
	MK	
LM2 to GDP	*1.52390*	*0.1756*
GDP to LM2	*3.21842****	*0.0056*
	PL	
LM2 to GDP	*1.58646*	*0.1310*
GDP to LM2	*1.61308*	*0.1230*
	RO	
LM2 to GDP	*1.19216*	*0.3216*
GDP to LM2	*2.69399****	*0.0093*
	RU	
LM2 to GDP	*6.38146****	*0.0027*
GDP to LM2	*2.51928**	*0.0869*
	SI	
LM2 to GDP	*2.09134*	*0.1301*
GDP to LM2	*0.50612*	*0.6047*
	SK	
LM2 to GDP	*2.53132**	*0.0860*
GDP to LM2	*0.82910*	*0.4402*
	TR	
LM2 to GDP	*1.90730***	*0.0535*
GDP to LM2	*0.67120*	*0.7710*
	UA	
LM2 to GDP	*3.69566***	*0.0154*
GDP to LM2	*3.02828***	*0.0346*

Note: *** and ** denotes significant at 1% and 5% significance level, respectively.

Table 4. Empirical Evidence of Supply-Leading and Demand-Following Hypothesis Presence in (CEESE) Economies

	FINANCE DEVELOPMENT IMPACT ECONOMIC GROWTH	**ECONOMIC GROWTH IMPACT FINANCIAL DEVELOPMENT**	**BI-DIRECTIONAL GRANGER CAUSALITY**	**SUPPORTED THEORY**
ALBANIA	Yes	No	No	Supply leading
BOSNIA AND HERCEGOVINA	Yes	No	No	Supply leading
BULGARIA	Yes	Yes	Yes	Supply leading/Demand following
BELARUS	Yes	No	No	Supply leading
CROATIA	Yes	Yes	Yes	Supply leading/Demand following
CZECH REPUBLIC	No	No	No	Neither

Table 4. Continued

	FINANCE DEVELOPMENT IMPACT ECONOMIC GROWTH	ECONOMIC GROWTH IMPACT FINANCIAL DEVELOPMENT	BI-DIRECTIONAL GRANGER CAUSALITY	SUPPORTED THEORY
ESTONIA	Yes	No	No	Supply leading
HUNGARY	Yes	Yes	Yes	Supply leading/Demand following
KAZAKHSTAN	Yes	Yes	Yes	Supply leading/Demand following
LATVIA	Yes	Yes	Yes	Supply leading/Demand following
LITHUANIA	Yes	Yes	Yes	Supply leading/Demand following
MACEDONIA	No	Yes	No	Demand following
POLAND	Yes	Yes	Yes	Supply leading/Demand following
ROMANIA	Yes	Yes	Yes	Supply leading/Demand following
RUSSIA	Yes	No	No	Supply leading
SLOVENIA	Yes	Yes	Yes	Supply leading/Demand following
SLOVAKIA	Yes	Yes	Yes	Supply leading/Demand following
TURKEY	Yes	No	No	Supply leading
UKRAINE	Yes	Yes	Yes	Supply leading/Demand following

Figure 1. Spectral Granger causality between financial development and economic growth in Albania, Bosnia and Hercegovina and Bulgaria

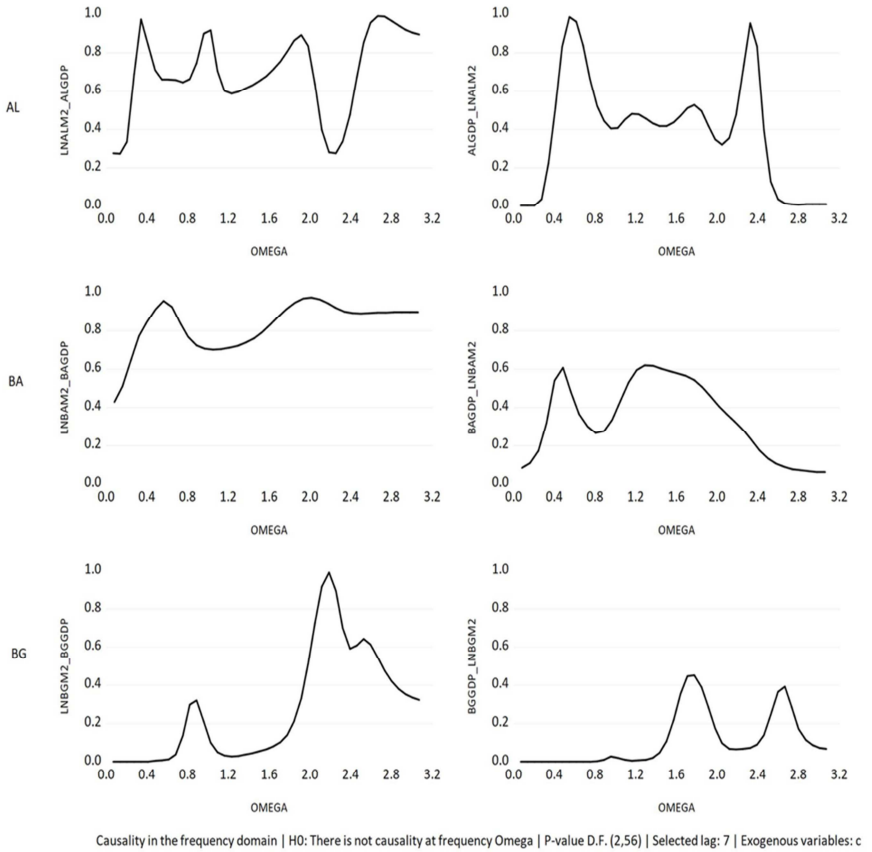


Figure 2. Spectral Granger causality between financial development and economic growth in Belarus, Czech Republic and Croatia

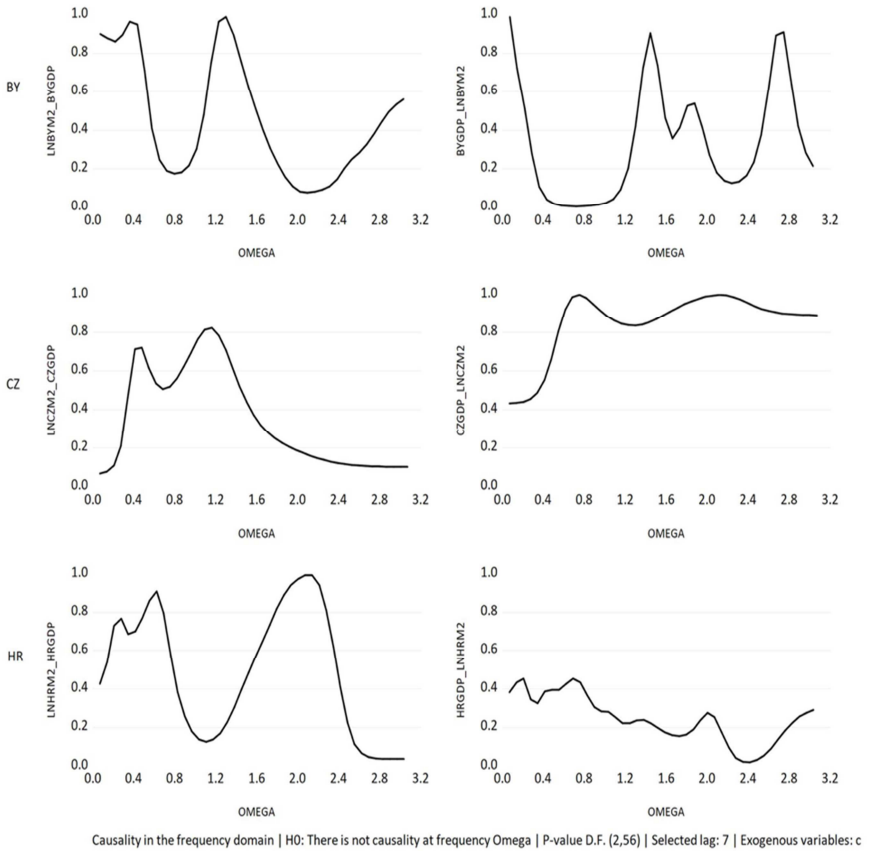


Figure 3. Spectral Granger causality between financial development and economic growth in Estonia, Hungary and Kazakhstan

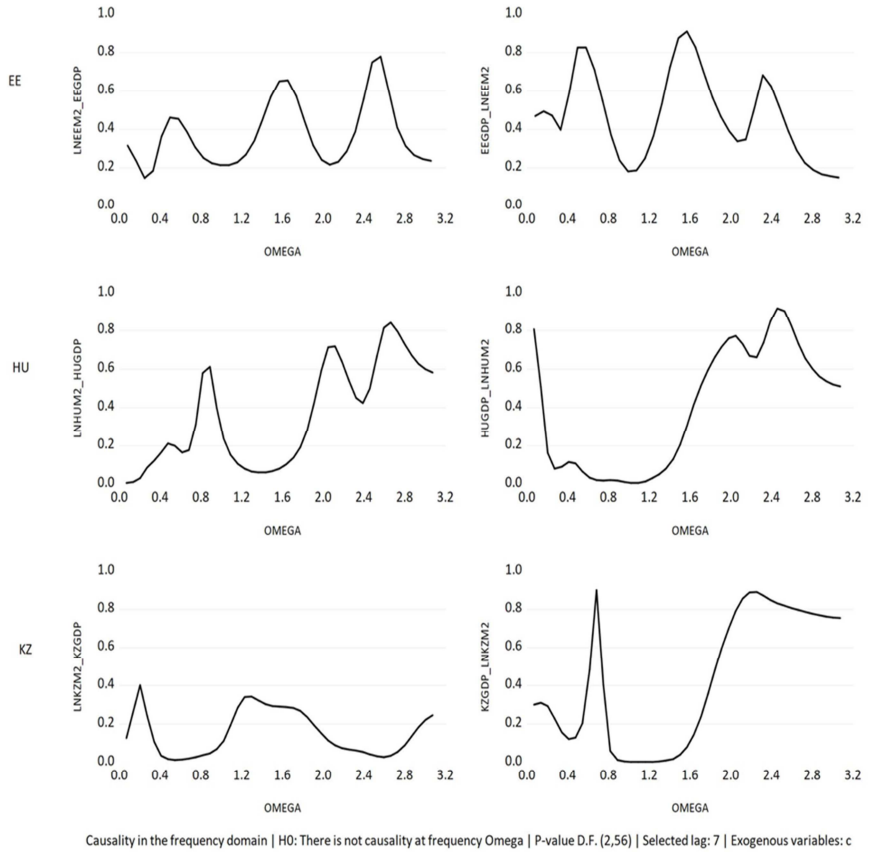


Figure 4. Spectral Granger causality between financial development and economic growth in Lithuania, Latvia and Macedonia

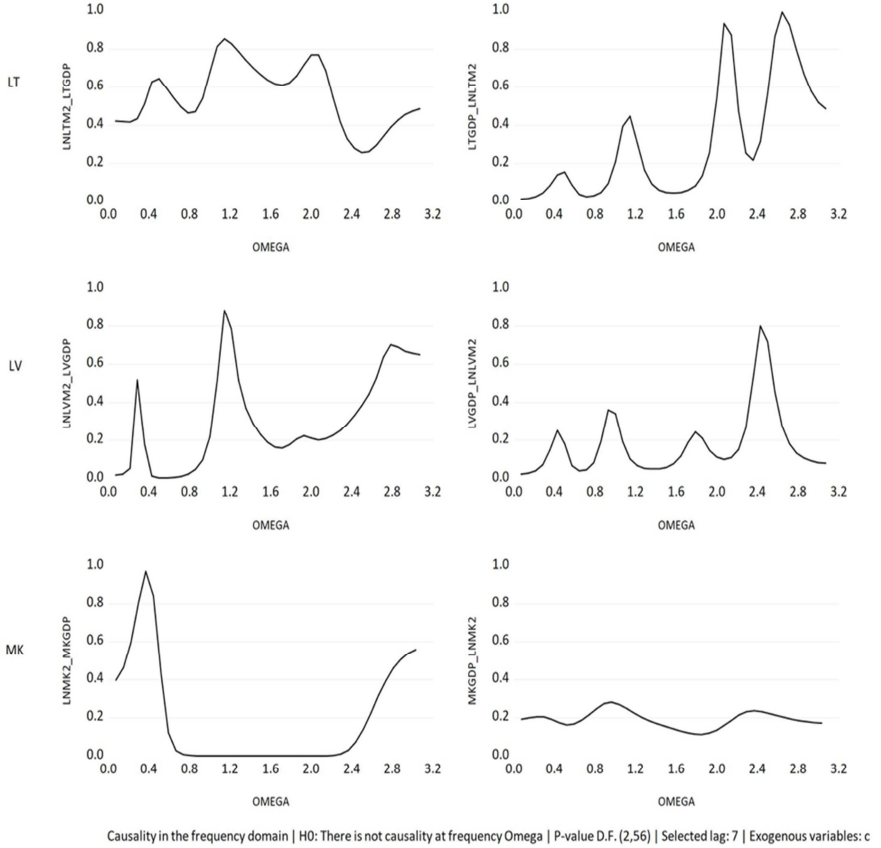
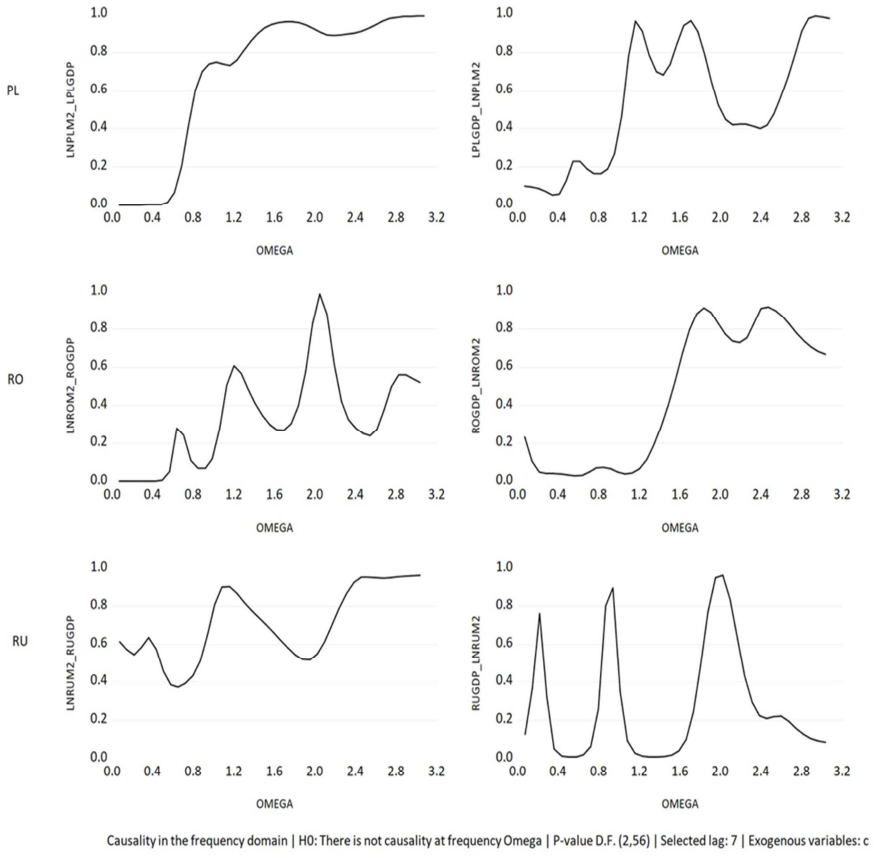


Figure 5. Spectral Granger causality between financial development and economic growth in Poland, Romania and Russia



Causality in the frequency domain | H0: There is not causality at frequency Omega | P-value D.F. (2,56) | Selected lag: 7 | Exogenous variables: c

Figure 6. Spectral Granger causality between financial development and economic growth in Slovenia, Slovakia and Turkey

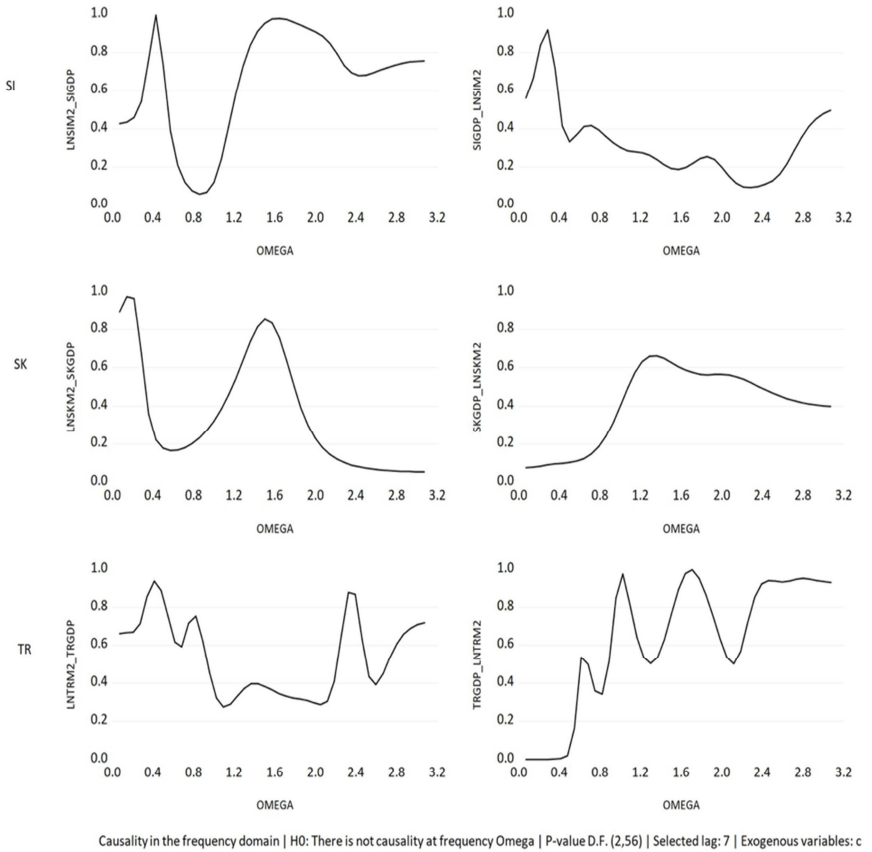
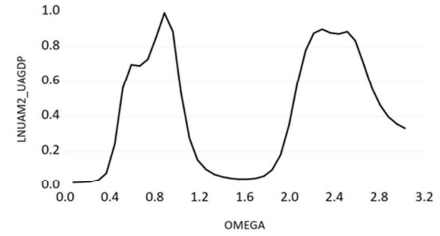
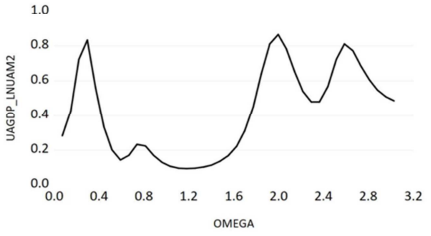


Figure 7. Spectral Granger causality between financial development and economic growth in Ukraine





UA

Causality in the frequency domain | H0: There is not causality at frequency Omega | P-value D.F. (2,54) | Selected lag: 10 | Exogenous variables: c