REM WORKING PAPER SERIES

Panel Granger causality between financial development and economic growth

Cândida Ferreira

REM Working Paper 0179-2021

May 2021

REM – Research in Economics and Mathematics

Rua Miguel Lúpi 20,
1249-078 Lisboa,
Portugal

ISSN 2184-108X

Any opinions expressed are those of the authors and not those of REM. Short, up to two paragraphs can be cited provided that full credit is given to the authors.

REM – Research in Economics and Mathematics

Rua Miguel Lupi, 20
1249-078 LISBOA
Portugal

Telephone: +351 - 213 925 912

E-mail: rem@iseg.ulisboa.pt

<https://rem.rc.iseg.ulisboa.pt/>

<https://twitter.com/ResearchRem>

<https://www.linkedin.com/company/researchrem/>

<https://www.facebook.com/researchrem/>

Panel Granger causality between financial development and economic growth

Cândida Ferreira¹

ISEG, UL – Lisbon School of Economics and Management of the Universidade de Lisboa
UECE - Research Unit in Complexity and Economics
REM – Research in Economics and Mathematics
e-mail: candidaf@iseg.ulisboa.pt

Abstract

This paper uses panel Granger causality estimations with the approaches developed by Nair-Reichert and Weinhold (2001), and Bangake and Eggoh (2011) as well as the Dumitrescu and Hurlin (2012) test, with the algorithm developed by Lopez and Weber (2017), to analyse the causality relations between all the nine IMF financial development indices, and the real GDP growth considering a sample of 46 countries spread by all continents over the interval 1990-2017. The results obtained reveal the dynamic character of these causality relations and overall, no significant differences were found when comparing the results obtained for the financial institutions indices with those regarding the financial markets indices. The results confirm the existence of bidirectional causality, although not with the same statistical robustness for all the IMF indices, addressing relevant aspects of the financial development: access, depth and efficiency of the financial institutions and markets.

Keywords: Panel Granger causality; financial development; IMF financial development indices; financial institutions and markets; economic growth.

JEL Classification: C33; E02; E44; F43; G20; O43.

¹ The author acknowledges financial Support from FCT – Fundação para a Ciência e Tecnologia (Portugal), national funding through research grant UIDB/05069/2020.

Panel Granger causality between financial development and economic growth

1. Introduction

Over decades and particularly since the 1990s, the link between the quality of the financial systems and economic growth has been studied and analysed with different methods and empirical tests, but it is still a controversial issue, deserving further investigation.

A relevant strand of literature used panel data and provided several robust findings demonstrating the contribution of different measures of financial development to economic growth. Several of these empirical studies explained output variables with financial variables and ratios such as total lending, private credit, liquid liabilities, bank loans to the private-sector, or stock market capitalisation, which were considered representative of the performance of the financial systems and institutions (see for example, Khan and Senhadji, 2000; Wachtel, 2001; and Sahay et al, 2015, for relevant discussion of the appropriate measures of financial sector development and the importance of the chosen econometric models and estimation techniques). Other studies supported the reverse view, saying that economic growth had a positive effect on financial development (namely, Kar et al, 2011; Song et al, 2021) and many others analysed the direction of the causality relation between financial development and economic growth providing evidence to support the existence of one direction or bi-direction causality (such as Levine et al, 2000; Calderón and Liu, 2003; Hassan et al, 2011; Pradhan et al, 2018).

This paper contributes to the literature by estimating panel Granger causality regressions with the approaches developed by Nair-Reichert and Weinhold (2001), Bangake and Eggoh (2011) as well as the Dumitrescu and Hurlin (2012) test using the algorithm developed by Lopez and Weber (2017), to analyse the causality relations between all the nine IMF financial development

indices and the real GDP growth considering a sample of 46 countries spread by all continents over the interval 1990-2017.

Overall, the results obtained demonstrate the existence of bidirectional causality, although not with the same statistical robustness for all the IMF financial development indices. They also confirm the need of using multiple indicators to measure the different aspects of the development of the financial markets and institutions. Moreover, no significant differences were found when comparing the results obtained for the financial institutions indices with those regarding the financial markets indices.

This paper is organised as follows: Section 2 provides a brief literature review; Section 3 describes the methodological aspects; Section 4 presents the used data and the results obtained; Section 5 concludes.

2. Brief literature review

There is a large strand of literature analysing the relevance of the financial sector's performance to economic growth particularly after the publication of the renowned King and Levine papers (1993-a, 1993-b). Many of these studies empirically analysed the contribution of the financial system to economic growth with time series, cross-country regressions, and panel estimations, considering different proxies for financial development, and most of them concluded that well-functioning banking institutions and financial markets contribute to economic growth.

King and Levine (1993-a) present cross-country evidence that financial development can promote economic growth using data on 80 countries over the period 1960-1989 and considering different measures of financial development: liquid liabilities over GDP, bank credit divided by the sum of bank and central bank credit, credit issued to nonfinancial private

firms divided by total credit, credit issued to nonfinancial private firms divided by GDP. This empirical analysis was reviewed and extended in King and Levine (1993-b) together with the analysis of the theoretical linkages between financial development and growth, corroborating that financial system and institutions are important for productivity growth and economic development.

Rousseau and Wachtel (1998) used data for five countries (USA, UK, Canada, Sweden, and Norway) for the period 1871-1929 and concluded that there was one-way causality from financial development and output. The financial development was measured by the ratio of financial institutions assets to output and the ratio of sum of financial institution assets, corporate stocks, and corporate bonds to total financial assets. Levine and Zervos (1998) considered data for 49 countries for the time interval 1976–1990 concluding that stock market liquidity and banking development both positively predicted growth, capital accumulation, and productivity improvements when included together in regression estimations.

Demirgüç-Kunt and Levine (1999), using data for 150 countries spanning the 1990s, also concluded that wealthy countries had more developed financial systems, and analysed this development in terms of the size and efficiency of the financial sector, measured by the assets, liabilities, overhead costs, and interest rate margins.

Greenwood et al (2010, 2013) also empirically analysed the effects of financial development on economic growth, using a state cost verification model, and concluding that as financial sector efficiency rose, financial resources got redirected from the less productive firms to their more productive peers.

Other authors analysed how financial systems differed around the world, comparing those that were mostly bank-based with those that were primarily market-based systems. Levine (1997) discussed many of these studies, providing a cross-country examination of which view of financial structure was more consistent with the data. The main conclusions indicated that

although financial development was robustly linked with economic growth, there was no robust support for either the bank-based or the market-based view.

Different conclusions were obtained by Gaytan and Rancière (2004) pointing out that, on the one hand, credit to the private sector and bank deposits contributed negatively to growth but, on the other hand, stock market size, liquidity and investment contributed positively to economic development. The same kind of conclusions were obtained by Ayadi et al (2015) using a sample of northern and southern Mediterranean countries for the 1985–2009 period: these authors confirmed that there were deficiencies in bank credit allocation in the considered countries as credit to the private sector and bank deposits were negatively associated with economic growth; however, on the stock market side, their results indicated that stock market size and liquidity did contribute to growth. Also, Cournède and Denk (2015) focusing on advanced countries, more precisely on OECD countries and G20 countries between 1970 and 2011, found that intermediated credit had a negative link with GDP growth and that stock market size had a positive one.

Simultaneously, another strand of literature analysed the potential causality relations between financial development and economic growth, considering that not only financial development could promote economic growth, but also that increased growth could contribute to financial development.

Demetriades and Hussein (1996) analysed some empirical works addressing the issue of causality between financial development and economic growth and they conducted causality tests between financial development (measured by the ratios bank deposit liabilities to GDP and the ratio of bank claims on the private sector to GDP) and real GDP using data from 16 not highly developed countries and time series techniques. Their results provided little support to the view that finance was a leading sector in the process of economic development; but they

found considerable evidence of bi-directionality and some evidence of reverse causation, meaning that it was finance that followed economic growth.

Berthelemy and Varoudakis (1996) discussed a theoretical endogenous growth model and tested it with data for 95 countries, demonstrating that causality between financial development and growth runed in both ways, since growth in the real sector caused the financial market to expand, thereby increasing banking competition and efficiency; and in return, the development of the banking sector raised the net yield on savings and enhanced capital accumulation and growth. The same kind of conclusions were obtained by Luintel and Khan (1999) who tested the long-run relationship between financial development (measured by the ratio of total deposit liabilities of deposit banks to one period lagged nominal GDP) and economic growth, using a sample of 10 countries and a data set that had an average time span of 38 years. They found bi-directional causality between financial development and economic growth.

Levine et al (2000) constructed a new dataset and, using different measures of financial intermediation, applied traditional cross-section, instrumental-variable procedures as well as dynamic panel techniques, considering a panel dataset of 74 countries, where the data were averaged over each of the seven 5-year intervals composing the period 1960-1995 and concluding that the development of financial intermediaries exerted an important causal impact on growth.

Calderón and Liu (2003) studied the direction of causality between financial development and growth employing pooled data of 109 developing and industrial countries from 1960 to 1994 and found that financial development generally leaded to economic growth, as well as that the Granger causality from financial development to economic growth and the Granger causality from economic growth to financial development coexisted.

Bangake and Eggoh (2011) used panel methods on a data set of 71 developed and developing countries over the period 1960–2004 to assess the causal relationship between financial

development and economic growth, confirming the existence of bidirectional causality between finance and growth. In addition, they concluded that while in low-and middle-income countries there was no supportive evidence of short-run causality between financial development and economic growth, in high income countries economic growth significantly affected financial development.

Hassan et al (2011) also empirically analysed how financial development linked to economic growth applying Granger causality tests for a sample period between 1980 and 2007 to different groups of countries: low- and middle-income countries in different geographic regions, and two groups of high-income countries (OECD and non-OECD countries). Overall, they found a positive relationship between financial development and economic growth in developing countries. However, short-term multivariate analysis provided mixed results: a two-way causality relationship between finance and growth for most regions and one-way causality from growth to finance for the two poorest regions.

Kar et al (2011) tested the direction of causality between financial development and economic growth in fifteen Middle East and North African (MENA) countries for the period 1980–2007, using six different ratios to capture specific aspects of financial development: the ratio of narrow money to income, the ratio of quasi money to income, the ratio of M2 to income, the ratio of deposit money bank liabilities to income, the ratio of private sector credit to income, and the ratio of domestic credit to income. The results obtained revealed the non-existence of clear consensus on the direction of causality between financial development and economic growth for all measurements of financial development in all considered countries. The same kind of conclusions were obtained by Kahouli (2017), testing the Granger causality between economic growth, energy consumption and financial development in six South Mediterranean countries over the 1995–2015 period, and presenting mixed results for individual countries, as

the causal relationships diverged essentially in intensity, and the rates of adjustment varied from country to country.

Pradhan et al (2018) used panel cointegration and causality tests to analyse the interactions between innovation, financial development, and economic growth in 49 European countries between 1961 and 2014. They found a myriad of results, demonstrating the existence of unidirectional or bidirectional causal links between the variables in several cases. For example, they found evidence of the presence of unidirectional causality from financial development to per capita economic growth, particularly when banking sector development was linked to innovation and per capita economic growth. They also found evidence of the presence of bidirectional causality between financial development and economic growth, particularly when both stock market development and overall financial development were considered jointly with innovation and economic growth.

Yang (2019) tested the impact of financial systems on economic growth in cross-sectional and time series frameworks considering three groups of economies: trapped middle income economies, graduated middle-income economies, and high-income economies over the period from 1970 to 2016. The main conclusions confirmed not only that financial development contributed significantly to economic growth but also the existence of Granger causality between equity market development and economic growth for all three groups of economies, although some stronger and some weaker. Moreover, there was a reverse causality between economic growth and equity market development in high-income economies, which was not detected in the other economies.

3. Methodology

The paper first considers the traditional Granger causality test (Granger, 1969) and the approaches developed to analyse the existence of causality relationships among variables in panels namely by Nair-Reichert and Weinhold (2001), and Bangake and Eggoh (2011).

According to the Granger causality concept correlation does not imply causality since the cause cannot come after its effect. More precisely, a variable, x , is said to Granger cause another variable y , if the current value of this variable y (y_t) significantly depends on the past values of the variable x , that is, $x_{t-1}, x_{t-2}, \dots$ (but not on its current value, x_t).

The starting point of the methodology is then the estimation of a general linear panel Granger causality model with two equations:

$$y_{i,t} = \alpha_1 + \sum_{k=1}^K \gamma_{1,i,k} y_{i,t-k} + \sum_{k=1}^K \beta_{1,i,k} x_{i,t-k} + \varepsilon_{1,i,t} \quad (1)$$

$$x_{i,t} = \alpha_2 + \sum_{k=1}^K \gamma_{2,i,k} x_{i,t-k} + \sum_{k=1}^K \beta_{2,i,k} y_{i,t-k} + \varepsilon_{2,i,t} \quad (2)$$

where $i = 1, \dots, N$ are the cross units; $t = 1, \dots, T$ are the time periods; $\alpha_{1,2}$ are the intercepts; $k = 1, \dots, K$ are the considered lags; $\varepsilon_{1,2}$ are the error terms (including not only the disturbance terms, but also the individual cross-unit specific effects).

The test of Granger non causality considers the null hypothesis $H_0: \beta_i = 0, \forall i = 1, \dots, N$.

If H_0 is rejected, it is possible to conclude that causality exists. More precisely, the strength of the Granger causality relations in each estimated equation can be evaluated using Wald tests for each of the β_i that are obtained for the considered time lags ($t-1, t-2, \dots$). If the Wald test indicates that H_0 is rejected, causality from x to y (or from y to x) exists.

In the second step, the paper follows the procedure proposed by Dumitrescu and Hurlin (2012) using the algorithm developed by Lopez and Weber (2017).

This procedure also considers the general linear panel Granger causality model and proposes a simple Granger non causality test for heterogeneous panel data models, taking into account both the heterogeneity of the causal relationships and the heterogeneity of the regression model used to test for Granger causality. The Dumitrescu and Hurlin (2012) panel test can be applied to balanced and heterogeneous panels, with or without cross-sectional dependence, the test may be used when $T > N$ or $N > T$ and has very good properties even in samples with very small values of T and N .

The Dumitrescu and Hurlin (2012) non-causality test allows to assess whether variable x does not Granger-cause variable y or if variable x Granger-cause variable y for at least one cross unit. More precisely, it proposes to test the non-causality considering the null hypothesis $H_0: \beta_i = 0, \forall i = 1, \dots, N$, with $\beta_i = (\beta_i^{(1)}, \dots, \beta_i^{(k)})$, which corresponds to the absence of causality for all cross units of the panel.

The test also assumes the existence of causality for some cross units although not necessarily for all, considering the alternative hypothesis $H_1: \beta_i = 0, \forall i = 1, \dots, N_1; \beta_i \neq 0, \forall i = N_1 + 1, N_1 + 2, \dots, N; (0 \leq \frac{N_1}{N} < 1)$. N_1 is unknown but the ratio $\frac{N_1}{N}$ must be inferior to one because if $N_1 = N$ there is no causality for any of the cross units of the panel (which is equivalent to the H_0 hypothesis); when $N_1 = 0$ there is causality for all the cross units of the panel.

This test is designed to detect causality at the panel level and rejecting H_0 does not exclude non causality for some units. However, following the methodology proposed by Lopez and Weber (2017) it is possible to obtain the individual Wald statistics and their corresponding p-values, allowing the identification of the cross-units for which causal relationship holds.

4. Data and empirical results

4.1. Data

The paper considers the interval 1990-2017 and includes annual data for 46 countries covering all continents: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, China, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, India, Indonesia, Ireland, Italy, Japan, Republic of Korea, Latvia, Lithuania, Luxembourg, Malta, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

All the data used in the estimations were sourced from the IMF databases. Economic growth is measured by the natural logarithm of the real Gross Domestic Product and financial development is represented by the nine IMF financial development indices that measure the depth, access and efficiency of the financial markets and institutions, as well explained in Sahay et al (2015) and in Svirydzenka (2016).

Before proceeding with the causality estimations, the stationarity of the considered series is analysed, using two of the most recommended panel unit roots test: the Levin-Lin-Chu tests (Levin et al, 2002), and Fisher-type (ADF) test (Choi, 2001; Maddala and Wu, 1999). The results obtained are reported in Annex I and reveal that some of the variables are not stationary in their levels but all of them are stationary in their first differences.

Further, the cointegration between each of the nine IMF financial development indices and the natural logarithm of the real GDP is analysed with the application of the Westerlund (2007) panel cointegration test, which is very flexible and works well in heterogeneous and/or relatively small panels, allowing for dependence both between and within the cross-panel units. The results obtained for the four Westerlund test statistics are presented in Annex II and provide

clear support to accept the existence of cointegration between the real GDP growth and all the nine IMF financial development indices.

4.2. Results obtained with panel Granger causality estimations

Following the methodology presented in the previous section, the panel causality estimations test the causality running from financial development to economic growth (represented by equation 1), and the causality running from economic growth to financial development (equation 2).

Both equations are first estimated with panel fixed effect estimations, which may not be fully appropriate since fixed-effects models cannot deal with endogenous regressors, and endogeneity may be an important concern in the context of the considered model. In order to deal with this eventual limitation, both equations are also estimated with GMM (Generalized Method of Moments) dynamic one-step and two-step estimations, following Arellano and Bond (1991) and Blundell and Bond (1998) as GMM estimations can not only address the endogeneity problems (although only for weak endogeneity and not for full endogeneity, as explained in Bond, 2002) but also reduce the potential bias of the estimated coefficients.

The use of annual data does not recommend the consideration of many lags (k) in the estimations, therefore only two models were estimated: model 1 considering only one lag ($k=1$) and model 2 including two lags ($k=2$).

The results of the panel Granger causality estimations are presented in Annex III, and overall, they are statistically validated. The R-squared of the fixed effects estimations are acceptable for panel estimations; in almost all situations the Arellano and Bond (1991) tests reject the null hypothesis of no autocorrelation of the first order and do not reject the hypothesis of no autocorrelation of the second order; moreover, with few exceptions, the Sargan and Hansen statistics as well as the Wald-test results validate the instruments.

Table 1 summarises the causality results obtained with fixed effects, GMM one-step GMM and two-step estimations, providing evidence that in almost all situations the Wald tests results validate the instruments of both models, and very particularly in the GMM estimations.

Overall, the results obtained with model 1 are corroborated by the results corresponding to the first lag of model 2 (although not always by the results corresponding to the second lag) and they allow the following conclusions regarding the causality relations between the real GDP growth and the nine IMF financial development indices:

1) There is clear evidence that, with few exceptions, the IMF financial development indices Granger cause positively the real GDP growth. The main exception regards the results of the Financial Institutions Access Index (with no strong evidence of causality and if accepting the existence of causality, it would be a negative causality relation); also, the results regarding the Financial Markets Efficiency Index, indicate that there is causality but raise doubts about its negative or positive influence on the real GDP growth.

2) In what regards to the causality running from the real GDP growth to the financial development indices, the results are not statistically so strong nor unanimous. Nevertheless, there is still robust evidence that the real GDP growth positively Granger causes the Financial Institutions Access Index, the Financial Markets Efficiency Index, and although not so evidently, also the Financial Institutions Efficiency Index, and the Financial Institutions Index.

Table 1 – Summary of the panel Granger causality estimations

Causality: Financial Development → GDP							Causality: GDP → Financial Development						
Expl. Variable	Model 1			Model 2			Expl. Variable	Model 1			Model 2		
	FE	GMM1	GMM2	FE	GMM1	GMM2		FE	GMM1	GMM2	FE	GMM1	GMM2
Financial Development Index t-1	-	+	+	+	+	+	GDP t-1	+	-	-			
		***	***		***	***		***		**			
Financial Development Index t-2							GDP t-2				+	+	-
											***		***
WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.910	0.000	0.000	0.009	0.000	0.000	WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.003	0.676	0.050	0.056	0.805	0.275
				0.000	0.000	0.000					0.002	0.544	0.020
				0.000	0.000	0.000					0.000	0.82	0.055
Financial Institutions Access Index t-1	-	-	-	-		-	GDP t-1	+	+	+	+		
		**	***					***	***	***	***		
Financial Institutions Access Index t-2					-	-	GDP t-2					+	+
						***							***
WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.443	0.023	0.000	0.221	0.984	0.998	WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.000	0.000	0.000	0.000	0.136	0.000
				0.464	0.654	0.012					0.000	0.276	0.000
				0.313	0.313	0.313					0.000	0.189	0.000
Financial Institutions Depth Index t-1	-	+	+		+	+	GDP t-1	-	-	-			
		***	***		***	***			***	***			
Financial Institutions Depth Index t-2				-			GDP t-2				+	+	+
				***							***	***	***
WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.202	0.000	0.000	0.002	0.000	0.000	WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.469	0.012	0.000	0.016	0.000	0.000
				0.000	0.000	0.000					0.000	0.000	0.000
				0.000	0.000	0.000					0.000	0.000	0.000
Financial Institutions Efficiency Index t-1	+	+	+	+	+	+	GDP t-1	+	+	+	+	+	+
	***	***	***	***	***	***				*	**		***
Financial Institutions Efficiency Index t-2							GDP t-2						
WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.000	0.000	0.000	0.001	0.000	0.000	WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.209	0.790	0.093	0.034	0.113	0.000
				0.198	0.000	0.000					0.630	0.111	0.000
				0.001	0.000	0.000					0.099	0.140	0.000
Financial Institutions Index t-1	+	+	+		+	+	GDP t-1	+	+	+		+	+
		***	***		***	***		***		**			***
Financial Institutions Index t-2				-			GDP t-2				+		
				**							***		
WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.474	0.009	0.000	0.070	0.000	0.000	WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.009	0.863	0.015	0.069	0.483	0.000
				0.028	0.000	0.000					0.000	0.170	0.000
				0.090	0.000	0.000					0.000	0.214	0.000
Financial Markets Access Index t-1	+	+	+	+	+	+	GDP t-1	+	-	-	+	+	-
		***	***	***	***	***		**		***	*		***
Financial Markets Access Index t-2							GDP t-2						
WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.227	0.000	0.000	0.000	0.000	0.000	WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.024	0.330	0.000	0.065	0.458	0.000
				0.000	0.000	0.000					0.319	0.909	0.362
				0.000	0.000	0.000					0.032	0.755	0.000
Financial Markets Depth Index t-1	+	+	+		+	+	GDP t-1	-	-	-		-	-
		***	***		***	***			***	***		***	***
Financial Markets				-			GDP t-2				+		

Depth Index t-2				***										
WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.503	0.000	0.000	0.000 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.951	0.000	0.000	0.106 0.000 0.000	0.000 0.029 0.000	0.000 0.000 0.000	
Financial Markets Efficiency Index t-1	- **	- ***	- ***	- ***			GDP t-1	+ **	+ *	+ ***	+ **	+ *	+ ***	
Financial Markets Efficiency Index t-2					+ ***	+ ***	GDP t-2							
WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.027	0.303	0.000	0.002 0.155 0.005	0.000 0.000 0.000	0.000 0.000 0.000	WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.054	0.066	0.000	0.038 0.835 0.093	0.023 0.279 0.069	0.000 0.000 0.000	
Financial Markets Index t-1	-	+	+	+	+	+	GDP t-1	+ **	- ***	- ***	+	-	- ***	
Financial Markets Index t-2							GDP t-2							
WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.550	0.303	0.000	0.015 0.000 0.005	0.000 0.000 0.000	0.000 0.000 0.000	WALD TEST p-values ($\beta_{1,1}=0$) ($\beta_{1,2}=0$) ($\beta_{1,1}=\beta_{1,2}=0$)	0.046	0.529	0.000	0.153 0.219 0.054	0.524 0.889 0.815	0.000 0.168 0.000	

***significant at 1% level; ** significant at 5% level; * significant at 10% level. In model 2, there is indication of the results obtained for lag 2 only when they clearly dominate the results obtained for lag 1.
Source: Author's calculations presented in Annex III.

4.3. Results obtained with Dumitrescu and Hurlin (2012) panel Granger non-causality test

Following the proposed methodology, this study applies the Dumitrescu and Hurlin (2012) panel non causality test to investigate the relations between the nine IMF financial development indices and the real GDP growth. As in Granger (1969), the existence of causality means that there are significant effects of past values of one variable on the present value of another variable. But this test outperforms the traditional panel Granger causality tests by allowing for the hypothesis of causality existence in at least one cross-section, against the non-existence of homogenous Granger-causality relationship.

Table 2 presents the results obtained with this test, considering one-lag and two-lags options, for both the causality running from the financial development indices to GDP and the reverse causality from GDP to the financial development indices.

The results obtained clearly demonstrate that there is positive causality running from all IMF financial development indices to real GDP growth, when considering the two-lags option. But

in what regards to the one-lag option, in almost all situations the outcomes of the test do not reject the null hypothesis, which corresponds to the absence of causality for all individual countries included in the panel. However, following the procedure proposed by Lopez and Weber (2017), it is possible to identify the countries for which the Wald tests reveal the existence of causality relations and which are presented in Annex IV.

Still according to the results reported in Table 2, the causality running from the real GDP growth to the IMF financial development is evident and almost always both considering one and two lags. But even in the few cases when it is not possible to reject the null hypothesis (the test outcomes regarding the Financial Institutions Efficiency Index and the Financial Markets Depth Index) there are still countries with evidence of causality, according to the Wald test results reported in Annex IV.

Table 2 - Dumitrescu & Hurlin (2012) Granger non-causality test results (Z-bar statistics)

Causality: Financial Development → GDP			Causality: GDP → Financial Development		
	Lag order: 1 lag	Lag order: 2 lags		Lag order: 1 lag	Lag order: 2 lags
Financial Development Index → GDP	-0.6880	5.3230***	GDP → Financial Development Index	2.6978***	1.7505*
Financial Institutions Access Index → GDP	0.9125	3.3854***	GDP → Financial Institutions Access Index	8.5340***	2.3188**
Financial Institutions Depth Index → GDP	0.6381	14.1988***	GDP → Financial Institutions Depth Index	2.3163**	5.2638***
Financial Institutions Efficiency Index → GDP	-0.3223	5.0634***	GDP → Financial Institutions Efficiency Index	0.4663	0.7142
Financial Institutions Index → GDP	0.3278	6.1566***	GDP → Financial Institutions Index	2.2808**	2.3199**
Financial Markets Access Index → GDP	0.8766	6.4812***	GDP → Financial Markets Access Index	2.2956**	4.5526***
Financial Markets Depth Index → GDP	2.0243**	23.7984***	GDP → Financial Markets Depth Index	-0.0587	0.1857
Financial Markets Efficiency Index → GDP	1.6562*	4.4122***	GDP → Financial Markets Efficiency Index	4.4862***	-
Financial Markets Index → GDP	-0.0412	6.6752***	GDP → Financial Markets Index	2.1558**	0.3734

H₀ = absence of causality for all countries included in the panel.

Rejection of H₀: ***significant at 1% level; ** significant at 5% level; * significant at 10% level.

Source: Author's calculations.

The results presented in Table 2 were confirmed with the use of a bootstrap procedure and the BIC option that provides the recommended number of lags. In almost all situations, the outcomes recommended the consideration of one lag (these specific outcomes are not presented in the paper, but they are available under request).

5. Concluding remarks

This paper contributes to the literature using the traditional Granger causality tests, following the approaches developed by Nair-Reichert and Weinhold (2001), and Bangake and Eggoh (2011) as well as the Dumitrescu and Hurlin (2012) non-causality panel test, using the algorithm developed by Lopez and Weber (2017) to analyse the causality relations between all the nine IMF financial development indices and the real GDP growth, considering a panel of 46 countries covering all continents over the interval 1990-2017.

The results obtained clearly confirm the existence of bi-directional causality, although not statistically with the same robustness for all the nine indices, confirming the potential existence of mixed results that were already found, for example, in Kar et al (2011), Kahouli (2017), and Pradhan et al (2018). Nevertheless, the results of this paper allow the following conclusions:

- In almost all situations, the Wald test obtained with the traditional panel Granger causality tests reveal the adequacy of the considered instruments and the presence of causality relations. Moreover, the results are more robust when using GMM estimations confirming the dynamic character of the tested causality relations, considering the capacity of these kind of estimations to reduce potential bias of the estimated coefficients, and well addressing the eventual endogeneity problems.
- With few exceptions, the results obtained with GMM estimations confirm positive causality running from the IMF financial development indices to GDP growth and although

not with the same statistical robustness also running from GDP growth to the financial development indices.

- The results obtained with the Dumitrescu and Hurlin (2012) test also confirm the presence of positive causality running from all the nine IMF financial development indices to the real GDP growth, particularly when considering the two-lags option. When considering the one-lag option, for some indices is not possible to reject the absence of causality for whole panel; however, following the procedure proposed by Lopez and Weber (2017), it is possible to identify the countries for which the Wald tests reveal the existence of causality relations.
- Still according to the results obtained with the Dumitrescu and Hurlin (2012) test there is clear evidence of the causality running from the real GDP growth to the IMF financial development is evident and almost always both considering one and two-lags options. Moreover, in the few cases when it is not possible to confirm the existence of causality relations for the whole panel, the Wald test results identify the countries of the panel for which there is evidence of causality running from real GDP growth to financial development.

Overall, the results obtained in this paper confirm the relevance of the relationships between financial development and economic growth, supporting the statements of Svirydzenka (2016) in what regards to the need of using multiple indicators to measure the different aspects of the development, namely considering the access, depth and efficiency of the financial markets and institutions. However, the results are not fully in line with the conclusions of some authors, such as Gaytan and Rancière (2004), Ayadi et al (2013), and Cournède and Denk (2015), as this paper does not reveal the existence of significant differences between the results obtained for the financial institutions indices versus the results regarding the financial markets indices.

Further research is still needed in this field, due to the complex and dynamic causality relations between the different aspects of the financial development and economic growth, and considering the diversity of the financial systems across countries as well as their different levels of development.

References

Arellano, M. and Bond, S. (1991) “Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations”, *Review of Economic Studies*, **58**, pp. 277-297.

Ayadi R., Arbak E., Naceur S.B., De Groen W.P. (2015) “Financial Development, Bank Efficiency, and Economic Growth Across the Mediterranean” In: Ayadi R., Dabrowski M., De Wulf L. (eds) *Economic and Social Development of the Southern and Eastern Mediterranean Countries*, Springer, Cham. https://doi.org/10.1007/978-3-319-11122-3_14

Bangake, C. and Eggoh, J. (2011) “Further evidence on finance-growth causality: A panel data analysis”, *Economic Systems*, **35**, pp. 176-188.

Berthelemy, J.C. and A. Varoudakis (1996) “Economic growth, convergence clubs, and the role of financial development”, *Oxford Economic Papers*, 48(2), 300–328.

Blundell, R. and Bond, S. (1998) “Initial conditions and moment restrictions in dynamic panel data models”, *Journal of Econometrics*, **87**, pp. 115–143.

Bond, S. (2002) *Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice*, Institute for Fiscal Studies, London, Working Paper No. 09/02.

Calderón, C. and Liu, L. (2003) “The direction of causality between financial development and economic growth”, *Journal of Development Economics*, **72**, pp. 321-334.

Choi, I. (2001) “Unit root tests for panel data”, *Journal of International Money and Finance*, **20**, pp. 249-272.

Cournède, B., and Denk, O. (2015) *Finance and Economic Growth in OECD and G20 Countries*, OECD Economics Department Working Papers No. 1223.

Demetriades, P. and Hussein, K. (1996) “Does financial development cause economic growth? Time-series evidence from 16 countries”, *Journal of Development Economics*, **51**, pp. 387-411.

Demirgüç-Kunt, A., and Levine, R. (1999) *Bank-Based and Market-Based Financial Systems: Cross Country Comparisons*, World Bank Policy Research Working Paper, No 2143.

Dumitrescu, E.-I. and Hurlin, C. (2012) “Testing for Granger non-causality in heterogeneous Panels”, *Economic Modelling*, **29**, pp. 1450–1460.

Gaytan, A., and Rancière, R. (2004) *Wealth, Financial Intermediation and Growth*, Departments of Economics and Business, Universitat Pompeu Fabra, Economics Working Papers No 851.

Granger, C. W.J. (1969) “Investigating Causal Relations by Econometric Models and Cross Spectral Methods”, *Econometrica*, **37**, pp. 424–438.

Greenwood, J., Wang, C., and Sanchez, J. M. (2010) “Financing development: The role of information costs”, *American Economic Review*, **100**, pp. 1875–1891.

Greenwood, J., Sanchez, J.M., and Wang, C. (2013) “Quantifying the impact of financial development on economic development”, *Review of Economic Dynamics*, **16**, pp. 194-215.

Hassan, M., Sanchez, B. and Yu, J. (2011) “Financial development and economic growth: New evidence from panel data”, *The Quarterly Review of Economics and Finance*, **51**, 88–104.

Kahouli, B. (2017) “The short and long run causality relationship among economic growth, energy consumption and financial development: Evidence from South Mediterranean Countries (SMCs)”, *Energy Economics*, **68**, pp. 19-30.

Kar, M., Nazlioglu, S. and Agir, H. (2011) “Financial development and economic growth nexus in the MENA countries: Bootstrap panel granger causality analysis”, *Economic Modelling*, **28**, 685–693.

Khan, M. S., and Senhadji, A. (2000) *Financial Development and Economic Growth: An Overview*, IMF Working Paper No 209.

King, R., and Levine, R. (1993-a) “Finance and Growth: Schumpeter Might Be Right”, *Quarterly Journal of Economics*, **108**, pp. 717-737.

King, R., and Levine, R. (1993-b) “Finance, entrepreneurship and growth: theory and evidence”, *Journal of Monetary Economics*, **32**, pp. 513-542.

Levin, A., Lin, C. F., and Chu, C. S. (2002) “Unit Root Tests in Panel Data: Asymptotic and Finite Sample Properties”, *Journal of Econometrics*, **108**, pp. 1-24.

Levine, R. (1997) “Financial Development and economic growth: views and agenda”, *Journal of Economic Literature*, **35**, pp. 688-726.

Levine, R., and Zervos, S. (1998) “Stock markets, banks and economic growth”, *American Economic Review*, **88**, pp. 537-558.

Levine, R., Loayza, N. and Beck, T. (2000) “Financial intermediation and growth: causality and causes”, *Journal of Monetary Economics*, **46**, pp. 31-77.

Lopez, L. and Weber, S. (2017) “Testing for Granger causality in panel data”, *The Stata Journal*, **17**, pp. 972-984.

Luintel, K. B. and Khan, M. (1999) “A Quantitative Reassessment of the Finance-growth Nexus: Evidence from a Multivariate VAR”, *Journal of Development Economics*, **60**, pp. 381-405.

Maddala, G. S. and Wu, S. (1999) “A comparative study of unit root tests with panel data and a new simple test”, *Oxford Bulletin of Economics and Statistics*, **61**, pp. 631-52.

Nair-Reichert, U. and Weinhold, D. (2001) “Causality tests for cross-country panels: a look at FDI and economic growth in less developed countries”, *Oxford Bulletin of Economics and Statistics*, **63**, pp. 153–171.

Pradhan, R. P., Arvin, M. B. and Bahmani, S. (2018) “Are innovation and financial development causative factors in economic growth? Evidence from a panel granger causality test”, *Technological Forecasting & Social Change*, **132**, pp. 130-142.

Rousseau, P. L. and Wachtel, P. (1998) “Financial Intermediation and Economic Performance: Historical Evidence from Five Industrialized Countries”, *Journal of Money, Credit and Banking*, **30**, pp. 657-678.

Sahay, R., Cihak, M., N’Diaye, P., Barajas, A., Bi, R., Ayala, D., Gao, Y., Kyobe, A., Nguyen, L., Saborowski, C., Svirydzenka, K. and Yousefi, S.R. (2015) *Rethinking Financial Deepening: Stability and Growth in Emerging Markets*, IMF Staff Discussion Note, SDN/15/08.

Song C-Q., Chang C-P., and Gong Q. (2021) “Economic growth, corruption, and financial development. Global evidence”, *Economic Modelling*, **94**, 822-830.

Svirydzenka, K. (2016) *Introducing a New Broad-based Index of Financial Development*, IMF Working Paper, WP/16/5.

Wachtel, P. (2001) “Growth and finance: what do we know and how do we know it?” *International Finance*, **4**, pp. 353–362.

Westerlund, J. (2007) “Testing for Error Correction in Panel Data”, *Oxford Bulletin of Economics and Statistics*, **69**, pp. 709-748.

Yang, F. (2019) “The impact of financial development on economic growth in middle-income countries”, *Journal of International Financial Markets, Institutions & Money*, **59**, pp. 74-89.

Annex I – Results obtained with panel unit root tests (p-values)

	Financial Development Index	Financial Institutions Access Index	Financial Institutions Depth Index	Financial Institutions Efficiency Index	Financial Institutions Index	Markets Access Index	Financial Markets Depth Index	Financial Markets Efficiency Index	Financial Markets Index	Ln GDP
Levin Li										
Levels	0.0000	0.5006	0.0039	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.954
Difference	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fisher										
(P statistic)	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0483	0.0000	0.0000	1.0000
Levels	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Difference										

Source: Author's calculations using STATA statistical software. Data were sourced from the IMF databases.

Annex II – Results obtained with Westerlund panel cointegration tests: Coefficients of the cointegration between the natural logarithm of the real GDP and the nine IMF financial development indices

	Financial Development Index	Financial Institutions Access Index	Financial Institutions Depth Index	Financial Institutions Efficiency Index	Financial Institutions Index	Markets Access Index	Financial Markets Depth Index	Financial Markets Efficiency Index	Financial Markets Index
Gt	-3.003***	-2.670***	-2.182***	-3.844***	-3.370***	-2.788***	-2.346***	-3.453***	-2.573***
Ga	-12.184***	-9.263***	-7.457***	-14.491***	-14.056***	-10.031***	-9.261***	-13.130***	-9.492***
Pt	-23.113***	-25.319***	-19.708***	-27.592***	-32.789***	-15.597***	-12.016***	-19.934***	-16.166***
Pa	-12.670***	-11.995***	-9.434***	-16.703***	-19.627***	-7.928***	-6.765***	-10.660***	-5.256***

***significant at 1% level; ** significant at 5% level; * significant at 10% level.

Source: Author's calculations using STATA statistical software. Data were sourced from the IMF databases.

Annex III – Results obtained with panel Granger causality estimations Annex III – Panel Granger causality estimations

Financial Development Index → GDP													GDP → Financial Development Index												
	Fixed effects				GMM one-step system				GMM two-step system					Fixed effects				GMM one-step system				GMM two-step system			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2			Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z		Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
GDP _{t-1}	.00352	0.000	.00341	0.000	.00544	0.000	.00495	0.000	.00547	0.000	.00501	0.000	Financial Development Index _{t-1}	.7948	0.000	.8441	0.000	1.024	0.000	1.080	0.577	1.022	0.000	1.085	0.000
GDP _{t-2}			-.00057	0.100			-.0027	0.000			-.00276	0.000	Financial Development Index _{t-2}			-.0350	0.170			-.049	0.577			-.056	0.000
Financial Development Index _{t-1}	-.00148	0.910	.06226	0.009	.08941	0.000	.52975	0.000	.08944	0.000	.52429	0.000	GDP _{t-1}	.0011	0.003	.0007	0.056	-.0003	0.676	-.0002	0.805	-.0003	0.050	-.0001	0.275
Financial Development Index _{t-2}			-.08967	0.000			-.4767	0.000			-.47265	0.000	GDP _{t-2}			.0012	0.002			.0005	0.543			-.0004	0.000
R-squared	0.1568		0.1417										R-squared	0.9576		0.9649									
AB AR(1) z p- value					-10.78 0.000		-9.43 0.000		-3.79 0.000		-3.88 0.000		AB AR(1) z p- value					-11.21 0.000		-5.67 0.000		-5.48 0.000		-5.57 0.000	
AB AR(2) z p- value					-0.91 0.365		0.93 0.354		-0.45 0.649		0.66 0.509		AB AR(2) z p- value					-2.12 0.034		-1.23 0.219		-2.46 0.014		-1.61 0.108	
Sargan test chi2 Prob > chi2					582.08 0.000		404.10 0.000		582.08 0.000		404.10 0.000		Sargan test chi2 Prob > chi2					42.71 0.007		102.46 0.000		42.71 0.007		102.46 0.000	
Hansen test chi2 Prob > chi2									45.52 0.615		43.69 0.527		Hansen test chi2 Prob > chi2									45.03 0.635		44.99 0.472	
WALD TEST (β ₁₁ =0) chi2 Prob > chi2	0.01 0.9097		6.82 0.0091		18.97 0.0000		44.43 0.0000		1783.87 0.0000		1262.80 0.0000		WALD TEST (β ₁₁ =0) chi2 Prob > chi2	8.88 0.0029		3.65 0.0562		0.18 0.6757		0.06 0.8048		3.85 0.0497		1.19 0.2752	
WALD TEST (β ₁₂ =0) chi2 Prob > chi2			15.10 0.0001				32.52 0.0000				1013.21 0.0000		WALD TEST (β ₁₂ =0) chi2 Prob > chi2			9.23 0.0024				0.37 0.5435				5.43 0.0198	
WALD TEST (β ₁₁ =β ₁₂ =0) chi2 Prob > chi2			8.02 0.0003				49.66 0.0000				1263.19 0.0000		WALD TEST (β ₁₁ =β ₁₂ =0) chi2 Prob > chi2			10.31 0.0000				0.37 0.8294				5.79 0.0553	
No.observations	1242		1196		1242		1196		1242		1196		No.observations	1242		1196		1242		1196		1242		1196	

Financial Development Index → GDP												GDP → Financial Development Index													
	Fixed effects				GMM one-step system				GMM two-step system					Fixed effects				GMM one-step system				GMM two-step system			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2			Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z		Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
GDP _{t-1}	.003511	0.000	.003576	0.000	.00545	0.000	.005982	0.000	.00544	0.000	.005982	0.000	Financial Institutions Access _{t-1}	.8890	0.000	.99558	0.000	.9470	0.000	1.320	0.000	.9502	0.000	1.321	0.000
GDP _{t-2}			-.00057	0.102			-.00275	0.000			-.00274	0.000	Financial Institutions Access _{t-2}			-.0531	0.018			-.365	0.000			-.369	0.000
Financial Institutions Access _{t-1}	-.00702	0.443	-.02892	0.221	-.0431	0.023	-.00197	0.984	-.0429	0.000	-.00004	0.998	GDP _{t-1}	.0022	0.000	.00150	0.000	.0020	0.002	.0011	0.135	.0019	0.000	.001	0.000
Financial Institutions Access _{t-2}			.016851	0.464			-.04377	0.654			-.04692	0.012	GDP _{t-2}			.00185	0.000			.0008	0.276			.0009	0.000
R-squared	0.1697		0.1660										R-squared	0.9752		0.9853									
AB AR(1) z p- value					-11.19 0.000		-10.54 0.000		-3.84 0.000		-3.88 0.000		AB AR(1) z p- value					-9.41 0.000		-6.48 0.000		-4.01 0.000		-4.78 0.000	
AB AR(2) z p- value					-0.71 .478		2.30 0.021		-0.36 0.717		1.42 0.155		AB AR(2) z p- value					0.45 0.651		1.30 0.192		0.57 0.565		1.76 0.078	
Sargan test chi2					601.91		524.36		601.91		524.36		Sargan test chi2					92.14		51.94		92.14		51.94	

Prob > chi2			0.000	0.000	0.000	0.000	Prob > chi2			0.000	0.222	0.000	0.222
Hansen test chi2					45.70	45.80	Hansen test chi2					43.76	44.16
Prob > chi2					0.608	0.439	Prob > chi2					0.685	0.508
WALD TEST ($\beta_{1,1}=0$) chi2	0.59	1.50	5.18	0.00	2193.81	0.00	WALD TEST ($\beta_{1,1}=0$) chi2	32.28	19.35	9.20	2.23	467.25	150.66
Prob > chi2	0.4425	0.2214	0.0228	0.9844	0.0000	0.9980	Prob > chi2	0.0000	0.0000	0.0024	0.1355	0.0000	0.0000
WALD TEST ($\beta_{1,2}=0$) chi2		0.54		0.20		6.37	WALD TEST ($\beta_{1,2}=0$) chi2		29.49		1.19		27.12
Prob > chi2		0.4644		0.6544		0.0116	Prob > chi2		0.0000		0.2763		0.0000
WALD TEST ($\beta_{1,1}=\beta_{1,2}=0$) chi2		1.16		5.35		245.37	WALD TEST ($\beta_{1,1}=\beta_{1,2}=0$) chi2		39.30		4.26		185.89
Prob > chi2		0.3126		0.0689		0.0000	Prob > chi2		0.0000		0.1188		0.0000
No.observations	1242	1196	1242	1196	1242	1196	No.observations	1242	1196	1242	1196	1242	1196

Financial Development Index → GDP												GDP → Financial Development Index													
	Fixed effects				GMM one-step system				GMM two-step system					Fixed effects				GMM one-step system				GMM two-step system			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2			Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z		Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
GDP _{t-1}	.00350	0.000	.003602	0.000	.005836	0.000	.005951	0.000	.00583	0.000	.005984	0.000	Financial Institutions Depth _{t-1}	.8237	0.000	.91638	0.000	.9854	0.000	.7887	0.000	.9892	0.000	.7967	0.000
GDP _{t-2}			-.00066	0.054			-.00233	0.009			-.00225	0.000	Financial Institutions Depth _{t-2}			-.0866	0.001			.2031	0.008			.1924	0.000
Financial Institutions Depth _{t-1}	-.0182	0.202	.084193	0.002	.070036	0.000	1.03179	0.000	.06938	0.000	1.03008	0.000	GDP _{t-1}	-.0002	0.469	-.0008	0.016	-.0016	0.012	-.0020	0.000	-.0015	0.000	-.0019	0.000
Financial Institutions Depth _{t-2}			-.13194	0.000			-.96992	0.000			-.97956	0.000	GDP _{t-2}			.00161	0.000			.0024	0.000			.0023	0.000
R-squared	0.1469		0.1011										R-squared	0.9824		0.9854									
AB AR(1) z					-11.47		-8.64		-3.81		-3.88		AB AR(1) z					-12.25		-3.92		-4.82		-5.48	
p- value					0.000		0.000		0.000		0.000		p- value					0.000		0.000		0.000		0.000	
AB AR(2) z					-0.53		1.25		-0.26		0.97		AB AR(2) z					-2.77		-3.04		-2.26		-3.11	
p- value					0.597		0.210		0.792		0.330		p- value					0.006		0.002		0.024		0.002	
Sargan test chi2					567.90		235.68		567.90		235.68		Sargan test chi2					110.94		129.19		110.94		129.19	
Prob > chi2					0.000		0.000		0.000		0.000		Prob > chi2					0.000		0.000		0.000		0.000	
Hansen test chi2									45.17		40.55		Hansen test chi2									44.97		42.63	
Prob > chi2									0.629		0.661		Prob > chi2									0.637		0.573	
WALD TEST													WALD TEST												
(β _{1,1} =0) chi2					23.67		79.02		378.65		954.38		(β _{1,1} =0) chi2	0.52		5.83		6.25		12.56		123.75		141.73	
Prob > chi2	1.63		10.07		0.0015		0.0000		0.0000		0.0000		Prob > chi2	0.4694		0.0160		0.0124		0.0004		0.0000		0.0000	
WALD TEST													WALD TEST												
(β _{1,2} =0) chi2			25.72				70.85				860.59		(β _{1,2} =0) chi2			22.36				16.44				261.85	
Prob > chi2			0.0000				0.0000				0.0000		Prob > chi2			0.0000				0.0001				0.0000	
WALD TEST													WALD TEST												
(β _{1,1} =β _{1,2} =0) chi2			14.63				83.47				1003.02		(β _{1,1} =β _{1,2} =0) chi2	11.36		0.0000				22.66				272.54	
Prob > chi2			0.0000				0.0000				0.0000		Prob > chi2			0.0000				0.0000				0.0000	
No.observations	1242		1196		1242		1196		1242		1196		No.observations	1242		1196		1242		1196		1242		1196	

Financial Development Index → GDP												GDP → Financial Development Index													
	Fixed effects				GMM one-step system				GMM two-step system					Fixed effects				GMM one-step system				GMM two-step system			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2		Financial Institutions Efficiency _{t-1}	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z		Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
GDP _{t-1}	.00344	0.000	.003489	0.000	.00526	0.000	.005381	0.000	.00523	0.000	.005522	0.000		.6748	0.000	.5919	0.000	.7312	0.000	.5845	0.000	.7350	0.000	.5693	0.000
GDP _{t-2}			-.00068	0.049			-.00303	0.000			-.00312	0.000	Financial Institutions Efficiency _{t-2}			.1332	0.000			.2290	0.011			.2394	0.000
Financial Institutions Efficiency _{t-1}	.033486	0.000	.048684	0.001	.13167	0.000	.397931	0.000	.13111	0.000	.415745	0.000	GDP _{t-1}	.0008	0.209	.0013	0.034	.0003	0.790	.0018	0.113	.0002	0.093	.0017	0.000
Financial Institutions Efficiency _{t-2}			-.01728	0.198			-.25035	0.000			-.26826	0.000	GDP _{t-2}			-.0003	0.630			-.0018	0.111			-.0013	0.000
R-squared	0.1433		0.1292										R-squared	0.8097		0.8418									

AB AR(1) z			-10.65	-8.64	-3.77	-4.13	AB AR(1) z			-9.64	-4.60	-4.59	-4.28
p- value			0.000	0.000	0.000	0.000	p- value			0.000	0.000	0.000	0.000
AB AR(2) z			-1.22	1.58	-0.64	1.10	AB AR(2) z			1.22	-0.80	0.94	-1.66
p- value			0.221	0.113	0.525	0.271	p- value			0.223	0.426	0.349	0.096
Sargan test chi2			568.92	345.17	568.92	345.17	Sargan test chi2			79.57	66.65	79.57	66.65
Prob > chi2			0.000	0.000	0.000	0.000	Prob > chi2			0.004	0.020	0.004	0.020
Hansen test chi2					45.40	40.37	Hansen test chi2					43.79	39.01
Prob > chi2					0.620	0.668	Prob > chi2					0.684	0.723
WALD TEST	14.17	10.82	22.44	35.94	926.19	1487.44	WALD TEST	1.58	4.49	0.07	2.51	2.82	62.31
($\beta_{11}=0$) chi2	0.0002	0.0010	0.0000	0.0000	.0000	0.0000	($\beta_{11}=0$) chi2	0.2087	0.0342	0.7902	0.1129	0.0928	0.0000
Prob > chi2							Prob > chi2						
WALD TEST		1.66		15.80		514.19	WALD TEST		0.23		2.55		32.35
($\beta_{12}=0$) chi2		0.1977		0.0001		0.0000	($\beta_{12}=0$) chi2		0.6301		0.1106		0.0000
Prob > chi2							Prob > chi2						
WALD TEST		6.83		40.57		1495.14	WALD TEST		2.32		3.93		64.87
($\beta_{11}=\beta_{12}=0$) chi2		0.0011		0.0000		0.0000	($\beta_{11}=\beta_{12}=0$) chi2		0.0987		0.1402		0.0000
Prob > chi2							Prob > chi2						
No.observations	1242	1196	1242	1196	1242	1196	No.observations	1242	1196	1242	1196	1242	1196

Financial Development Index → GDP												GDP → Financial Development Index													
	Fixed effects				GMM one-step system				GMM two-step system					Fixed effects				GMM one-step system				GMM two-step system			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2			Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z		Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
GDP _{t-1}	.00351	0.000	.003510	0.000	.00560	0.000	.00486	0.000	.00556	0.000	.004775	0.000	Financial Institutions Index _{t-1}	.7680	0.000	.8028	0.000	.9429	0.000	.8805	0.000	.9451	0.000	.8788	0.000
GDP _{t-2}			-.00065	0.063			-.0033	0.000			-.00322	0.000	Financial Institutions Index _{t-2}			.0423	0.042			.0711	0.389			.0730	0.000
Financial Institutions Index _{t-1}	.009266	0.474	.04687	0.070	.05182	0.009	.86470	0.000	.05148	0.000	.862063	0.000	GDP _{t-1}	.0009	0.009	.0006	0.069	.0001	0.863	.0004	0.483	.0001	0.015	.0004	0.000
Financial Institutions Index _{t-2}			-.0522	0.028			-.8025	0.000			-.79645	0.000	GDP _{t-2}			.0014	0.000			.0008	0.170			.0007	0.000
R-squared	0.1398		0.1495										R-squared	0.9621		0.9785									
AB AR(1) z					-11.23		-8.31		-3.81		-4.00		AB AR(1) z					-10.26		-5.35		-5.03		-4.88	
p- value					0.000		0.000		0.000		0.000		p- value					0.000		0.000		0.000		0.000	
AB AR(2) z					-0.71		2.06		-0.36		1.74		AB AR(2) z					0.00		-0.03		0.00		-0.06	
p- value					0.477		0.040		0.716		0.082		p- value					0.998		0.977		0.998		0.951	
Sargan test chi2					590.55		290.00		590.55		290.00		Sargan test chi2					77.94		84.48		77.94		84.48	
Prob > chi2					0.000		0.000		0.000		0.000		Prob > chi2					0.005		0.000		0.005		0.000	
Hansen test chi2									45.61		43.09		Hansen test chi2									43.48		42.95	
Prob > chi2									0.612		0.553		Prob > chi2									0.696		0.559	
WALD TEST (β ₁₁ =0) chi2	0.51		3.29		6.84		43.08		311.17		478.17		WALD TEST (β ₁₁ =0) chi2	6.79		3.31		0.03	0.8633	0.49		5.97		28.39	
Prob > chi2	0.4742		0.0698		0.0089		0.0000		0.0000		0.0000		Prob > chi2	0.0093		0.0693			0.4828		0.0145		0.0000		
WALD TEST (β ₁₂ =0) chi2			4.84				39.27				501.95		WALD TEST (β ₁₂ =0) chi2			20.79				1.89				94.16	
Prob > chi2			0.0279				0.0000				0.0000		Prob > chi2			0.0000				0.1697				0.0000	
WALD TEST (β ₁₁ =β ₁₂ =0) chi2			2.42				43.79				503.02		WALD TEST (β ₁₁ =β ₁₂ =0) chi2			18.12				3.09				132.74	
Prob > chi2			0.0892				0.0000				0.0000		Prob > chi2			0.0000				0.2136				0.0000	
No.observations	1242		1196		1242		1196		1242		1196		No.observations	1242		1196		1242		1196		1242		1196	

Financial Development Index → GDP													GDP → Financial Development Index												
	Fixed effects				GMM one-step system				GMM two-step system					Fixed effects				GMM one-step system				GMM two-step system			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2			Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z		Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
GDP _{t-1}	.003495	0.000	.003551	0.000	.00504	0.000	.005699	0.000	.00508	0.000	.00567	0.000	Financial Markets Access _{t-1}	.7815	0.000	.6662	0.000	.9836	0.000	.7755	0.000	.9822	0.000	.7833	0.000
GDP _{t-2}			-.00068	0.049			-.00312	0.000			-.00318	0.000	Financial Markets Access _{t-2}			.1231	0.000			.2358	0.030			.2236	0.000
Financial Markets Access _{t-1}	.009979	0.227	.04818	0.001	.10278	0.000	.276343	0.000	.10196	0.000	.273923	0.000	GDP _{t-1}	.0015	0.024	.0013	0.065	-.0014	0.330	.0002	0.458	-.0015	0.000	-.0011	0.000

Financial Markets Access ₁₂			-0.04826	0.001			-0.18899	0.001				-0.18609	0.000	GDP ₁₂			.0007	0.319			-0.0018	0.909				.0002	0.362
R-squared	0.1434		0.1475											R-squared	0.9407		0.9432										
AB AR(1) z p- value					-10.48 0.000		-10.06 0.000			-3.79 0.000		-4.20 0.000	AB AR(1) z p- value						-13.90 0.000		-4.17 0.000			-4.35 0.000		-4.18 0.000	
AB AR(2) z p- value					-1.04 0.299		1.99 0.046			-0.52 0.602		1.30 0.195	AB AR(2) z p- value						-0.46 0.647		-1.86 0.063			-0.44 0.657		-2.71 0.007	
Sargan test chi2 Prob > chi2					583.55 0.000		412.13 0.000			583.55 0.000		412.13 0.000	Sargan test chi2 Prob > chi2						69.55 0.028		71.32 0.007			69.55 0.028		71.32 0.007	
Hansen test chi2 Prob > chi2										44.96 0.638		45.08 0.469	Hansen test chi2 Prob > chi2											44.92 0.639		44.40 0.497	
WALD TEST (β ₁₁ =0) chi2 Prob > chi2	1.46 0.2266		11.44 0.0007		39.15 0.0000		26.85 0.0000			1601.02 0.0000		301.97 0.0000	WALD TEST (β ₁₁ =0) chi2 Prob > chi2	5.09 0.0242		3.40 0.0653		0.95 0.3296		0.55 0.4581			13.95 0.0002			13.33 0.0003	
WALD TEST (β ₁₂ =0) chi2 Prob > chi2			11.97 0.0006				10.98 0.0009					111.14 0.0000	WALD TEST (β ₁₂ =0) chi2 Prob > chi2			1.00 0.3185				0.01 0.9088						0.83 0.3623	
WALD TEST (β ₁₁ =β ₁₂ =0) chi2 Prob > chi2			6.52 0.0015				45.43 0.0000					1146.93 0.0000	WALD TEST (β ₁₁ =β ₁₂ =0) chi2 Prob > chi2			3.46 0.0317				0.56 0.7554						16.29 0.0003	
No.observations	1242		1196		1242		1196		1242		1196		No.observations	1242		1196		1242		1196		1242		1196			

Financial Development Index → GDP													GDP → Financial Development Index												
	Fixed effects				GMM one-step system				GMM two-step system					Fixed effects				GMM one-step system				GMM two-step system			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2			Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z		Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
GDP _{t-1}	.003536	0.000	.003622	0.000	.00554	0.000	.00719	0.000	.00552	0.000	.007202	0.000	Financial Markets Efficiency _{t-1}	.7127	0.000	.7272	0.000	.7734	0.000	.7783	0.000	.7806	0.000	.8136	0.000

GDP _{t-2}			-.00058	0.093			-.00289	0.000			-.00291	0.000	Financial Markets Efficiency _{t-2}			-.019	0.483			.0402	0.686			.0043	0.906
Financial Markets Efficiency _{t-1}	-.00916	0.027	-.01885	0.002	-.0136	0.000	-.10759	0.000	-.0138	0.000	-.10798	0.000	GDP _{t-1}	.0029	0.054	.0033	0.038	.0052	0.066	.0070	0.023	.0051	0.000	.0064	0.000
Financial Markets Efficiency _{t-2}			.008651	0.155			.123455	0.000			.125110	0.000	GDP _{t-2}			-.0003	0.835			-.0033	0.279			-.0032	0.000
R-squared	0.1392		0.1281										R-squared	0.8053		0.8158									
AB AR(1) z p- value					-11.00 0.000		-9.39 0.000		-3.84 0.000		-4.07 0.000		AB AR(1) z p- value					-9.53 0.000		-4.35 0.000		-4.65 0.000		-4.46 0.000	
AB AR(2) z p- value					-0.61 0.542		2.36 0.018		-0.31 0.753		1.62 0.106		AB AR(2) z p- value					-2.03 0.043		-1.37 0.169		-1.76 0.079		-1.46 0.144	
Sargan test chi2 Prob > chi2					605.41 0.000		380.21 0.000		605.41 0.000		380.21 0.000		Sargan test chi2 Prob > chi2					110.99 0.000		87.95 0.000		110.99 0.000		87.95 0.000	
Hansen test chi2 Prob > chi2									45.75 0.606		45.15 0.466		Hansen test chi2 Prob > chi2									44.49 0.656		43.85 0.521	
WALD TEST (β _{t-1} =0) chi2 Prob > chi2	4.89 0.0272		9.25 0.0024		1.06 0.3030		15.89 0.0001		120.92 0.0000		746.91 0.0000		WALD TEST (β _{t-1} =0) chi2 Prob > chi2	3.72 0.0539		4.32 0.0380		3.38 0.0661		5.15 0.0232		106.69 0.0000		75.36 0.0000	
WALD TEST (β _{t-2} =0) chi2 Prob > chi2			2.02 0.1554				22.73 0.0000				1306.65 0.0000		WALD TEST (β _{t-2} =0) chi2 Prob > chi2			0.04 0.8349				1.17 0.2789				96.14 0.0000	
WALD TEST (β _{t-1} =β _{t-2} =0) chi2 Prob > chi2			5.28 0.0052				22.83 0.0000				1321.62 0.0000		WALD TEST (β _{t-1} =β _{t-2} =0) chi2 Prob > chi2			2.38 0.0926				5.34 0.0693				172.68 0.0000	
No.observations	1242		1196		1242		1196		1242		1196		No.observations	1242		1196		1242		1196		1242		1196	

Financial Development Index → GDP												GDP → Financial Development Index													
	Fixed effects				GMM one-step system				GMM two-step system					Fixed effects				GMM one-step system				GMM two-step system			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2			Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z		Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
GDP _{t-1}	.00353	0.000	.00344	0.000	.00522	0.000	.005418	0.000	.00523	0.000	.005393	0.000	Financial Markets Index _{t-1}	.8331	0.000	.8756	0.000	1.011	0.000	1.136	0.000	1.009	0.000	1.137	0.000
GDP _{t-2}			-.00055	0.112			-.00272	0.000			-.00276	0.000	Financial Markets Index _{t-2}			-.0614	0.027			-.1362	0.147			-.1457	0.000
Financial Markets Index _{t-1}	-.0047	0.550	.0364	0.015	.08483	0.000	.246719	0.000	.0837	0.000	.248915	0.000	GDP _{t-1}	.0012	0.046	.0009	0.153	-.0008	0.000	-.0009	0.524	-.0008	0.000	-.0008	0.000
Financial Markets Index _{t-2}			-.0535	0.000			-.17787	0.000			-.18134	0.000	GDP _{t-2}			.0008	0.219			.0002	0.889			.0004	0.168
R-squared	0.1548		0.1371										R-squared	0.9324		0.9352									
AB AR(1) z p- value					-10.54 0.000		-9.88 0.000		-3.76 0.000		-3.86 0.000		AB AR(1) z p- value					-11.84 0.000		-5.71 0.000		-5.20 0.000		-5.03 0.000	
AB AR(2) z p- value					-1.10 0.270		1.26 0.207		-0.55 0.580		0.80 0.423		AB AR(2) z p- value					-3.16 0.002		-1.10 0.269		-3.17 0.002		-1.66 0.097	
Sargan test chi2 Prob > chi2					580.91 0.000		454.31 0.000		580.91 0.000		454.31 0.000		Sargan test chi2 Prob > chi2					144.89 0.000		109.20 0.000		144.89 0.000		109.20 0.000	
Hansen test chi2 Prob > chi2									45.62 0.611		44.55 0.491		Hansen test chi2 Prob > chi2							45.68 0.608		43.82 0.522			
WALD TEST (β _{t-1} =0) chi2 Prob > chi2	0.36 0.5503		5.89 0.0154		24.19 0.0000		28.17 0.0000		639.03 0.0000		869.39 0.0000		WALD TEST (β _{t-1} =0) chi2 Prob > chi2	3.99 0.0461		2.05 0.1527		0.40 0.5292		0.41 0.5242		22.25 0.0000		32.62 0.0000	
WALD TEST (β _{t-2} =0) chi2 Prob > chi2			13.05 0.0003				13.26 0.0003				334.95 0.0000		WALD TEST (β _{t-2} =0) chi2 Prob > chi2			1.51 0.2189				0.02 0.8885				1.90 0.1678	
WALD TEST (β _{t-1} =β _{t-2} =0) chi2 Prob > chi2			7.19 0.0008				37.03 0.0000				1589.56 0.0000		WALD TEST (β _{t-1} =β _{t-2} =0) chi2 Prob > chi2			2.93 0.0538				0.41 0.8150				32.62 0.0000	
No.observations	1242		1196		1242		1196		1242		1196		No.observations	1242		1196		1242		1196		1242		1196	

Source: Author's calculations using STATA statistical software. Data were sourced from the IMF databases.

Annex IV - Granger non-causality test results: individual countries results (Wald statistics)

Causality: Financial Development → GDP			Causality: GDP→ Financial Development		
	Lag order: 1 lag	Lag order: 2 lags		Lag order: 1 lag	Lag order: 2 lags
Financial Development Index → GDP	Bulgaria: 2.944* China: 3.155* Greece: 3.083* Rep. Korea: 5.917** Norway: 7.733***	Australia: 12.55* Bulgaria: 6.753* Cyprus: 5.169* Czech Rep.: 6.19* Denmark: 9.948** Rep. Korea: 8.379** Netherlands: 8.81** Norway: 24.105*** Sweden: 7.781** UK: 6.059* US: 12.107*	GDP → Financial Development Index	Argentina: 5.62** Australia: 3.086* Belgium: 5.530** Canada: 3.224* Cyprus: 6.06** Czech Rep. 3.793* Romania: 12.13*** Switzerland: 5.24**	Argentina: 10.16*** Belgium: 5.158* Bulgaria: 7.017** Canada: 7.359** Romania: 11.206*** Russian Fed.: 7.761** Slovenia: 6.954** South Africa: 8.966**
Financial Institutions Access Index → GDP	Greece: 8.531*** Rep. Korea: 13.30*** Malta: 3.279* Norway: 3.06* US: 3.408*	Argentina: 8.474** Australia: 13.4*** Czech Rep.: 9.327** Greece: 6.70** India: 5.164* Rep. Korea: 15.89** New Zealand: 6.85** Norway: 7.899** Russian Fed.: 5.273* US: 7.272**	GDP → Financial Institutions Access Index	Australia: 10.51** Denmark: 8.866* Hungary: 24.87*** Indonesia: 3.947* Italy: 4.999** Romania: 5.835**	Denmark: 8.304** Greece: 14.75*** Hungary: 6.311* Italy: 5.328* Lithuania: 10.57*** Russian Fed.: 7.61** Slovenia: 5.701*
Financial Institutions Depth Index → GDP	Germany: 7.88*** Rep. Korea: 7.26*** Malta: 8.02*** Switzerland: 4.499**	Australia: 8.644** Canada: 9.899** Czech Rep.: 13.47*** Denmark: 15.03*** Finland: 9.72** Germany: 13.80*** Hungary: 8.865** Iceland: 7.70** Indonesia: 19.05*** Italy: 29.44*** Rep. Korea: 10.29** Luxembourg: 6.03* Malta: 9.224** Portugal: 6.375* South Africa: 8.885** Spain: 10.14** Sweden: 6.61* Switzerland: 14.88*** UK: 30.164***	GDP → Financial Institutions Depth Index	China: 5.912** Hungary: 3.597* India: 7.483*** Italy: 2.951* Malta: 3.861* New Zealand: 4.73** Poland: 4.587** Spain: 3.306* UK: 3.66* US: 8.014***	China: 8.425** Finland: 19.25*** Hungary: 10.49*** India: 5.710* Latvia: 13.28*** New Zealand: 8.64** Portugal: 6.658* Russian Fed.: 5.267* Slovenia: 9.05** South Africa: 11.22*** UK: 8.102** US: 6.799**
Financial Institutions Efficiency Index → GDP	France: 2.953* Malta: 5.994** Poland: 5.509**	Argentina: 19.36*** Australia: 13.67*** Brazil: 6.70** China: 5.534* France: 5.2830061** Germany: 10.22 Greece: 6.640* Hungary: 8.08** Norway: 9.702** Poland: 7.351** Romania: 14.647***	GDP → Financial Institutions Efficiency Index	Australia: 4.185** Denmark: 3.899* India: 8.938*** Romania: 4.744** Turkey: 3.205*	Cyprus: 5.479* Denmark: 5.312* Estonia: 12.095*** Iceland: 6.790** India: 6.034* Italy: 7.05**
Financial Institutions Index → GDP	Austria: 3.677* Greece: 3.972* Rep. Korea: 9.278*** Malta: 6.340** Norway: 3.684* Switzerland: 4.25**	Argentina: 7.543** Australia: 13.945*** Austria: 10.413*** Czech Rep.: 14.53*** Denmark: 6.408* Finland: 5.654* Germany: 8.625** Rep. Korea: 10.193** Norway: 7.022** Romania: 6.73* Switzerland: 12.82*** UK: 5.702*	GDP → Financial Institutions Index	Australia: 5.196** China: 3.869* Greece: 9.864*** Hungary: 11.608*** Romania: 7.643***	China: 7.364** 596 .04259014 Finland: 15.076*** 099 .00340798 Greece: 10.248** Hungary: 8.357** South Africa: 7.25**
Financial Markets Access Index → GDP	Bulgaria: 3.205* Japan: 3.171* Rep. Korea: 3.915* Norway: 6.022** Poland: 3.290* South Africa: 3.707* Switzerland: 4.235**	Australia: 8.835** Croatia: 9.961** Cyprus: 11.38*** Finland: 6.023* France: 8.185** Japan: 11.89*** Lithuania: 6.353* Netherlands: 17.65*** Norway: 7.323** Poland: 5.517* Sweden: 14.626*** US: 7.381**	GDP → Financial Markets Access Index	Argentina: 6.44** Hungary: 7.896*** Iceland: 3.613* Italy: 10.076*** Malta: 5.691** Turkey: 3.117*	Argentina: 12.865*** Canada: 5.6170* Cyprus: 5.527* Denmark: 6.838** Finland: 6.418* Italy: 9.657** Rep. Korea: 20.29*** 2783 .00082532
Financial	Brazil: 4.403**	Australia: 9.40**	GDP → Financial	Cyprus: 3.012*	Rep. Korea: 15.79***

Markets Depth Index → GDP	Bulgaria: 9.561*** China: 4.968** Rep. Korea: 2.958* Lithuania: 3.957* Norway: 5.933** Romania: 7.797***	Austria: 13.67*** Brazil: 22.92*** Bulgaria: 5.283* Canada: 11.78*** China: 6.605** Croatia: 9.33* Cyprus: 8.296** Czech Rep. 7.12** Denmark: 14.32*** Finland: 5.31* France: 34.97*** Germany: 5.44* Hungary: 6.02* Iceland: 6.96** Rep. Korea: 9.22** Latvia: 9.169** Lithuania: 35.02*** Mexico: 6.41* Netherlands: 30.21*** Norway: 15.15*** Portugal: 5.067* Romania: 8.32** Slovenia: 24.82*** Spain: 6.856** Sweden: 31.76*** UK: 17.24*** US: 15.96***	Markets Depth Index	Rep. Korea: 9.336*** Latvia: 3.811* New Zealand: 3.12* Russian Fed.: 3.07* Switzerland: 3.20*	Russian Fed.: 6.48* South Africa: 5.96*
Financial Markets Efficiency Index → GDP	Brazil: 5.09** Norway: 3.217* Poland: 7.00*** Russian Fed.: 3.117* Switzerland: 5.979**	Australia: 7.11** Belgium: 13.18*** Brazil: 9.98** Canada: 10.87*** Mexico: 8.93* Norway: 6.29* Poland: 8.54** South Africa: 11.06***	GDP → Financial Markets Efficiency Index	Belgium: 5.964** Bulgaria: 12.40*** Canada: 4.98** Luxembourg: 3.732* Netherlands: 4.77** Norway: 3.09* Slovak Rep: 11.4*** UK: 5.07**	Bulgaria: 11.81*** Canada: 6.243* Luxembourg: 7.853** Netherlands: 5.772* Slovak Rep.: 9.59**
Financial Markets Index → GDP	China: 3.75* Rep.Korea: 4.479** Lithuania: 3.99* Norway: 8.83***	Australia: 10.09** Bulgaria: 6.08* Croatia: 10.03** Cyprus: 5.46* Denmark: 5.75* Iceland: 6.26* Rep. Korea: 6.99** Lithuania: 15.44*** Netherlands: 21.25*** Norway: 23.69*** Poland: 7.229** Sweden: 5.91** US: 9.78**	GDP → Financial Markets Index	Argentina: 6.89*** Belgium: 7.96*** Bulgaria: 9.14*** Canada: 3.06* Cyprus: 4.70** Ireland: 3.33* Switzerland: 4.79**	Belgium: 8.50** Bulgaria: 8.96** Canada: 7.63** Ireland: 5.47* Russian Fed.: 6.179*

***significant at 1% level; ** significant at 5% level; * significant at 10% level.

Source: Author's calculations using STATA statistical software. Data were sourced from the IMF databases.