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CAUSALITY TESTS BETWEEN FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH: EMPIRICAL EVIDENCE FROM A PANEL INCLUDING 46 COUNTRIES SPREAD BY ALL CONTINENTS*

ABSTRACT

This paper contributes to the literature by using the financial development index and sub-indices available in the International Monetary Fund database to test the causal relationship between financial development and economic growth. It applies 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) non-causality test, using the algorithm developed by Lopez and Weber (2017), in a sample including 46 countries spread across all continents over the period 1990-2017. The results obtained confirm the existence of causality running from financial development to economic growth, and, although not with the same statistical robustness, they also confirm the existence of reverse causality running from economic growth to financial development. The empirical findings also demonstrate that there are no significant differences between the results obtained for the sub-indices capturing the different aspects of the development of financial institutions and the development of financial markets. Overall, the paper confirms that the diversities of financial systems across countries require multiple indicators to measure their financial development. In line with the contributions of Sahay *et al.* (2015) and Svirydzenka (2016), the findings of this study recommend a broad definition of financial development and the use of measures encompassing relevant characteristics of banking and non-banking financial institutions and the financial markets. The paper specifically confirms the importance of the causal relation between economic growth and three specific dimensions of the financial institutions and markets: their

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size and liquidity (depth), the ability of individuals and companies to access financial services (access), and the ability of the institutions to provide financial services at low costs and with sustainable revenues, as well as the level of activities of the financial markets (the efficiency of the financial institutions and markets).

Keywords: Financial Development; Financial Development Indices; Financial Institutions and Markets; Economic Growth; Panel Granger-Causality
JEL Classification: C33; E02; E44; F43; G20; O43

Riassunto

Test di causalità tra sviluppo finanziario e crescita economica: evidenze empiriche da un panel di 46 paesi di tutti i continenti

Questo articolo analizza la relazione causale tra sviluppo finanziario e crescita economica utilizzando gli indici e i sottoindici di sviluppo finanziario forniti dal database del Fondo Monetario Internazionale. Vengono applicati test di causalità di Granger secondo gli approcci di Nair-Reichert e Weinhold (2001), Bangake ed Eggoh (2011) e tests di non-causalità di Dumitrescu e Hurlin (2012), utilizzando l'algoritmo di Lopez e Weber (2017) su un campione di 46 paesi per il periodo 1990-2017. I risultati ottenuti confermano l'esistenza di causalità dallo sviluppo finanziario alla crescita economica e anche se non con la stessa robustezza statistica, confermano l'esistenza di una causalità inversa da crescita economica a sviluppo finanziario. I risultati empirici dimostrano anche che non vi sono significative differenze tra i risultati ottenuti per i sub-indici che colgono i diversi aspetti dello sviluppo delle istituzioni finanziarie e dei mercati finanziari. Soprattutto i risultati dello studio confermano che è necessaria una molteplicità di indicatori per misurare lo sviluppo finanziario dei vari paesi a causa delle differenze tra i loro sistemi finanziari. In linea con i lavori di Sahay *et al.* (2015) e Svirydzenka (2016), questi risultati suggeriscono di dare una definizione ampia dello sviluppo finanziario e di usare misure che colgano le caratteristiche delle istituzioni finanziarie, sia bancarie che non, e dei mercati finanziari. In particolare, lo studio conferma l'importanza della relazione causale tra la crescita e tre specifici aspetti delle istituzioni e dei mercati finanziari: la loro dimensione e liquidità (la profondità), la capacità dei privati e delle istituzioni di fornire servizi finanziari a basso costo e con ricavi sostenibili, il livello di attività dei mercati finanziari (cioè l'efficienza delle istituzioni e dei mercati).

1. Introduction

Over decades and particularly since the pioneer works of King and Levine (1993a, 1993b), the link between the quality of financial systems and economic growth has been studied and analysed with different methods and empirical tests, but their findings are still far from consensus and stimulate further investigation.

A relevant strand of literature (for example, Levine, 1997; Demirguç-Kunt and Levine, 1999; Beck *et al.*, 2000; Greenwood *et al.*, 2010, 2013) provided several robust findings demonstrating the contribution of different measures of financial development to economic growth. 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). There are also relevant empirical analyses (such as Wachtel, 2001; Khan and Senhadij, 2003; Rousseau and Wachtel, 2011; Arcand *et al.*, 2012; Dabla-Norris *et al.*, 2015) finding a negative or insignificant link between financial development and economic growth.

The empirical studies included different 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 appropriate representatives of the performance of the financial systems and institutions. The importance of the specific variables used to measure financial development is particularly evident and provides justification for the mixed results that were obtained in several empirical works. For example, Gaytan and Rancière (2004) pointed 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. Ayadi *et al.* (2015) found deficiencies in bank credit allocation, 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 economic growth. Cournède and Denk (2015) also found that intermediated credit had a negative link with GDP growth and that stock market size had a positive one.

The importance and difficulty of agreement on a satisfactory empirical measure of financial development are well discussed, for example, in Khan and Senhadji (2000), Wachtel (2001), Kar *et al.* (2011), and Sahay *et al.* (2015). As well highlighted in Kar *et al.* (2011), this difficulty of agreement comes from the broad definition of financial development, considering that overall it

includes the capability of one country to channel savings into investment efficiently and effectively within its own borders owing to the quality of its institutional and regulatory framework, the size of its financial markets, the diversity of its financial instruments and private agents' ease of access to them and the financial markets' performance in terms of efficiency and liquidity.

Sahay *et al.* (2015) corroborate the need for new measures corresponding to a broader definition of financial development. They specifically underline that despite the important role of banking institutions, many nonbank financial institutions, such as insurance companies, mutual funds, pension funds, and venture capital firms, also play very substantive roles, clearly contributing to financial development. They also highlight that financial markets have evolved in ways that allow individuals and firms to diversify their savings, and firms to raise money through stocks, bonds, and foreign exchange markets, and that the diversities of financial systems across countries require multiple indicators to measure their financial development. Sahay *et al.* (2015) develop a new financial index encompassing the banking and non-banking financial institutions as well as the financial markets across three relevant dimensions: depth (size and liquidity), access (ability of individuals and companies to access financial services), and efficiency (ability of institutions to provide financial services at low costs and with sustainable revenues and the level of activities of financial markets). This broad financial development index is also very clearly presented and well discussed in Svirydzenka (2016) and is nowadays available at the International Monetary Fund (IMF) database, which provides nine specific financial development indices over 180 countries with an annual frequency from 1980 onwards (although not all the indices are available for all countries since 1980).

Despite the extensive literature analysing the relationship between financial development and economic growth, to our knowledge, not many works have considered these nine specific financial development indices to analyse the potential causal relationships between financial development and economic growth.

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) non-causality test, using the algorithm developed by Lopez and Weber (2017) to analyse the Granger-causality relations between real GDP growth

and the financial development index and sub-indices available at the IMF database. Taking into consideration the importance of financial globalisation and the integration of some specific countries and regions, the paper considers a sample of 46 countries, including not only all European Union (EU) members but also other relevant countries spread across all continents, with which the EU members have relevant economic and financial relationships, during the period 1990-2017. More precisely, the paper aims to provide answers to the following questions:

1) Does financial development Granger-cause economic growth?
2) Does economic growth Granger-cause financial development?
3) Is it possible to identify relevant differences in the results obtained for the sub-indices capturing the development of financial institutions and the development of financial markets?
4) Is it possible to identify relevant differences in the results obtained for the sub-indices capturing the different aspects (access, depth, and efficiency) of the development of the financial institutions?
5) Is it possible to identify relevant differences in the results obtained for the sub-indices capturing the different aspects (access, depth, and efficiency) of the development of the financial markets?
6) Is it possible to identify relevant differences in the individual results obtained for the 46 countries included in the panel?

The results obtained demonstrate the existence of bidirectional panel Granger-causality, although not with the same statistical robustness for all the financial development index and the sub-indices available at the IMF database for the considered panel of 46 countries between 1990 and 2017. Overall, the results obtained both by the Granger-causality estimations and the Dumitrescu and Hurlin (2012) Granger non-causality test indicate that the causal relationship from financial development to economic growth is statistically more robust than the reverse causality from economic growth to financial development. No significant differences were found when comparing the results obtained for the financial institutions indices with those regarding the financial markets indices. However, it is still possible to identify some differences in the results, capturing the different aspects of the development of financial institutions and markets. For example, the results regarding the different aspects of the development of the financial institutions reveal that the past values of the depth and efficiency of these institutions are much

more important than the past values of the access to the financial institutions to explain the evolution of the real GDP growth in the considered panel.

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

2. Brief literature review

There is a relatively large strand of literature empirically analysing the relevance of financial development to economic growth, particularly after the pioneering empirical analyses of King and Levine (1993a, 1993b). Other authors focused on the reverse contribution of economic growth to financial development. For example, Demirguç-Kunt and Levine (1999) concluded that wealthy countries had more developed financial systems.

Not so many works have analysed the potential causal relations between financial development and economic growth. Nevertheless, there are some early studies analysing these causal relations, and some relevant empirical studies have used various approaches and datasets to test the potential existence of one-directional or bi-directional causality between financial development and economic growth. Some of these studies particularly highlighted the relevance of using different proxies to measure financial development.

Examples of Early Studies Empirically Testing the Causal Relations between Financial Development and Economic Growth

Demetriades and Hussein (1996) analysed some pioneering empirical works addressing the issue of causality between financial development and economic growth, underlying some of their limitations, namely those related to the measures of financial development and to the used estimation techniques. Using time series techniques, they conducted causality tests between financial development (measured by the ratios of 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, they clearly demonstrated that causality patterns vary across countries. Moreover, Demetriades and Hussein (1996) results provided little support for the view that finance was a leading sector in the process of economic development, but they found considerable evidence of

bi-directionality and some relevant 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 runs in both directions, 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 a bank's total deposit liabilities to one period-lag 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.

Studies Highlighting the Relevance of Using Different Approaches and Datasets to Test the Causal Relationship between Financial Development and Economic Growth

Several studies analysing the potential causal relations between financial development and economic growth highlight the importance of adopting different approaches and using datasets and some specific proxies to measure financial development.

For example, Levine *et al.* (2000) constructed a new dataset using different measures of financial intermediation, such as liquid liabilities of the financial system in relation to GDP, defined as currency plus demand and interest-bearing liabilities of financial intermediaries, and the ratio of credit value by financial intermediaries to the private sector to GDP. They applied traditional cross-sectional and instrumental-variable procedures as well as dynamic panel techniques, considering a panel dataset of 74 countries, and concluded 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. Using two specific measures of financial development (the ratio of broad money, M2 to GDP, and the ratio of credits provided by financial intermediaries to the private sector to GDP), the authors found that financial development generally led 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. Financial development was measured by three variables aiming to capture the variety of channels through which finance can affect growth: the ratio of liquid liabilities to GDP, the ratio of deposit money bank assets to GDP, and the ratio of private domestic credit to GDP. The findings overall confirmed 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) used domestic credit to the private sector as a percentage of GDP and broad money (M3) to empirically analyse how financial development was linked to economic growth. They applied 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 Granger-causality between finance and growth for most of the considered regions and a one-way Granger-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 a 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), who used real domestic credit to the private sector

as a share of GDP to measure financial development. They tested the Granger-causality between economic growth, energy consumption, and financial development in six South Mediterranean countries over the 1995-2015 period and presented mixed results for individual countries, as the causal relationships diverged essentially in intensity and the rates of adjustment varied from country to country.

Some Recent Empirical Studies Incorporating Different Measures of Financial Development

Corroborating the idea developed, for example, in Kar *et al.* (2011), that the scope of financial development includes improvements in products, institutions, and organisations in the banking sector, non-banking financial structures, and capital markets, several recent empirical studies testing the causal relations between financial development and economic growth expand the set of variables representing financial development.

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. Financial development was measured through three composite indices: a banking sector development index, a stock market development index (STD), and an overall financial development index. The authors 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.

Hatemi-J (2019) empirically assessed the potential causal impact of stock market development on the economic growth of the United Arab Emirates (UAE). Using quarterly data covering the period 2006:Q1-2016:Q1, the paper concluded that the financial sector has a positive causal impact on the economic performance and that the development of the stock market in the UAE could function as a successful tool for the development of the real sector of the UAE economy.

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. Financial development was proxied by three groups of indicators: bank efficiency indicators (including the ratio of broad money, M3, to GDP; the growth of broad money: the ratio of credit to private sector to GDP; the growth of domestic credit to private sector; and the ratio of the claims on private sector to broad money); equity market efficiency indicators (namely the total value of stocks traded to GDP, and the market capitalization of listed domestic companies to GDP); and an additional financial development indicator, the fiscal policy efficiency (more precisely, the ratio of government final consumption expenditure to GDP) capturing the influence of government planning on economic growth. The main conclusions of Yang (2019) 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 were stronger and some were weaker. Moreover, there was a reverse Granger-causality between economic growth and equity market development in high-income economies, which was not detected in the other economies.

Mhadhbi *et al.* (2020) examined the direction of causality between banking sector development and economic growth in 40 developing countries from 1970 to 2012. They used principal component analysis to obtain composite indicators for both bank outputs and inputs and to construct summary indices capturing different dimensions of financial development. The components of their index of outputs for banking sector development included the broad money supply, the domestic credit provided by the banking sector, and the domestic credit to the private sector. To construct the input index of banking sector development they employed the banking system's share in GDP, the number of banks and branches *per capita*, and the share of manpower employed in the banking system. The empirical results showed that the direction of causality between banking sector development and economic growth was sensitive to the choice of indices of banking sector development, capturing either the outputs or the inputs of banking activity. Despite the wide range of results, the authors highlighted that there was a causal relationship between banking sector development and economic growth in 25 countries, representing 62.5% of the countries considered in the empirical estimations.

Despite the overall conclusions pointing to the existence of causal relations between financial development and economic growth in some relevant studies, the conclusions about the direction of these causal relations are still far from consensus. Some of these works highlighted that the development of financial intermediaries exerted an important causal impact on growth, and many of them found bi-directional causality between financial development and economic growth, although not with the same strength and not always for all the considered countries or regions. Moreover, and still in line with the pioneering work of Demetriades and Hussein (1996), and the pertinent discussions of, among others, Kar *et al.* (2011), Sahay *et al.* (2015), and Svirydzenka (2016), the results of the empirical tests clearly depend on the concrete proxies used to measure the different aspects of the development of financial institutions and markets. Following this line of research this paper uses the financial development indices available in the IMF database to test the potential causality relations between financial development and economic growth in a sample including 46 countries spread across all continents over the period 1990-2017.

3. METHODOLOGY AND DATA

3.1 Methodology

Granger (1969) developed a very widely used definition of causality that is often employed by economists and political scientists who are interested in the intertemporal flow of effects between two variables *x* and *y*. According to the developed general Granger-causality concept, 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}, ..., but not specifically on its current value, x_t, as the cause cannot come after its effect.

Following not only Granger (1969) but also other authors, such as Nair-Reichert and Weinhold (2001), Bangake and Eggoh (2011), Pradhan *et al.* (2018), Antonietti and Franco (2021), Joshi and Beck (2021), and Cincinelli *et al.* (2022), the starting point to investigate the possible directions of the Granger-causality between the variables *y* and *x* is the estimation of the following general bivariate VAR model:

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

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

where $i = 1,...,N$ are the cross units; $t = 1,...,T$ are the time periods; $\alpha_{1,2}$ are the intercepts; $k = 1,...K$ 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 $H_0: \beta_i = 0, \forall i = 1,...,N$.
If H_0 is rejected, it is possible to conclude that causality exists. More precisely, the strength of the Granger-causality in each estimated equation can be evaluated using Wald tests for each of the β_i that are obtained for the considered time lags ($t-1$, $t-2$,...). If the Wald test indicates that H_0 is rejected, causality from x to y (or from y to x) exists.

The Granger-causality can also be measured with the procedure proposed by Dumitrescu and Hurlin (2012) and the algorithm developed by Lopez and Weber (2017). This procedure also considers the previous 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 it 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-causes variable y for at least one cross-unit. More precisely, it proposes to test the non-causality considering the null hypothesis $H_0: \beta_i = 0, \forall i = 1,...,N$, with $\beta_i = (\beta_i^{(1)}, ..., \beta_i^{(k)})$, which corresponds to the absence of Granger-causality for all cross units of the panel.

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

This test is designed to detect Granger-causality at the panel level, and rejecting H_0 does not exclude Granger 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 the Granger causal relationship holds.

3.2 Data

Economic growth is usually proxied by real Gross Domestic Product and here it is represented by the natural logarithm of the series "Gross Domestic Product, Volume, Seasonally Adjusted", sourced from the International Financial Statistics available at the IMF database.

The used proxies for financial development are not so consensual, as the empirical studies represent the performance of the financial systems and institutions with different financial variables and ratios. For example, King and Levine (1993a, 1993b) included the 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, and credit issued to nonfinancial private firms divided by GDP; Rousseau and Wachtel (1998) used 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; Gaytan and Rancière (2004), Ayadi *et al.* (2015), and Cournède and Denk (2015) considered not only the credit to the private sector and bank deposits but also the stock market size and liquidity. However, as well explained, for instance, in Sahay *et al.* (2015), these measures do not capture all the relevant channels through which finance is expected to influence economic growth.

Here, financial development is represented by the index and sub-indices developed and very well explained in Sahay *et al.* (2015) and in Svirydzenka (2016), which is available in the IMF database (more precisely in "Financial Development – Story – IMF Data"). Closely following the matrix of financial system characteristics developed by Čihák *et al.* (2012), these indices capture the level of development of both financial institutions (including banks, insurance companies, mutual funds, pension funds, and other types of nonbank financial institutions) and financial markets (including mainly stock and bond markets). They measure how financial institutions and financial markets are developed in terms of their depth, access, and efficiency.

The depth includes the size and liquidity of the financial institutions and markets; the access represents the ability of individuals and companies to access financial services; and the efficiency indicates the ability of institutions to provide financial services at low costs and with sustainable revenues, as well as the level of activity of capital markets.

As well explained in Sahay *et al.* (2015) and in Svirydzenka (2016), the financial development index is constructed using a three-step approach, including the normalization of variables, the aggregation of normalized variables into the sub-indices representing a particular functional dimension, and the aggregation of the sub-indices into the final index. The overall financial development index includes two sub-indices capturing the specific development of the financial institutions and of the financial markets, and each of these two sub-indices captures the depth, the access, and the efficiency of respectively the financial institutions or markets. This methodology allows the production of nine indices that assess, at varying levels of abstraction, how developed financial systems are across countries and are nowadays available in the IMF database (Annex I presents the specific variables used in the construction of the Financial Development Index and in each sub-index).

This paper uses annual data over the interval 1990-2017, and the choice of the sample of countries mainly took into consideration the availability of data during this relatively large period. The sample includes all European Union (EU) countries as well as other countries with which EU countries have relevant economic and financial relationships. More precisely, the paper considers 46 countries covering all continents: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, China, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, India, Indonesia, Ireland, Italy, Japan, the Republic of Korea, Latvia, Lithuania, Luxembourg, Malta, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, the Russian Federation, the Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

Annex II presents a table with the values of the nine indices capturing the different aspects of the development of financial institutions and markets in 2017 for each of the 46 countries included in the panel. Annex III presents charts with the evolution of the annual averages of these nine indices for the years 1990-2017.

4. EMPIRICAL ESTIMATIONS AND RESULTS OBTAINED

This paper tests the direction of Granger causality between economic growth, and each of the nine indices measuring the different aspects of financial development in the considered panel with the estimation of the following classical bivariate VAR model:

$$GDP_{i,t} = \alpha_1 + \sum_{k=1}^{2} \gamma_{1,i,k} GDP_{i,t-k} + \sum_{k=1}^{2} \beta_{1,i,k} FD_{i,t-k} + \sum_{k=1}^{2} \theta_{1,i,k} inflation_{i,t-k} + \sum_{k=1}^{2} \rho_{1,i,k} unemployment_{i,t-k} + \varepsilon_{1,i,t} \quad (3)$$

$$FD_{i,t} = \alpha_2 + \sum_{k=1}^{2} \gamma_{2,i,k} FD_{i,t-k} + \sum_{k=1}^{2} \beta_{2,i,k} GDP_{i,t-k} + \sum_{k=1}^{2} \theta_{2,i,k} inflation_{i,t-k} + \sum_{k=1}^{2} \rho_{2,i,k} unemployment_{i,t-k} + \varepsilon_{2,i,t} \quad (4)$$

Where:

GDP = Gross Domestic Product;

FD = financial development (measured with one of the nine indices provided by the IMF);

Inflation = deflator of the Gross Domestic Product;

Unemployment = Unemployment rate (%);

$i = 1,\ldots,N$ are the 46 countries included in the sample;

$t = 1,\ldots,T$ is the time period: 1990-2017;

$\alpha_{1,2}$ are the intercepts;

$k = 1,2$ 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).

Inflation and unemployment are included as control variables that potentially influence economic growth and financial development.

Before proceeding with the Granger-causality estimations, the stationarity of the considered series is analysed using two of the most recommended panel unit roots tests: the Levin-Lin-Chu test (Levin *et al.*, 2002) and the Fisher-type (ADF) test (Choi, 2001; Maddala and Wu, 1999). Moreover, taking into consideration the eventual existence of structural breaks, we also apply panel unit root tests suggested by Karavias and Tzavalis (2014) that allow for breaks both in the intercepts of the individual series and in linear trends. The results obtained with these three

panel unit root tests are reported in Annex IV and reveal that, at least according to one of these tests, the stationarity of the variables is demonstrated, and in most situations, the results of the panel unit root tests are fully in line and raise no doubts about the stationarity of the series.

4.1 Results Obtained with Panel Fixed-Effects and GMM Estimations

The performed panel estimations analyse both the Granger-causality running from financial development to economic growth (represented by Equation 3) and the Granger-causality running from economic growth to financial development (Equation 4).
Equations (3) and (4) are first estimated with panel fixed-effects estimations, which have the important advantage of allowing the control for omitted variables that differ across individuals or entities (here the different countries) but are constant over time. However, these estimations 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 (Generalised 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 these panel Granger-causality estimations are presented in Annex V, 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 Granger-causality results obtained with fixed effects, GMM one-step and GMM two-step estimations, providing evidence that in almost all situations, the Wald test results validate the instruments of both models, and particularly in the GMM estimations.

Granger-Causality Running from Financial Development to Economic Growth

The information provided in Table 1 clearly demonstrates the existence of causality running from financial development to economic growth. It shows the importance of the intertemporal flow of effects between the considered index and sub-indices measuring financial development and the growth of the real GDP. Overall, the evidence of this causality is statistically more robust in the results obtained with Model 2, which includes two lags of the explanatory variables.

The results obtained for the two sub-indices capturing the specific development of the financial institutions (the Financial Institutions Index) and of the financial markets (the Financial Markets Index) are very similar. This reveals that the intertemporal flow of effects of the development of financial institutions are as important as the intertemporal flow of effects of the development of financial markets, as they both contribute to real GDP growth.
Focusing on the results obtained for the different aspects of the development of the financial institutions that are captured with the Financial Institutions Index, it is possible to conclude that the past values of the depth (representing the size and liquidity of the financial institutions) and the efficiency (more precisely, the ability of institutions to provide financial services at low costs and with sustainable revenues) are much more important than the past values of the access (meaning the ability of individuals and companies to access financial services) to explain the evolution of economic growth.

On the other hand, looking at the results obtained for the different aspects of the development of the financial markets that are captured with the Financial Markets Index, it is possible to conclude that the past values of the three aspects: access, depth, and efficiency are equally important. More precisely, the evolution of real GDP growth can be explained by the ability of individuals and companies to access the services provided by financial markets (measured by the Financial Markets Access Index), by the size and liquidity of the financial markets (measured by the Financial Markets Depth Index), as well as by the efficient level of activity of financial markets (measured by the Financial Markets Efficiency 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 ($\beta_{t-1}=0$) ($\beta_{t-2}=0$) ($\beta_{t-1}=\beta_{t-2}=0$)	0.669	0.000	0.000	0.001 0.000 0.000	0.000 0.000 0.000	0.000 0.000 0.000	WALD TEST p-values ($\beta_{t-1}=0$) ($\beta_{t-2}=0$) ($\beta_{t-1}=\beta_{t-2}=0$)	0.006	0.596	0.048	0.081 0.005 0.000	0.215 0.962 0.464	0.000 0.827 0.000
Financial Institutions Access Index t-1	-	- **	- ***	+	+	+ **	**GDP t-1**	**+ *****	**+ ****	**+ *****	**+ *****	**+**	+ ***
Financial Institutions Access Index t-2				-	-	- ***	**GDP t-2**				+ ***	**+**	**+**
WALD TEST p-values ($\beta_{t-1}=0$) ($\beta_{t-2}=0$) ($\beta_{t-1}=\beta_{t-2}=0$)	0.993	0.003	0.000	0.955 0.867 0.961	0.783 0.408 0.047	0.024 0.000 0.000	WALD TEST p-values ($\beta_{t-1}=0$) ($\beta_{t-2}=0$) ($\beta_{t-1}=\beta_{t-2}=0$)	0.000	0.032	0.000	0.000 0.000 0.000	0.248 0.762 0.497	0.000 0.202 0.000
Financial Institutions Depth Index t-1	-	+ ***	+ ***	+ ***	+ ***	+ ***	**GDP t-1**	**-**	**- ****	**- *****	- *	- **	- ***
Financial Institutions Depth Index t-2				- ***	- ***	- ***	**GDP t-2**				**+ *****	**+ *****	**+ *****
WALD TEST p-values ($\beta_{t-1}=0$) ($\beta_{t-2}=0$) ($\beta_{t-1}=\beta_{t-2}=0$)	0.231	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 ($\beta_{t-1}=0$) ($\beta_{t-2}=0$) ($\beta_{t-1}=\beta_{t-2}=0$)	0.233	0.011	0.000	0.022 0.000 0.000	0.041 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 ($\beta_{t-1}=0$) ($\beta_{t-2}=0$) ($\beta_{t-1}=\beta_{t-2}=0$)	0.000	0.000	0.000	0.002 0.104 0.004	0.000 0.000 0.000	0.000 0.000 0.000	WALD TEST p-values ($\beta_{t-1}=0$) ($\beta_{t-2}=0$) ($\beta_{t-1}=\beta_{t-2}=0$)	0.177	0.703	0.236	0.149 0.697 0.353	0.894 0.129 0.313	0.900 0.000 0.000
Financial Institutions Index t-1	+	+ **	+ ***	+ **	+ ***	+ ***	**GDP t-1**	**+ *****	**+**	**+ ****	+	**+**	**+**
Financial Institutions Index t-2				- **	- ***	- ***	**GDP t-2**				**+ *****	+	+ ***
WALD TEST p-values ($\beta_{t-1}=0$) ($\beta_{t-2}=0$) ($\beta_{t-1}=\beta_{t-2}=0$)	0.289	0.020	0.000	0.005 0.003 0.009	0.000 0.000 0.000	0.000 0.000 0.000	WALD TEST p-values ($\beta_{t-1}=0$) ($\beta_{t-2}=0$) ($\beta_{t-1}=\beta_{t-2}=0$)	0.040	0.995	0.765	0.148 0.000 0.000	0.729 0.326 0.583	0.136 0.000 0.000

TABLE 1 - *continued*

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 Markets Access Index t-1	+ *	+ ***	+ ***	+ ***	+ ***	+ ***	**GDP t-1**	**+ ****	**-**	**- *****	**+**	**-**	**- *****
Financial Markets Access Index t-2				- **	- **	- ***	**GDP t-2**				+	-	+
WALD TEST p-values (β_{t-1}=0) (β_{t-2}=0) (β_{t-1}=β_{t-2}=0)	0.058	0.000	0.000	0.001 0.003 0.004	0.000 0.001 0.000	0.000 0.000 0.000	WALD TEST p-values (β_{t-1}=0) (β_{t-2}=0) (β_{t-1}=β_{t-2}=0)	0.020	0.316	0.001	0.060 0.262 0.035	0.316 0.857 0.595	0.001 0.269 0.001
Financial Markets Depth Index t-1	+	+ ***	+ ***	+	+ ***	+ ***	**GDP t-1**	**+**	**- *****	**- *****	-	**- *****	**- *****
Financial Markets Depth Index t-2				- ***	- ***	- ***	**GDP t-2**				+ ***	+	+ ***
WALD TEST p-values (β_{t-1}=0) (β_{t-2}=0) (β_{t-1}=β_{t-2}=0)	0.284	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 (β_{t-1}=0) (β_{t-2}=0) (β_{t-1}=β_{t-2}=0)	0.886	0.000	0.000	0.189 0.000 0.000	0.001 0.128 0.002	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 β_{t-1}=0) (β_{t-2}=0) (β_{t-1}=β_{t-2}=0)	0.036	0.208	0.000	0.004 0.142 0.020	0.000 0.000 0.000	0.000 0.000 0.000	WALD TEST p-values (β_{t-1}=0) (β_{t-2}=0) (β_{t-1}=β_{t-2}=0)	0.070	0.277	0.000	0.041 0.833 0.134	0.951 0.010 0.036	0.154 0.000 0.000
Financial Markets Index t-1	-	+ ***	+ ***	+ **	+ ***	+ ***	**GDP t-1**	**+ ****	**-**	**- ****	**+**	**- ****	**- *****
Financial Markets Index t-2				- ***	- **	- ***	**GDP t-2**				+	-	-
WALD TEST p-values (β_{t-1}=0) (β_{t-2}=0) (β_{t-1}=β_{t-2}=0)	0.858	0.000	0.000	0.012 0.000 0.002	0.000 0.000 0.000	0.000 0.000 0.000	WALD TEST p-values (β_{t-1}=0) (β_{t-2}=0) (β_{t-1}=β_{t-2}=0)	0.041	0.583	0.005	0.125 0.151 0.042	0.057 0.723 0.152	0.000 0.150 0.000

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

Source: Author's calculations presented in Annex V.

Granger-Causality Running from Economic Growth to Financial Development

The causality running from economic growth is also demonstrated, although it is not statistically as robust as the reverse causality running from financial development to economic growth. Furthermore, now there are no remarkable differences between the results obtained by Model 1 (including only one lag of all explanatory variables) and Model 2 (which includes two lags of the explanatory variables).

There are also no relevant differences between the results obtained regarding the influence of economic growth on the two sub-indices capturing the specific development of financial institutions and markets: the Financial Institutions Index and the Financial Markets Index. Moreover, the results obtained corroborate that there are no remarkable differences between the influence of past values of real GDP growth on the sub-indices capturing the different aspects of the development of financial institutions and markets. More precisely, now there is clear evidence that the past values of economic growth have a relevant influence on both the access of financial institutions and markets (representing the ability of individuals and companies to access financial services provided by these institutions and markets) as well as on their depth (meaning the size and liquidity of the financial institutions and markets). However, the causality running from economic growth to the sub-indices capturing the efficiency of the financial institutions (the Financial Institutions Efficiency Index) and the efficiency of the financial markets (the Financial Markets Efficiency Index) is not statistically very robust.

TABLE 2 - *Dumitrescu & Hurlin (2012) Granger Non-Causality Test Results (Z-Bar Statistics)*

Causality: Financial Development → GDP			Causality: GDP→ Financial Development		
	Lag order: 1 la	Lag order: lags		Lag order: 1 lag	Lag order: 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 Acces 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

H_0 = absence of causality for all countries included in the panel.
Rejection of H_0: ***significant at 1% level; ** significant at 5% level; * significant at 10% level.
Source: Author's calculations.

4.2 Results Obtained with Dumitrescu and Hurlin (2012) Panel Granger Non-Causality Test

This study also applies the Dumitrescu and Hurlin (2012) panel Granger non-causality test to investigate the relations between the nine financial development indices available in the IMF database and real GDP growth. As in Granger (1969), the existence of causality means that there are significant effects of the 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 Granger-causality existence in at least one cross-section, against the non-existence of homogenous Granger-causality.

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

Causality Running from Financial Development to Economic Growth

The results reported in Table 2 clearly corroborate the existence of Granger-causality running from all the financial development indices to GDP, particularly with the two-lags option. Also in line with the results obtained with panel fixed-effects and GMM estimations, there are no remarkable differences between the results regarding the sub-indices capturing the development of the financial institutions and those capturing the development of the financial markets. Still according to the results obtained with the two-lags option, the most relevant aspect of the development of both the financial institutions and markets is their depth, clearly indicating that the past values of the size and liquidity of the financial institutions and of the financial markets are very important to explain the real GDP growth.

Looking at the results obtained with 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 Granger-causality for the whole panel. Nevertheless, 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 Granger-causality, and which are presented in Annex VI. For example, according to the results reported in this Annex, the one-lag value of the overall financial development index is important to explain the economic growth of five countries (Bulgaria, China, Greece, Rep. Korea, and Norway); the one-lag value of the index measuring the development of the financial institutions

is relevant to explain the economic growth of six countries (Austria, Greece, Rep. Korea, Malta, Norway, and Switzerland); and the one-lag value of the index measuring the development of the financial markets is important to explain the economic growth of four countries (China, Rep. Korea, Lithuania, and Norway).

Causality Running from Economic Growth to Financial Development

The results reported in Table 2 regarding the panel Granger-causality running from real GDP growth to financial development are also overall in line with the results obtained with panel fixed-effects and GMM estimations.

Although the results are statistically not as robust as those obtained for the causality running from financial development to economic growth with the two-lags option, there is still evidence of the existence of causal relations between economic growth and almost all indices reporting the different aspects of the development of financial institutions and markets. Now there are no very significant differences between the results obtained with the one-lag and two-lags options. Again, in the few cases where it is not possible to reject the null hypothesis, there is still evidence of Granger-causality for some individual countries, according to the Wald test results reported in Annex VI. For instance, although it is not possible to reject the absence of causality running from economic growth to the financial institutions efficiency index, the results included in Annex VI point to the existence of this causal relation in five countries when considering the one-lag option (Australia, Denmark, India, Romania, and Turkey) and when considering the two-lags option (Cyprus, Denmark, Estonia, Iceland, India, and Italy). Also, regarding the causality running from economic growth to the financial markets depth index, it is not possible to reject the absence of causality for the whole panel, but there is evidence of this causal relation in six countries when considering the one-lag option (Cyprus, Rep. Korea, Latvia, New Zealand, Russia, and Switzerland) and in three countries when considering the two-lags option (Rep. Korea, Russia, and South Africa).

The results presented in Table 2 were confirmed with the use of a bootstrap procedure and the 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 upon 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 Granger-causality between all the nine financial development indices available at the IMF database and the real GDP growth, considering a panel of 46 countries covering all continents over the period 1990-2017.

The performed tests point to some differences in the statistical robustness of the results associated with the nine financial development index and sub-indices, confirming the 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 obtained for the nine indices capturing the overall influence of the financial development of the financial institutions and markets, as well as their depth (size and liquidity), access (ability of individuals and companies to access financial services), and efficiency (ability of institutions to provide financial services at low costs and with sustainable revenues and the level of activities of financial markets), provide the following answers to the proposed questions:

1) There is a robust demonstration that financial development Granger-causes economic growth in the considered panel.
2) Although not with the same statistical robustness, there is still evidence that economic growth Granger-causes financial development.
3) Overall, there are no remarkable differences between the results obtained for the sub-indices capturing the development of financial institutions and the development of financial markets.
4) The results regarding the causality running from the different aspects of the development of the financial institutions demonstrate that the past values of the depth and efficiency of these institutions are much more important than the access to them to explain the growth of the real GDP. The results regarding the reverse causality show that the past values of economic growth are relevant to explain the

access and depth of the financial institutions but not so evidently to explain the efficiency of these institutions.

5) The results regarding the causality running from the development of the financial markets to economic growth reveal that the past values of the access, depth, and efficiency of these markets are relevant to explain real GDP growth. On the other hand, the past values of economic growth are relevant to explain both the access and the depth of financial markets, but not as important to explain the efficiency of these markets.
6) The results obtained with the Dumitrescu and Hurlin (2012) panel Granger non-causality test are overall in line with those obtained with those obtained with panel fixed-effects and GMM estimations. In addition, in the few cases where the results of this non-causality test do not allow the rejection of the absence of causality for the whole panel, it is still possible to identify some countries for which there is evidence of the existence of causality. However, the results obtained with the Dumitrescu and Hurlin (2012) non-causality test indicate that the groups of countries for which causality is demonstrated are very heterogeneous and do not allow the identification of significant differences in the individual results obtained for each of the 46 countries included in the panel.

Overall, the results obtained in this paper confirm the relevance of the causal relationships between financial development and economic growth, supporting the statements of Svirydzenka (2016) regarding the need for using multiple indicators to measure the different aspects of financial development, namely considering the access, depth, and efficiency of financial markets and institutions.

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Annex I – *Construction of the Financial Development Index*

	FINANCIAL INSTITUTIONS	FINANCIAL MARKETS
DEPTH	1. Private-sector credit (% of GDP) 2. Pension fund assets (% of GDP) 3. Mutual fund assets (% of GDP) 4. Insurance premiums, life and non-life (% of GDP)	1. Stock market capitalization to GDP 2. Stocks traded to GDP 3. International debt securities government (% of GDP) 4. Total debt securities of nonfinancial corporations (% of GDP) 5. Total debt securities of financial corporations of GDP)
ACCESS	1. Branches (commercial banks) per 100,000 adults 2. ATMs per 100,000 adults	1. Percent of market capitalization outside of top 10 largest companies 2. Total number of issuers of debt (domestic and external, nonfinancial corporations, and financial corporations)
EFFICIENCY	1. Net interest margin 2. Lending-deposits spread 3. Non-interest income to total income 4. Overhead costs to total assets 5. Return on assets 6. Return on equity	1. Stock market turnover ratio (stocks traded/ capitalization)

Source: Sahay *et al.* (2015).

Annex II – *Values of the Financial Development Index and Sub-Indices(*) in 2017 for the 46 Countries considered in the Panel Estimations*

	Financial Development Index	Financial Institutions Access Index	Financial Institutions Depth Index	Financial Institutions Efficiency Index	Financial Institutions Index	Financial Markets Access Index	Financial Markets Depth Index	Financial Markets Efficiency Index	Financial Markets Index
	1	2	3	4	5	6	7	8	9
Argentina	0.340968	0.424723	0.200492	0.559105	0.409981	0.654254	0.094249	0.056580	0.264660
Australia	0.871400	0.838035	0.902151	0.848854	0.927544	0.797991	0.972495	0.566371	0.796612
Austria	0.627314	0.637297	0.618400	0.719033	0.701292	0.827983	0.497867	0.277326	0.539914
Belgium	0.584621	0.480455	0.639766	0.816323	0.676873	0.292803	0.781330	0.299128	0.479860
Brazil	0.593412	0.707625	0.500791	0.552127	0.634124	0.544188	0.395788	0.707559	0.540004
Bulgaria	0.375435	0.934898	0.250882	0.743525	0.684441	0.016659	0.101636	0.048539	0.058397
Canada	0.855571	0.745247	0.952501	0.823958	0.903025	0.740984	1.000000	0.570700	0.789811
China, P.R.: Mainland	0.644841	0.485044	0.497185	0.841512	0.631485	0.236026	0.702616	1.000000	0.644399
Croatia	0.400298	0.871118	0.364628	0.699032	0.689791	0.028307	0.227916	0.023849	0.102240
Cyprus	0.509799	0.721819	0.494029	0.558729	0.639067	0.593070	0.450349	0.025858	0.369624
Czech Republ	0.376810	0.497479	0.300909	0.830946	0.557944	0.088147	0.164573	0.320040	0.187613
Denmark	0.660325	0.465098	0.956852	0.824522	0.794897	0.500000	0.648292	0.347684	0.511625
Estonia	0.325010	0.426027	0.317429	0.814141	0.531233	0.090015	0.141974	0.096264	0.111834
Finland	0.662648	0.165006	0.808155	0.870479	0.633749	0.500000	0.781682	0.728512	0.677369
France	0.769661	0.886939	0.776219	0.812898	0.887742	0.361428	0.899068	0.591485	0.635113
Germany	0.687219	0.647199	0.626341	0.716847	0.707574	0.552078	0.716075	0.671225	0.652161
Greece	0.535309	0.542177	0.322099	0.768703	0.565095	0.647788	0.506369	0.308138	0.494071
Hungary	0.431125	0.445752	0.292804	0.761238	0.513789	0.511658	0.180751	0.347394	0.339237
Iceland	0.577801	0.806778	0.680734	0.513608	0.730596	0.500000	0.424846	0.298785	0.412643
India	0.424104	0.268958	0.292385	0.575139	0.388855	0.199266	0.591656	0.537037	0.450279
Indonesia	0.366743	0.447157	0.142625	0.704112	0.439743	0.402519	0.261733	0.187582	0.285897
Ireland	0.689058	0.645877	0.700151	0.750027	0.745237	1.000000	0.613358	0.208052	0.618137

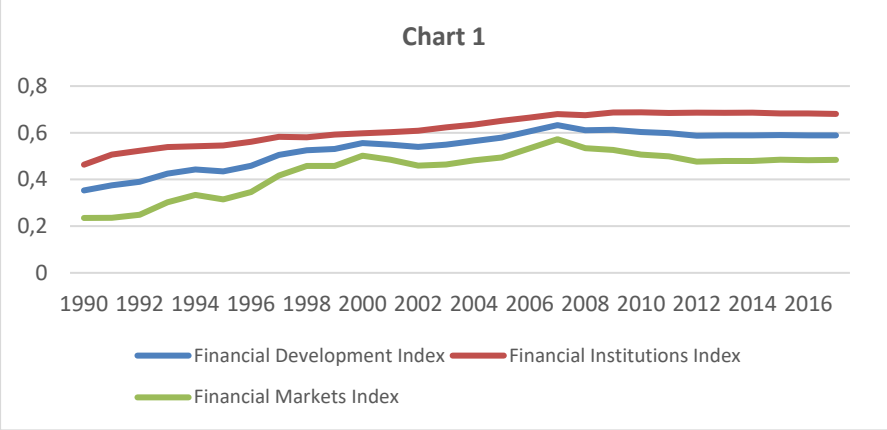
Annex II - *continued*

	Financial Development Index	Financial Institutions Access Index	Financial Institutions Depth Index	Financial Institutions Efficiency Index	Financial Institutions Index	Financial Markets Access Index	Financial Markets Depth Index	Financial Markets Efficiency Index	Financial Markets Index
	1	2	3	4	5	6	7	8	9
Italy	0.791249	0.922426	0.595077	0.633163	0.778715	0.682591	0.696641	1.000000	0.786854
Japan	0.876659	0.888512	0.851040	0.890080	0.940023	0.521257	0.871813	0.980195	0.794539
Korea, Republ	0.868454	0.676404	0.854897	0.842107	0.843969	0.752146	0.869141	1.000000	0.874357
Latvia	0.277982	0.470696	0.217439	0.707865	0.478793	0.121611	0.059552	0.030956	0.071224
Lithuania	0.258243	0.369217	0.201986	0.802921	0.461319	0.040913	0.060592	0.044722	0.049641
Luxembourg	0.754778	1.000000	0.656564	0.818303	0.887838	1.000000	0.746492	0.001310	0.605569
Malta	0.559637	0.622536	0.790392	0.799728	0.785474	0.747366	0.194159	0.021527	0.321827
Mexico	0.402780	0.406011	0.257377	0.625701	0.444270	0.448809	0.329210	0.274497	0.352671
Netherlands	0.701732	0.339341	0.827709	0.875238	0.711095	0.386244	0.951504	0.639135	0.677354
New Zealand	0.607621	0.612881	0.679438	0.863508	0.758109	0.819027	0.369594	0.130378	0.444133
Norway	0.672664	0.229134	0.710484	0.831534	0.609872	1.000000	0.756200	0.370035	0.721063
Poland	0.476574	0.647527	0.303413	0.785374	0.604241	0.446830	0.228712	0.355368	0.338711
Portugal	0.656738	0.845231	0.522488	0.661174	0.728908	0.217770	0.638677	0.855301	0.570515
Romania	0.303997	0.608910	0.138948	0.746936	0.514568	0.011692	0.050509	0.211375	0.086922
Russian Feder	0.482136	0.833671	0.190699	0.611824	0.582435	0.548945	0.317382	0.244352	0.371522
Slovak Republ	0.321480	0.584732	0.314222	0.808463	0.590609	0.019981	0.084141	0.024104	0.045474
Slovenia	0.382108	0.764689	0.305249	0.796474	0.654237	0.136766	0.101628	0.063345	0.101804
South Africa	0.626661	0.429620	0.883488	0.776771	0.738624	0.405632	0.763221	0.271729	0.501291
Spain	0.863621	1.000000	0.626482	0.809366	0.873642	0.751978	0.867986	0.872260	0.835123
Sweden	0.708838	0.330758	0.975550	0.818348	0.747499	0.500000	0.931177	0.469175	0.655010
Switzerland	0.931177	0.912139	0.977596	0.791005	0.968353	1.000000	0.989505	0.584836	0.874078
Turkey	0.516038	0.555695	0.205195	0.613073	0.479254	0.336551	0.343638	1.000000	0.541781
United Kingd	0.852460	0.787062	1.000000	0.708090	0.903177	0.736510	0.986199	0.571822	0.783504
United States	0.876822	0.859229	0.795169	0.661135	0.838973	0.678775	0.989501	1.000000	0.895910
averages	**0.588694**	**0.625807**	**0.554748**	**0.747457**	**0.680828**	**0.486882**	**0.529387**	**0.418142**	**0.483965**

Source: IMF database (available at "Financial Development - Story - IMF Data"). Averages: author's calculations.

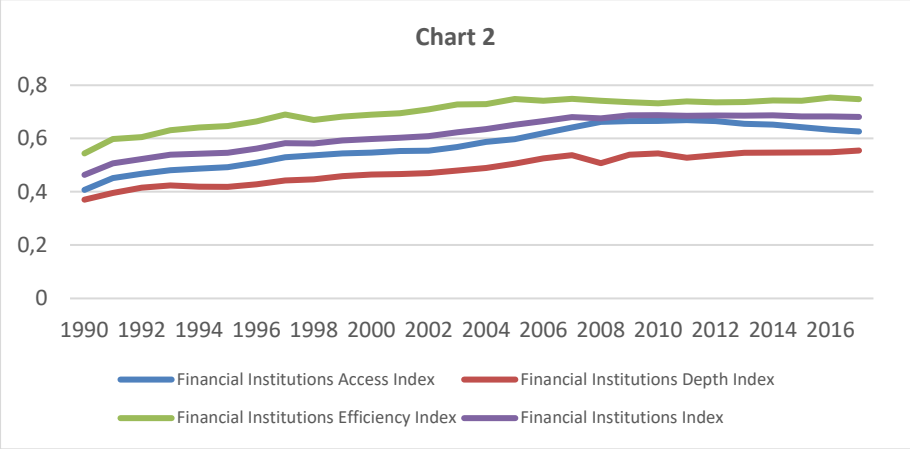
(*) The overall Financial Development Index (column 1) captures the development of both the financial institutions (Financial Institutions Index - column 5) and the financial markets (Financial Markets Index – column 9).
The Financial Institutions Index (column 5) combines the Financial Institutions Access Index (column 2), the Financial Institutions Depth Index (column 3), and the Financial Institutions Efficiency Index (column 4).
The Financial Markets Index (column 9) combines the Financial Markets Access Index (column 6), the Financial Markets Depth Index (column 7), and the Financial Markets Efficiency Index (column 8). Further details on the construction of these indices are presented in Annex I and very clearly explained at the IMF database as well as in Sahay *et al.* (2015) and in Svirydzenka (2016).

Annex III – *Evolution of the Annual Averages of the Financial Development Index and Sub-Indices for the 46 Countries Considered in the Panel Estimations between 1990 and 2017*



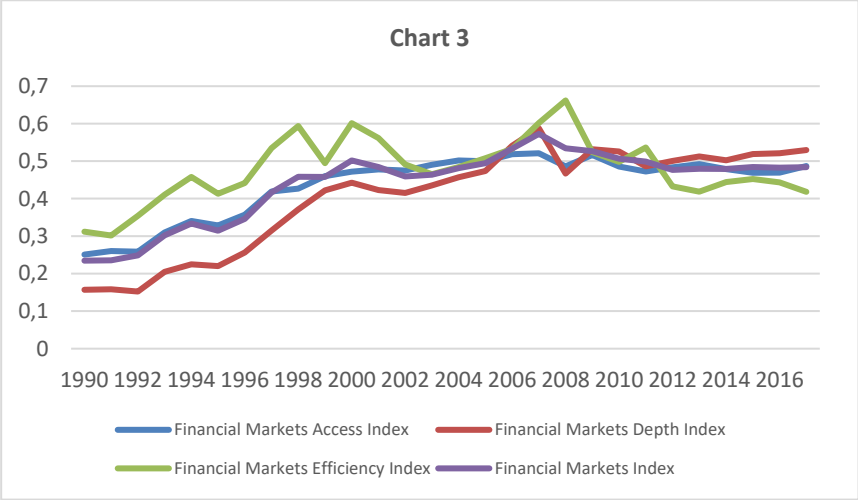
Source: Author's calculations using data available at the IMF Financial Development Index Database.

Chart 1 presents the evolution of the Financial Development Index (blue line), which captures the evolution of both the Financial Institutions Index (red line) and the Financial Markets Index (green line). It clearly demonstrates that the Financial Institutions Index is always higher and less volatile than the Financial Markets Index. It is particularly evident that the subprime crisis that began in 2007 affected much more the financial markets than the financial institutions.



Source: Author's calculations using data available at the IMF Financial Development Index Database.

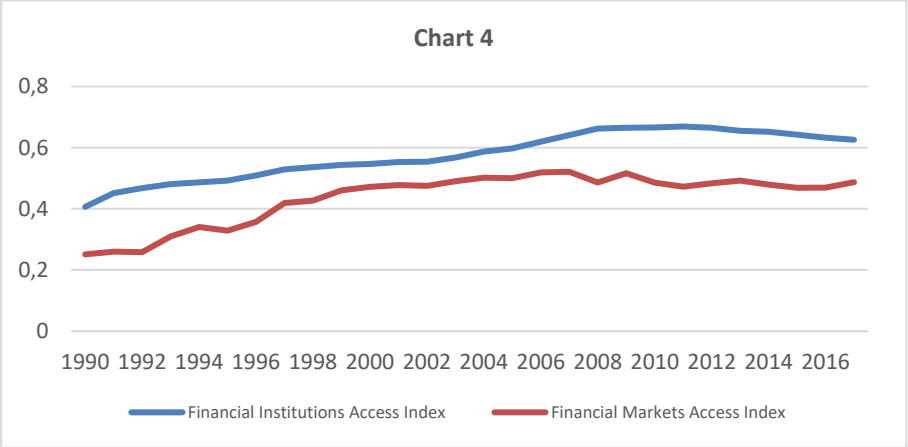
Chart 2 reports the evolution of the sub-indices related to the development of financial institutions: the Financial Institutions Index (violet line), which combines the evolution of the Financial Institutions Access Index (blue line), the Financial Institutions Depth Index (red line), and the Financial Institutions Efficiency Index (green line). There is clear evidence that the efficiency of the financial institutions (representing their overall ability to provide financial services at low costs and with sustainable revenues) is always much more relevant than the access (that is, the ability of individuals and companies to access financial services) and the depth (including the size and liquidity of the financial institutions). The specific measures and indicators used in the construction of these sub-indices are presented in Annex I.



Source: Author's calculations using data available at the IMF Financial Development Index Database.

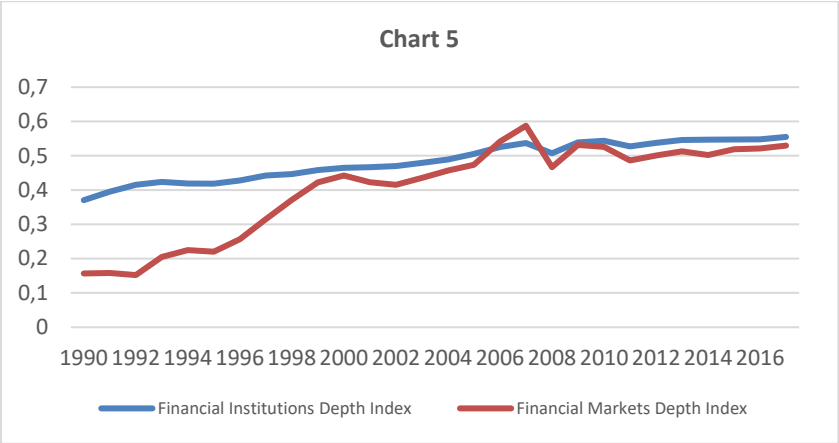
Chart 3 presents the evolution of the indices, representing the different aspects of the development of the financial markets. The Financial Markets Index (violet line) captures the evolution of the Financial Markets Access Index (blue line), the Financial Markets Depth Index (red line), and the Financial Markets Efficiency Index (green line). The volatility of the financial market's efficiency (more precisely, the stock market turnover ratio, as specified in Annex I) is clearly evident, as well as its relevance to the increase in the development of the financial markets, particularly before the subprime crisis. The evolution of the Financial Markets Depth Index (capturing the size and liquidity of these markets with the five measures specified in

Annex I) reveals not only its remarkable increase until the sub-prime crisis but also its good recovery and stability after the crisis.



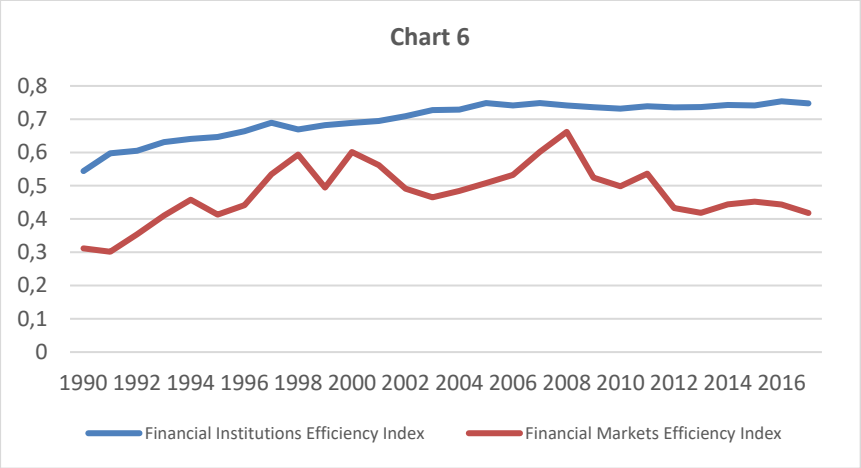
Source: Author's calculations using data available at the IMF Financial Development Index Database.

Chart 4 very clearly demonstrates that during the whole period, the Financial Institutions Access Index was always higher than the Financial Markets Access Index, revealing that individuals and companies had easier access to the financial services provided by the financial institutions (namely in terms of branches of commercial banks and ATMs) than to those provided by the financial markets (namely in terms of percent of market capitalization outside of the top 10 largest companies and the total number of issuers of debt, as specified in Annex I).



Source: Author's calculations using data available at the IMF Financial Development Index Database.

The overall stability of the Financial Institutions Depth Index during the considered period is very clearly demonstrated in **Chart 5**. On the other hand, the Financial Markets Depth Index was much more volatile, with a remarkable increase until the sub-prime crisis and relative stabilisation after this crisis (Annex I specifies the concrete measures and indicators that were used to measure the depth of the financial institutions and markets).



Source: Author's calculations using data available at the IMF Financial Development Index Database.

In line with the previous charts, **Chart 6** highlights the differences between the evolution of the indices measuring the efficiency of the financial institutions and markets (Annex I also presents the information that was used to measure the efficiency of the institutions and markets). During the whole period, the Financial Institutions Efficiency Index was less volatile and always higher than the Financial Markets Efficiency Index.

Annex IV – *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	Financial Markets Access Index	Financial Markets Depth Ind	Financial Markets Efficiency Index	Financial Markets Index	GDP	Inflation	Unemployment
Levin Li												
Levels	0.0000	0.5006	0.0039	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2330
Levels trend	0.0000	0.0538	0.0045	0.0000	0.0000	0.0000	0.0029	0.0000	0.0000	0.0000	0.0000	0.6184
Fisher (P statistic)												
Levels	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0488	0.0000	0.0000	0.0000	0.0000	0.3759
Levels trend	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1856	0.0000	0.0530	0.0000	0.0000	0.9821
Karavias and Tzavalis (2014)												
One unknow break	0.0000	0.1000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0100	0.0000
Two unknow breaks	0.0000	0.0600	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0200	0.0500

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

Annex V – *Results Obtained with Panel Granger-Causality Estimations*

Part A – Causality Running from Financial Development to Economic Growth

	Fixed effects				**GMM one-step system**				**GMM two-step system**			
	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|
GDP_{t-1}	.0038	0.000	.0025	0.000	.0057	0.000	.0011	0.304	.0058	0.000	.0010	0.000
GDP_{t-2}			-.0003	0.396			-.0037	0.000			-.0038	0.000
Financial Development Index $_{t-1}$	.0056	0.669	.0747	0.001	.1270	0.000	.5087	0.000	.1224	0.000	.5035	0.000
Financial Development Index $_{t-2}$			-.0928	0.000			-.4302	0.000			-.4313	0.000
Inflation $_{t-1}$	-.0001	0.516	.0003	0.351	.0001	0.895	.0006	0.563	.00008	0.425	.0007	0.207
Inflation $_{t-2}$			-.0006	0.116			.0002	0.873			.0002	0.463
Unemployment $_{t-1}$	.0001	0.000	-.0023	0.001	.0023	0.014	-.0131	0.000	.0023	0.000	-.0133	0.000
Unemployment $_{t-2}$			.0040	0.000			.0161	0.000			.0161	0.000
R-squared	0.1165		0.1158									
AB AR(1) z p- value					-10.57 0.000		-9.29 0.000		-3.78 0.000		-4.44 0.000	
AB AR(2) z p- value					-0.44 0.657		-0.17 0.865		-0.22 0.826		-0.12 0.907	
Sargan test chi2 Prob > chi2					574.54 0.000		375.71 0.000		574.54 0.000		375.71 0.000	
Hansen test chi2 Prob > chi2									44.88 0.561		44.54 0.325	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	0.18 0.6689		10.21 0.0014		23.03 0.0000		37.91 0.0000		250.30 0.0000		650.79 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			16.86 0.0000				23.04 0.0000				536.07 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			8.46 0.0002				42.38 0.0000				655.02 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				**GMM one-step system**				**GMM two-step system**			
	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|
GDP$_{t-1}$	.0038	0.000	.0027	0.000	.0056	0.000	.0017	0.096	.0057	0.000	.0017	0.000
GDP$_{t-2}$			-.0003	0.356			-.0041	0.000			-.0041	0.000
Financial Institutions Access $_{t-1}$	-.00009	0.993	.0013	0.955	-.0626	0.003	.0296	0.782	-.0643	0.000	.0478	0.024
Financial Institutions Access $_{t-2}$			-.0038	0.867			-.0882	0.408			-.1112	0.000
Inflation $_{t-1}$	-.0001	0.491	.0002	0.417	-.0015	0.033	-.0009	0.402	-.0015	0.000	-.0009	0.009
Inflation $_{t-2}$			-.0005	0.197			-.0005	0.670			-.0006	0.001
Unemployment $_{t-1}$	.0016	0.000	-.0023	0.002	-.0013	0.122	-.0167	0.000	-.0012	0.000	-.0162	0.000
Unemployment $_{t-2}$			.0040	0.000			.0166	0.000			.0162	0.000
R-squared	0.1186		0.1123									
AB AR(1) z p- value					-10.42 0.000		-0.44 0.000		-3.69 0.000		-4.44 0.000	
AB AR(2) z p- value					-0.17 0.868		0.79 0.431		-0.07 0.946		0.75 0.451	
Sargan test chi2 Prob > chi2					567.80 0.000		433.52 0.000		567.80 0.000		433.52 0.000	
Hansen test chi2 Prob > chi2									45.21 0.547		44.33 0.333	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	0.00 0.9925		0.00 0.9546		8.78 0.0030		0.08 0.7825		150.55 0.0000		5.11 0.0238	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			0.03 0.8671				0.69 0.4078				22.36 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			0.04 0.9609				6.11 0.0472				102.57 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				GMM one-step system				GMM two-step system			
	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|
GDP_{t-1}	.0038	0.000	.0027	0.000	.0061	0.000	.0006	0.650	.0062	0.000	.0002	0.605
GDP_{t-2}			-.0004	0.307			-.0043	0.000			-.0041	0.000
Financial Institutions Depth $_{t-1}$	-.0170	0.231	.1110	0.000	.0939	0.000	1.141	0.000	.0907	0.000	1.157	0.000
Financial Institutions Depth $_{t-2}$			-.1534	0.000			-1.071	0.000			-1.109	0.000
Inflation $_{t-1}$	-.0001	0.427	.0003	0.218	.0006	0.433	.0014	0.316	.0006	0.000	.0016	0.010
Inflation $_{t-2}$			-.0007	0.060			.0007	0.673			.0004	0.495
Unemployment $_{t-1}$	.0016	0.000	-.0025	0.000	.0021	0.018	-.0187	0.000	.0022	0.000	-.0190	0.000
Unemployment $_{t-2}$			.0043	0.000			.0206	0.000			.0214	0.000
R-squared	0.1143		0.1018									
AB AR(1) z p- value					-10.95 0.000		-8.23 0.000		-3.87 0.000		-4.31 0.000	
AB AR(2) z p- value					-0.23 0.821		0.11 0.914		-0.11 0.913		-0.11 0.858	
Sargan test chi2 Prob > chi2					564.91 0.000		173.64 0.000		564.91 0.000		173.64 0.000	
Hansen test chi2 Prob > chi2									44.06 0.595		37.25 0.638	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	1.44 0.2307		18.07 0.0000		27.19 0.0000		80.84 0.0000		848.88 0.0000		364.52 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			36.10 0.0000				70.24 0.0000				292.01 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			18.95 0.0000				83.66 0.0000				446.90 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				**GMM one-step system**				**GMM two-step system**			
	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|
GDP_{t-1}	.0038	0.000	.0027	0.000	.0055	0.000	.0024	0.027	.0056	0.000	.0024	0.000
GDP_{t-2}			-.0004	0.307			-.0042	0.000			-.0042	0.000
Financial Institutions Efficiency $_{t-1}$	.0311	0.000	.0456	0.002	.1356	0.000	.3222	0.000	.1399	0.000	.3472	0.000
Financial Institutions Efficiency $_{t-2}$			-.0213	0.104			-.1757	0.006			-.1956	0.000
Inflation $_{t-1}$	-.0001	0.566	.0002	0.392	-.0005	0.459	-.0007	0.540	-.0005	0.000	-.0007	0.004
Inflation $_{t-2}$			-.0005	0.210			.0017	0.194			.0017	0.000
Unemployment $_{t-1}$	.0016	0.000	-.0021	0.004	-.0017	0.442	-.0127	0.000	.0009	0.000	-.0128	0.000
Unemployment $_{t-2}$			.0038	0.000			.0142	0.000			.0144	0.000
R-squared	0.1209		0.1083									
AB AR(1) z p- value					-10.34 0.000		-8.67 0.000		-3.75 0.000		-4.31 0.000	
AB AR(2) z p- value					-0.78 0.433		1.18 0.239		-0.37 0.710		0.86 0.390	
Sargan test chi2 Prob > chi2					560.05 0.000		349.26 0.000		560.05 0.000		349.26 0.000	
Hansen test chi2 Prob > chi2									43.95 0.600		44.09 0.668	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	12.45 0.0004		9.88 0.0017		21.27 0.0000		21.31 0.0000		514.72 0.0000		108.07 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			2.64 0.1043				7.48 0.0001				65.08 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			5.45 0.0044				25.41 0.0000				117.91 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				GMM one-step system				GMM two-step system			
	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|
GDP_{t-1}	.0038	0.000	.0026	0.000	.0058	0.000	.0010	0.394	.0058	0.000	.001	0.000
GDP_{t-2}			-.0004	0.317			-.0046	0.000			-.0048	0.000
Financial Institutions Index$_{t-1}$	.0136	0.288	.0723	0.005	.0554	0.020	.8072	0.000	.0525	0.000	.8481	0.000
Financial Institutions Index$_{t-2}$			-.0706	0.002			-.7479	0.000			-.8122	0.000
Inflation$_{t-1}$	-.0001	0.515	.0003	0.349	-.0003	0.619	.0003	0.785	-.0004	0.000	.0006	0.150
Inflation$_{t-2}$			-.0005	0.158			.0003	0.837			-.0001	0.798
Unemployment$_{t-1}$	.0016	0.000	-.0024	0.001	.0005	0.527	-.0146	0.000	.0005	0.000	-.0147	0.000
Unemployment$_{t-2}$			.0042	0.000			.0156	0.000			.0152	0.000
R-squared	0.1029		0.1056									
AB AR(1) z p- value					-10.66 0.000		-8.48 0.000		-3.79 0.000		-4.58 0.000	
AB AR(2) z p- value					-0.37 0.713		1.26 0.208		-0.18 0.855		1.51 0.132	
Sargan test chi2 Prob > chi2					584.63 0.000		280.51 0.000		584.63 0.000		280.51 0.000	
Hansen test chi2 Prob > chi2									44.51 0.576		41.83 0.434	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	1.13 0.2885		8.09 0.0045		5.43 0.0198		37.69 0.0000		203.87 0.0000		545.99 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			9.21 0.0025				33.86 0.0000				364.48 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			4.78 0.0085				37.90 0.0000				679.57 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				**GMM one-step system**				**GMM two-step system**			
	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|
GDP$_{t-1}$	.0038	0.000	.0027	0.000	.0052	0.000	.0023	0.021	.0052	0.000	.0024	0.000
GDP$_{t-2}$			-.0004	0.266			-.0042	0.000			-.0043	0.000
Financial Markets Access$_{t-1}$	.0156	0.058	.0461	0.001	.1169	0.000	.2306	0.000	.1174	0.000	.2343	0.000
Financial Markets Access$_{t-2}$			-.0402	0.003			-.1393	0.018			-.1435	0.000
Inflation $_{t-1}$	-.0001	0.554	.0002	0.409	-.0001	0.910	-.0001	0.959	-.0001	0.564	-.0001	0.832
Inflation $_{t-2}$			-.0005	0.187			.0012	0.311			.0015	0.000
Unemployment $_{t-1}$	.0017	0.000	-.0022	0.002	.0017	0.039	-.0123	0.000	.0017	0.000	-.0129	0.000
Unemployment $_{t-2}$			.0039	0.000			.0146	0.000			.0153	0.000
R-squared	0.1126		0.1131									
AB AR(1) z p- value					-10.37 0.000		-9.65 0.000		-3.75 0.000		-4.62 0.000	
AB AR(2) z p- value					-0.60 0.548		1.18 0.237		-0.31 0.760		0.92 0.357	
Sargan test chi2 Prob > chi2					580.07 0.000		400.44 0.000		580.07 0.000		400.44 0.000	
Hansen test chi2 Prob > chi2									45.08 0.553		43.93 0.348	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	3.59 0.0584		10.96 0.0010		41.37 0.0000		16.85 0.0000		1347.05 0.0000		536.89 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			8.60 0.0034				5.63 0.0009				106.40 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			5.61 0.0038				30.48 0.0000				785.37 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				GMM one-step system				GMM two-step system			
	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|
GDP_{t-1}	.0037	0.000	.0026	0.000	.0054	0.000	.0011	0.258	.0056	0.000	.0009	0.002
GDP_{t-2}			-.0002	0.569			-.0024	0.003			-.0025	0.000
Financial Markets Depth $_{t-1}$	.0080	0.284	.1343	0.000	.140	0.000	.4018	0.000	.1320	0.000	.3984	0.000
Financial Markets Depth $_{t-2}$			-.1469	0.000			-.3763	0.000			-.3739	0.000
Inflation $_{t-1}$	-.0001	0.560	.0004	0.131	.0010	0.133	.0018	0.089	.0009	0.000	.0018	0.000
Inflation $_{t-2}$			-.0008	0.037			-.0008	0.547			-.0007	0.038
Unemployment $_{t-1}$	.0016	0.000	-.0025	0.000	.0037	0.000	-.0128	0.000	.0036	0.000	-.0131	0.000
Unemployment $_{t-2}$			.0039	0.000			.0149	0.000			.0153	0.000
R-squared	0.1146		0.1791									
AB AR(1) z p- value					-10.09 0.000		-9.48 0.000		-3.80 0.000		-4.85 0.000	
AB AR(2) z p- value					-0.57 0.567		-1.25 0.923		-0.27 0.784		-1.10 0.272	
Sargan test chi2 Prob > chi2					575.36 0.000		311.39 0.000		575.36 0.000		311.39 0.000	
Hansen test chi2 Prob > chi2									43.73 0.609		44.17 0.339	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	1.15 0.2837		89.29 0.0000		67.50 0.0000		148.02 0.0000		409.45 0.0000		482.75 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			108.11 0.0000				96.02 0.0000				688.70 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			54.57 0.0000				148.36 0.0000				716.72 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				**GMM one-step system**				**GMM two-step system**			
	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|
GDP$_{t-1}$	.0038	0.000	.0028	0.000	.0056	0.000	.0031	0.010	.0056	0.000	.0030	0.000
GDP$_{t-2}$			-.0003	0.394			-.0045	0.000			-.0044	0.000
Financial Markets Efficiency$_{t-1}$	-.0086	0.036	-.0177	0.004	-.0200	0.208	-.1157	0.000	-.0198	0.000	-.1102	0.000
Financial Markets Efficiency$_{t-2}$			.0088	0.141			.1232	0.000			.1148	0.000
Inflation$_{t-1}$	-.0001	0.428	.0002	0.513	-.0008	0.239	-.0014	0.235	-.0008	0.000	-.0014	0.000
Inflation$_{t-2}$			-.0004	0.246			.0012	0.364			.0009	0.001
Unemployment$_{t-1}$	.0016	0.000	-.0023	0.002	-.0010	0.248	-.0177	0.000	-.0010	0.000	-.0179	0.000
Unemployment$_{t-2}$			.0040	0.000			.0178	0.000			.0182	0.000
R-squared	0.1067		0.1024									
AB AR(1) z p- value					-10.04 0.000		-8.32 0.000		-3.76 0.000		-4.36 0.000	
AB AR(2) z p- value					-0.36 0.718		1.10 0.273		-0.19 0.852		0.93 0.354	
Sargan test chi2 Prob > chi2					588.52 0.000		306.21 0.000		588.52 0.000		306.21 0.000	
Hansen test chi2 Prob > chi2									45.81 0.522		42.75 0.396	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	4.42 0.0358		8.47 0.003		1.58 0.2081		13.29 0.0001		24.57 0.0000		345.51 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			2.16 0.1415				19.51 0.0000				280.58 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			4.67 0.0096				19.76 0.0000				410.27 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				GMM one-step system				GMM two-step system			
	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|
GDP$_{t-1}$	.0038	0.000	.0026	0.000	.0056	0.000	.0014	0.174	.0056	0.000	.0014	0.000
GDP$_{t-2}$			-.0003	0.439			-.0036	0.000			-.0036	0.000
Financial Markets Index$_{t-1}$	-.0014	0.858	.0372	0.012	.1198	0.000	.2571	0.000	.1190	0.000	.2664	0.000
Financial Markets Index$_{t-2}$			-.0498	0.001			-.1618	0.002			-.1730	0.000
Inflation$_{t-1}$	-.0001	0.483	.0002	0.400	-.0003	0.658	-.0001	0.950	-.0002	0.270	-.0001	0.821
Inflation$_{t-2}$			-.0006	0.137			.0008	0.556			.0008	0.042
Unemployment$_{t-1}$	.0016	0.000	-.0022	0.002	.0026	0.005	-.0133	0.000	.0027	0.000	-.0134	0.000
Unemployment$_{t-2}$			.0039	0.000			.0172	0.000			.0174	0.000
R-squared	0.1179		0.1089									
AB AR(1) zp-value					-10.47 0.000		-9.24 0.000		-3.70 0.000		-4.44 0.000	
AB AR(2) zp-value					-0.46 0.649		-0.08 0.935		-0.24 0.809		-0.09 0.928	
Sargan test chi2 Prob > chi2					564.29 0.000		393.55 0.000		564.29 0.000		393.55 0.000	
Hansen test chi2 Prob > chi2									45.16 0.549		44.49 0.327	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	0.03 0.8584		6.40 0.0115		30.47 0.0000		25.31 0.0000		316.05 0.0000		457.76 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			11.75 0.0006				9.55 0.0003				182.76 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			6.09 0.0023				31.91 0.0000				500.52 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

Part B – Causality Running from Economic Growth to Financial Development

	Fixed effects				**GMM one-step system**				**GMM two-step system**			
	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|
Financial Development Index$_{t-1}$	.7925	0.000	.8450	0.000	1.018	0.000	1.068	0.000	1.018	0.000	1.080	0.000
Financial Development Index$_{t-2}$			-.0359	0.162			-.0234	0.809			-.0428	0.123
GDP$_{t-1}$	.0011	0.006	.000738	0.081	-.0004	0.596	-.0014	0.215	-.0003	0.047	-.0014	0.000
GDP$_{t-2}$			.0011	0.004			.0001	0.961			.0001	0.827
Inflation$_{t-1}$	.0001	0.872	.0003	0.347	.0002	0.850	-.0001	0.955	.0001	0.921	-.0002	0.650
Inflation$_{t-2}$			-.0003	0.493			.0006	0.661			.0006	0.250
Unemployment$_{t-1}$	-.0005	0.171	.0001	0.961	-.0005	0.702	-.0046	0.145	-.0004	0.050	-.0048	0.000
Unemployment$_{t-2}$			-.0002	0.841			.0055	0.094			.0057	0.000
R-squared	0.7948		0.9649									
AB AR(1) z p- value					-10.64 0.000		-5.42 0.000		-5.47 0.000		-5.49 0.000	
AB AR(2) z p- value					-2.11 0.035		-1.44 0.150		-2.45 0.014		-1.77 0.076	
Sargan test chi2 Prob > chi2					132.37 0.000		-1.44 0.000		132.37 0.007		97.29 0.000	
Hansen test chi2 Prob > chi2									45.21 0.547		43.99 0.346	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	7.52 0.0062		3.04 0.0813		0.28 0.5961		1.54 0.2151		3.93 0.0475		21.54 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			8.12 0.0045				0.00 0.9615				0.05 0.8273	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			7.78 0.0004				1.54 0.4635				23.49 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				GMM one-step system				GMM two-step system			
	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|
Financial Institutions Access $_{t-1}$	.8819	0.000	.9932	0.000	.9473	0.000	1.307	0.000	.9466	0.000	1.305	0.000
Financial Institutions Access $_{t-2}$			-.0538	0.017			-.3500	0.001			-.3483	0.000
GDP$_{t-1}$	.0019	0.000	.0013	0.000	.0015	0.032	.0011	0.248	.0014	0.000	.0010	0.000
GDP$_{t-2}$			.0016	0.000			.0002	0.762			.0004	0.202
Inflation $_{t-1}$	.0002	0.466	-.0003	0.298	.0013	0.069	.0004	0.659	.0013	0.000	.0003	0.357
Inflation $_{t-2}$			.0008	0.032			.0007	0.517			.0008	0.053
Unemployment $_{t-1}$	-.0016	0.000	-.0014	0.050	-.0011	0.208	-.0008	0.770	-.0014	0.000	-.0014	0.057
Unemployment $_{t-2}$			.0010	0.150			-.0003	0.920			.0003	0.725
R-squared	0.9741		0.9853									
AB AR(1) z p- value					-9.26 0.000		-6.31 0.000		-3.98 0.000		-4.72 0.000	
AB AR(2) z p- value					0.33 0.740		1.32 0.186		0.40 0.692		1.73 0.083	
Sargan test chi2 Prob > chi2					86.61 0.000		49.32 0.175		86.61 0.000		49.32 0.175	
Hansen test chi2 Prob > chi2									42.50 0.659		43.29 0.374	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	24.66 0.0000		12.25 0.0005		4.61 0.0318		1.33 0.2484		246.20 0.0000		17.52 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			20.34 0.0000				0.09 0.7622				1.63 0.2017	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			22.65 0.0000				1.40 0.4965				20.20 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				**GMM one-step system**				**GMM two-step system**			
	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|
Financial Institutions Depth $_{t-1}$	.8215	0.000	.9146	0.000	.9562	0.000	.7453	0.000	.9613	0.000	.7813	0.000
Financial Institutions Depth $_{t-2}$			-.0856	0.001			.2240	0.005			.1862	0.000
GDP$_{t-1}$	-.0004	0.233	-.0009	0.022	-.0017	0.011	-.0017	0.041	-.0017	0.000	-.0018	0.000
GDP$_{t-2}$			.0015	0.000			.0027	0.000			.0026	0.000
Inflation $_{t-1}$	-.0001	0.538	-.0002	0.525	-.0013	0.076	-.0015	0.087	-.0011	0.000	-.0012	0.000
Inflation $_{t-2}$			.0002	0.636			-.0007	0.459			-.0009	0.001
Unemployment $_{t-1}$	-.0011	0.001	-.0005	0.504	-.0022	0.019	.0004	0.866	-.0018	0.000	-.0002	0.750
Unemployment $_{t-2}$			.0001	0.848			-.0012	0.614			-.0004	0.615
R-squared	0.9823		0.9854									
AB AR(1) z p- value					-12.25 0.000		-3.68 0.000		-4.85 0.000		-5.54 0.000	
AB AR(2) z p- value					-2.45 0.014		-3.13 0.002		-2.08 0.038		-2.97 0.003	
Sargan test chi2 Prob > chi2					107.30 0.000		121.60 0.000		107.30 0.000		121.60 0.000	
Hansen test chi2 Prob > chi2									43.76 0.607		41.62 0.444	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	1.42 0.2334		5.26 0.0220		6.50 0.0108		4.20 0.0405		290.52 0.0000		67.35 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			17.86 0.0000				16.45 0.0000				96.76 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			9.49 0.0001				21.19 0.0000				156.26 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				GMM one-step system				GMM two-step system			
	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|
Financial Institutions Efficiency $_{t-1}$	.6737	0.000	.5904	0.000	.7486	0.000	.5583	0.000	.7623	0.000	.5092	0.000
Financial Institutions Efficiency $_{t-2}$			.1322	0.000			.2770	0.004			.3101	0.000
GDP$_{t-1}$	.0008	0.177	.0010	0.149	.0005	0.703	.0002	0.894	.0003	0.236	.0001	0.900
GDP$_{t-2}$			-.0002	0.697			-.0020	0.129			-.0014	0.000
Inflation $_{t-1}$	-.0003	0.339	-.0007	0.160	.0001396	0.915	-.0001	0.961	.0002	0.647	-.0010	0.113
Inflation $_{t-2}$			.0010	0.140			.0007	0.707			.0010	0.040
Unemployment $_{t-1}$	.0003	0.627	-.0013	0.321	.0017	0.287	-.0050	0.285	.0008	0.039	-.0057	0.000
Unemployment $_{t-2}$			.0020	0.111			.0080	0.108			.0087	0.000
R-squared	0.9942		0.8415									
AB AR(1) z p- value					-9.58 0.000		-4.24 0.000		-4.62 0.000		-3.85 0.000	
AB AR(2) z p- value					1.19 0.233		-0.97 0.332		0.93 0.353		-2.15 0.032	
Sargan test chi2 Prob > chi2					76.79 0.004		61.37 0.021		76.79 0.004		61.37 0.021	
Hansen test chi2 Prob > chi2									39.51 0.773		39.39 0.542	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	1.82 0.1773		2.08 0.149		0.15 0.7030		0.02 0.8940		1.40 0.2361		0.02 0.9000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			0.15 0.6966				2.30 0.1290				12.89 0.0003	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			1.04 0.3527				2.32 0.3132				13.11 0.0014	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				**GMM one-step system**				**GMM two-step system**			
	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|
Financial Institutions Index$_{t-1}$	.7645	0.000	.8000	0.000	.9367	0.000	.8785	0.000	.9335	0.000	.8592	0.000
Financial Institutions Index$_{t-2}$			.0439	0.036			.0854	0.315			.0992	0.000
GDP$_{t-1}$	.0007	0.040	.0005	0.149	4.17e-06	0.995	.0003	0.729	-.0001	0.765	.0004	0.136
GDP$_{t-2}$			.0012	0.000			.0006	0.326			.0005	0.000
Inflation$_{t-1}$	-.0001	0.820	-.0004	0.151	.0001	0.929	-.0003	0.707	-.0001	0.944	-.0002	0.631
Inflation$_{t-2}$			.0008	0.029			.0009	0.355			.0012	0.004
Unemployment$_{t-1}$	-.0012	0.000	-.0009	0.183	-.0006	0.543	-.0010	0.631	-.0011	0.000	-.0014	0.025
Unemployment$_{t-2}$			.0005	0.421			.0015	0.518			.0015	0.004
R-squared	0.9614		0.9784									
AB AR(1) z p- value					-10.26 0.000		-5.29 0.000		-5.05 0.000		-4.50 0.000	
AB AR(2) z p- value					0.00 0.998		0.03 0.976		0.04 0.968		-0.14 0.893	
Sargan test chi2 Prob > chi2					77.94 0.005		83.06 0.000		78.37 0.003		83.06 0.000	
Hansen test chi2 Prob > chi2									38.71 0.800		39.87 0.521	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	4.21 0.0403		2.09 0.1488		0.00 0.9953		0.12 0.7286		0.09 0.7650		2.23 0.1356	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			14.26 0.0002				0.97 0.3256				14.90 0.0001	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			10.78 0.0000				1.08 0.5833				22.91 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				GMM one-step system				GMM two-step system			
	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|
Financial Markets Access$_{t-1}$	.7835	0.000	.6662	0.000	.9794	0.000	.7316	0.000	.9784	0.000	.7315	0.000
Financial Markets Access$_{t-2}$			.1266	0.000			.2700	0.016			.2602	0.000
GDP$_{t-1}$	.0015	0.020	.0015	0.059	-.0013	0.400	-.0019	0.316	-.0014	0.001	-.0016	0.001
GDP$_{t-2}$			.0008	0.262			.0003	0.857			.0004	0.269
Inflation $_{t-1}$	.0001	0.698	-.0004	0.439	-.0005	0.724	-.0011	0.578	-.0005	0.044	-.0009	0.014
Inflation $_{t-2}$			.0012	0.152			-.0004	0.844			-.0005	0.057
Unemployment $_{t-1}$	.0005	0.421	.0009	0.552	-.0002	0.902	-.0041	0.466	-.0002	0.601	-.0034	0.006
Unemployment $_{t-2}$			-.0001	0.967			.0046	0.433			.0038	0.006
R-squared	0.9407		0.9430									
AB AR(1) z p- value					-13.58 0.000		-3.87 0.000		-4.35 0.000		-4.19 0.000	
AB AR(2) z p- value					-0.47 0.636		-2.10 0.036		-0.45 0.650		-3.09 0.002	
Sargan test chi2 Prob > chi2					32.29 0.055		71.30 0.002		69.75 0.017		71.30 0.002	
Hansen test chi2 Prob > chi2									44.71 0.568		43.92 0.349	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	5.46 0.0196		3.56 0.0595		0.71 0.3999		1.00 0.3162		10.81 0.0010		10.84 0.0010	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			1.26 0.2619				0.03 0.8570				1.22 0.2693	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			3.36 0.0351				1.04 0.5953				13.59 0.0011	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				**GMM one-step system**				**GMM two-step system**			
	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|
Financial Markets Depth $_{t-1}$	.8573	0.000	.8323	0.000	.9570	0.000	.8374	0.000	.9617	0.000	.8155	0.000
Financial Markets Depth $_{t-2}$			.0090	0.757			.2100	0.004			.2387	0.000
GDP$_{t-1}$	.0001	0.886	-.0010	0.189	-.0044	0.001	-.0060	0.001	-.0042	0.000	-.0056	0.000
GDP$_{t-2}$			.0028	0.000			.0023	0.128			.0020	0.000
Inflation $_{t-1}$	-.0001	0.743	-.0003	0.541	-.0014	0.308	-.0050	0.011	-.0015	0.000	-.0051	0.000
Inflation $_{t-2}$			.0003	0.730			.0044	0.000			.0047	0.000
Unemployment $_{t-1}$	.0008	0.187	.0012	0.380	-.0026	0.158	-.0084	0.064	-.0025	0.000	-.0094	0.000
Unemployment $_{t-2}$			-.0001	0.925			.0099	0.103			.0101	0.000
R-squared	0.9560		0.9549									
AB AR(1) z p- value					-13.74 0.000		-6.06 0.000		-4.98 0.000		-4.52 0.000	
AB AR(2) z p- value					-1.71 0.087		-2.40 0.016		-2.08 0.037		-3.72 0.000	
Sargan test chi2 Prob > chi2					277.93 0.000		254.44 0.000		277.93 0.000		254.44 0.000	
Hansen test chi2 Prob > chi2									45.11 0.551		39.12 0.554	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	0.02 0.8857		1.73 0.1890		11.54 0.0007		10.78 0.0010		321.83 0.0000		134.23 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			15.73 0.0001				2.32 0.1277				25.63 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			7.87 0.0004				12.99 0.0015				143.47 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				GMM one-step system				GMM two-step system			
	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|
Financial Markets Efficiency$_{t-1}$	.7127	0.000	.7301	0.000	.6228	0.000	.6290	0.000	.6474	0.000	.6525	0.000
Financial Markets Efficiency$_{t-2}$			-.0210	0.448			.0364	0.703			.0070	0.769
GDP$_{t-1}$	.0027	0.070	.0036	0.041	.0030	0.278	-.0003	0.951	.0024	0.000	-.0030	0.154
GDP$_{t-2}$			-.0003	0.833			-.0084	0.010			-.0093	0.000
Inflation$_{t-1}$	.0003	0.679	.0034	0.009	.0014	0.626	.0052	0.208	.0027	0.000	.0060	0.000
Inflation$_{t-2}$			-.0051	0.005			-.0042	0.342			-.0059	0.005
Unemployment$_{t-1}$	-.0008	0.588	.0018	0.587	-.0156	0.000	-.0321	0.004	-.0167	0.000	-.0356	0.000
Unemployment$_{t-2}$			-.0034	0.294			.0177	0.131			.0207	0.000
R-squared	0.8055		0.8180									
AB AR(1) z p- value					-7.71 0.000		-3.97 0.000		-4.55 0.000		-4.96 0.000	
AB AR(2) z p- value					-2.27 0.023		-1.34 0.179		-2.02 0.043		-1.77 0.077	
Sargan test chi2 Prob > chi2					110.10 0.000		75.14 0.001		110.10 0.000		75.14 0.001	
Hansen test chi2 Prob > chi2									41.50 0.699		41.05 0.468	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	3.28 0.0704		4.17 0.0413		1.18 0.2778		0.00 0.9508		23.30 0.0000		2.03 0.1542	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			0.04 0.8332				6.64 0.0100				44.73 0.0000	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			2.18 0.1135				6.65 0.0360				106.89 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

	Fixed effects				**GMM one-step system**				**GMM two-step system**			
	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|
Financial Markets Index $_{t-1}$	.8344	0.000	.8787	0.000	.9759	0.000	1.096	0.000	.9566	0.000	1.109	0.000
Financial Markets Index $_{t-2}$			-.0633	0.023			-.1479	0.131			-.1565	0.000
GDP$_{t-1}$	.0013	0.041	.0011	0.124	-.0007	0.584	-.0036	0.057	-.0007	0.005	-.0038	0.000
GDP$_{t-2}$			.0010	0.151			-.0006	0.723			-.0004	0.150
Inflation $_{t-1}$	.0002	0.625	.0009	0.086	-.0011	0.383	.0006	0.785	-.0013	0.000	.0002	0.606
Inflation $_{t-2}$			-.0013	0.083			-.0023	0.308			-.0026	0.000
Unemployment $_{t-1}$	.0004	0.545	.0014	0.319	-.0024	0.185	-.0105	0.052	-.0028	0.000	-.0113	0.000
Unemployment $_{t-2}$			-.0012	0.377			.0090	0.109			.0104	0.000
R-squared	0.9323		0.9355									
AB AR(1) z p- value					-10.87 0.000		-5.49 0.000		-5.11 0.000		-5.26 0.000	
AB AR(2) z p- value					-3.19 0.001		-1.00 0.316		-3.15 0.002		-1.77 0.076	
Sargan test chi2 Prob > chi2					146.39 0.000		102.95 0.000		146.39 0.000		102.95 0.000	
Hansen test chi2 Prob > chi2									44.02 0.597		42.21 0.418	
WALD TEST (β_{t-1}=0) chi2 Prob > chi2	4.18 0.0411		2.36 0.1245		0.30 0.5838		3.61 0.0573		7.84 0.0051		18.99 0.0000	
WALD TEST (β_{t-2}=0) chi2 Prob > chi2			2.07 0.1508				0.13 0.7231				2.08 0.1495	
WALD TEST (β_{t-1}=β_{t-2}=0) chi2 Prob > chi2			3.17 0.0422				3.77 0.1519				20.13 0.0000	
No.observations	1242		1196		1242		1196		1242		1196	

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

Annex VI - *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: 6.8 Norway: 7.899** Russian Fed.: 5.27 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.: 7.6 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: 6.0 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:4.7 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: 5.283** 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** .

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 Institutions Index → GDP	Austria: 3.677* Greece: 3.972* Rep. Korea: 9.278*** Malta: 6.340** Norway: 3.684* Switzerland: 4.2	Argentina: 7.543** Australia: 13.945* Austria: 10.413*** Czech Rep.: 14.53 Denmark: 6.408* Finland: 5.654* Germany: 8.625** Rep. Korea: 10.19 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** Finland: 15.076*** Greece: 10.248** Hungary: 8.357** South Africa: 7.25
Financial Markets Access Index→ GDP	Bulgaria: 3.205* Japan: 3.171* Rep, Korea: 3.91 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 Markets Depth Index → GDP	Brazil: 4.403** Bulgaria: 9.561*** China: 4.968** Rep. Korea: 2.95 Lithuania: 3.957 Norway: 5.933** Romania: 7.797**	Australia: 9.40** 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***	**GDP → Financial Markets Depth Index**	Cyprus: 3.012* Rep. Korea: 9.336*** Latvia: 3.811* New Zealand: 3.1 Russian Fed.: 3.0 Switzerland: 3.2	Rep. Korea: 15.79 Russian Fed.: 6.4 South Africa: 5.96

Causality: Financial Development → GDP			Causality: GDP→ Financial Development		
	Lag order: 1 lag		Lag order: 1 lag		Lag order: 1 lag
Financial Markets Efficiency Index → GDP	Brazil: 5.09** Norway: 3.217* Poland: 7.00*** Russian Fed.: 3.11 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: 5.77 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.: 6.17

Source: Author's calculations using STATA statistical software. Data were sourced from the IMF databases.
*** significant at 1% level; ** significant at 5% level; * significant at 10% level.