Mapping the elasticity of economic growth to financial development: A 1980 - 2012 empirical analysis for 100 countries

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Abstract

This research analyzes the impact of financial development on economic growth for a set of 100 countries. It applies cointegration methods taking into account country-heterogeneities, which have not been studied up to now at a detailed level.
Financial development is measured by a broad index or one of its three dimensions (deepness, accessibility and efficiency). Mapping the estimated elasticities of economic growth to financial development, deepness and accessibility exhibit, graphically, a bell-shaped quadratic form. The evidence of strong country-heterogeneity suggests that policy prescriptions should take into account the idiosyncratic factors of each country.

Keywords: financial development, economic growth, elasticities, cointegration.

JEL classification: G19, O16

Resumen

Esta investigación evalúa el impacto del desarrollo financiero al crecimiento económico para un conjunto de 100 países a través del método DOLS de cointegración teniendo en cuenta heterogeneidades entre los países, algo que no se ha estudiado en detalle en la literatura. El desarrollo financiero es medido por un índice amplio o por los sub-índices de profundidad, acceso y eficiencia financiera. El mapeo de las elasiticidades del crecimiento económico con respecto al desarrollo financiero (índice amplio, al de profundidad y al de acceso) muestra una forma de campana.

Keywords: Desarrollo Financiero, Crecimiento económico, Elasticidades, Cointegración

Content

1. Introduction

The financial system primary role is to facilitate resource allocation through time and space. Its development is key for economic growth as financial instruments and markets creation facilitate investment and technological innovation. The economic growth-financial development linkages have been largely studied, but, in most of the cases, financial development was measured by a narrow set of indicators, e.g. the ratio credit to private sector-to-GDP and stock market capitalization-to-GDP.

Svirydzenka (2016) builds a financial development broad index on basis of variables belonging to financial institutions (e.g. credit to private sector/GDP, pension funds' assets/GDP, number of branches of commercial banks per 100,000 adults, lending-deposits spread, etc.) and financial markets (e.g. stock market capitalization/GDP, total number of issuers of debt, etc.). Also, the broad index is subdivided in three sub-indices: the financial depth index, the financial access index and the financial efficiency index.

Based on Svirydenka (2016) and Sahay et al. (2015), this research evaluates the impact of financial development (measured by its broad index or one of its sub-indices) on economic growth for a set of 100 countries during the period 1980-2012. Sahay *et al*. (2015) estimate the economic growth-financial development relationship for 128 countries during 1980-2013, but possible feedbacks or cointegration relationships amongst these variables are neglected. Our contribution lies in applying the Dynamic Ordinary Least Squares (DOLS) cointegration method to estimate the economic growth-financial development elasticities; it takes into account the economic growth – financial development interrelations and avoids estimating spurious regressions.

This paper is organized as follows: section 2 presents the stylized facts, section 3 defines financial development and its measurement, section 4 gives the data sources and the relationships to estimate, section 5 presents the estimated results and their analysis; and finally section 6 concludes.

2.Stylized facts

The role of financial development on economic growth has been studied in a variety of forms. For instance, Bagehot (1873) highlights the banking system's role in rapidly redirecting resources towards those places with higher returns; the businessmen of a country could then take new investment opportunities faster than businessmen from countries with a less developed banking system. Schumpeter (1911) suggests that additional services provided by financial intermediaries (mobilizing savings, evaluating projects, facilitating risk management, exert control and facilitating transactions) increase the technological innovation and economic growth of a country. Goldsmith (1969) found evidence of strong correlation between financial development and economic growth in 35 countries, and emphasized the importance of financial development on capital accumulation.

Following Patrick (1966), the impact of financial development on economic growth should not focus solely on its direction (+,- or none), but also on the causality between them; in other words, their inter-relationships should also be studied. Three hypothesis are distinguished within this debate: a) the supply-leading hypothesis, which holds that the creation of financial institutions and the increase of the financial services supply boosts economic growth; b) the demand-following hypothesis, which states that economic growth increases the demand for financial services, and therefore stimulates his development; and c) the hypothesis of bidirectional

effects:, meaning that not only financial development boosts economic growth, but also that the later creates a demand that stimulates a higher level of financial development.

The seminal paper of King and Levine (1993a) boosted the debate regarding the financial development - economic growth linkages. They tested Schumpeter's hypothesis for 80 countries between 1960 and 1989 and found that financial development (measured by four indicators) has a positive correlation a) on economic growth (contemporaneous correlation ranges from 0.37 to 0.55), b) on the physical capital accumulation rate and c) on the efficiency in capital allocation.They postulate that financial development (variable with a leading behavior) is a good predictor of economic growth since they find high correlation rates between the lags of the financial development and economic growth.

The analysis of the financial development-economic growth relationship varies depending on the involved variables and the econometric methods applied. King and Levine (1993a) perform a cross section analysis (time series properties such as the order of integration are neglected) using control variables such as public expenditure-to-GDP, openness to trade and inflation rate. Neusser and Kugler (1998) considers the time series properties, but disregarded the simultaneity or endogeneity issue. Recently, long-run relationships are estimated by cointegration techniques, e.g. Christopoulos and Tsionas (2004).

3.Financial development

Financial development embraces a variety of dimensions that are often hard to define or even summarize under a unique index. A financial development index should reflect the depth, access and efficiency of the financial institutions or markets. Table 1, based on Sahay et al. (2015), classifies various financial development indicators according to their relationship to the financial institutions/financial markets or to the financial depth, access and efficiency.

Table 1. Financial system variables

	Financial institutions	**Financial markets**
Depth	-Private-sector credit (% of GDP) -Pension fund assets (% of GDP) -Mutual fund assets (% of GDP) -Insurance premiums, life and non-life (% of GDP)	-Stock market capitalization to GDP -Stocks traded to GDP -International debt securities government(% of GDP) -Total debt securities of financial corporations (% of GDP)
Access	-Branches (commercial banks) per 100,000 adults -ATMs per 100,000 adults	-Percent of market capitalization outside of top 10 large companies -Total number of issuers of debt (domestic and external as well as financial and non-financial corporations)
Efficiency	-Net interest margin -Lending-deposits spread -Non-interest income to total income -Overhead costs to total assets -Return on assets -Return on equity	-Stock market turnover ratio (stocks traded/capitalization)

Financial depth measures the size and liquidity of markets by aggregating the quantity and variety of services provided by the financial sector. Financial access reflects the ability of individuals to access financial services. Financial efficiency measures the degree of capital markets activity and the ability of financial institutions to provide services with sustainable revenues and low costs. Svirydzenka (2016) build a broad financial development index, as well as its three sub-indexes:the financial depth, access and efficiency indexes.

Financial development depends on the functions that the financial system exerts on the economy. Next, such functions and the manner in which financial development affect economic growth are analyzed based on Levine (1997, 2005).

3.1.Financial system functions

Following Merton and Brodie (1995) the primary role of the financial system is to facilitate resource allocation under uncertainty, through time and through space. The resource allocation facilitating function is disentangled by Levine (1997) into five sub-functions: i) mobilize savings; ii) allocate resources and acquire information; ii) corporate control and monitor managers; iv) facilitate risk management; and v) facilitate the exchange process. Levine (1997) points out that each these 5 sub-functions affects economic growth through capital accumulation and technological innovation.

3.1.1. Mobilize savings

The mere existence of saving does not assure that it will be addressed to investment. Even if savers are willing to invest, the required scale of certain projects or the lack of information about themmight reduce/eliminate the possibility of taking part in them. The so-called pooling (a common fund, created by the contributions of many agents, addressed to investment projects) is the mechanism that facilitates the redirection of savings because it generates economies of scale and, thus,reducesthetransaction and information costs.

Pooling enables carrying out projects that require high capital and that otherwise should be self-financed or would require that one or a few investors involve a great proportion of their capital in them. Following Levine (1997, p.699), pooling also implies the creation of small denomination instruments, which in turn ease the financing of large scale investments, increases liquidity and allow the diversification of portfolios. Sirri and Tufano(1995, p.100) suggest that benefits of mobilizing savings attract-and therefore allocate-greater amounts of capital as well as boost the implementation of new or existing technologies that favour economic growth.

3.1.2. Allocate resources and acquire information

Information about projects, firms and markets is a key factor in the investor's decision process.[1] The costs, for each saver, of gathering such information are high.Levine(1997, p.694) states that"individual savers may not have the time, capacity, or means to collect and process information on a wide array of enterprises, managers, and economic conditions". A firm with a profitable project might not find the required funding if the information about this project is not efficiently transmitted.

Financial intermediaries (a group of agents that collaborate to provide financial services) reduce these costs by centralizing the processes of collecting and analyzing information for their

[1] King and Levine (1993b) suggest that financial intermediaries may promote technological innovation by detecting those startup entrepreneurs with larger chances of success.

members anddistributing the costs amongst them. When the cost of being informed about investment projects is more affordable, the resource allocation is more efficient.

3.1.3. Corporate control and monitor managers

Investors require information before placing their capital (*ex ante*), e.g. the expected rate of return or the investment period, but they alsorequire information after they have invested (*ex post*). The later refers to the information that allows controlling the managers and the firm's performance. Agents might be reluctant to invest due to the uncertainty about the management of their funds. The costs of acquiring information about it may restrict some investment projects. As it was mentioned earlier, financial intermediaries lower the costs of acquiring *ex ante* information bydispersing it amongst savers.They also reduce control costs since such control is performed by the financial intermediaries (not by each saver). Additionally, the creation of financial contracts diminishes monitoring costs and increase investment incentives since they compromise the borrower to provide information and guarantee to the lender.

Stock markets also promote corporate control. Diamond and Verrecchia (1982) point out that the price of shares that are publicly sold and purchased can be used by the owners as a source of information. Thus, equity prices can be included in manager's contracts to incentive them according to the owner's interests. The same occurs with the takeover possibility of poorly managed firms (usually this process is accompanied by the manager's replacement). The increased takeover risk will help aligning managerial incentives with those of the owners (Grossman and Hart, 1980). Nevertheless, implicit contracts[2] between managers and employees, providers and other agents can be modified or even cancelled in case of a takeover (Shleifer and Summers, 1988), thus the new owners would obtain benefits at the expense of the rest of the agents involved in this contracts. Therefore, stock markets that ease takeovers can yield social welfare losses and a reduction in the efficiency of resource allocation.

3.1.4. Facilitate risk management

Many investment projects require large capital amounts that would keep savings immobilized for a certain period of time. The consequent liquidity risk might push investors out ofthese projects, namely, because of the fear to not being able to sell their shares if they wanted to avoid losses or have means of payment to fulfill obligations. The financial system reduces liquidity risk by implementing and easing the use of assets that can be purchased and sold with facility (shares, bonds or deposits). The reduction of liquidity risk encourages agents to place their savings in long run projects and technologies.

Besides, financial systems allow risk diversification and therefore enable non-systematic risk reduction, i.e. the risk associated to a specific sector or group of financial instruments. Given that it only affects certain projects, this risk can be reduced by the function of *pooling*.

3.1.5. Facilitate the exchange process

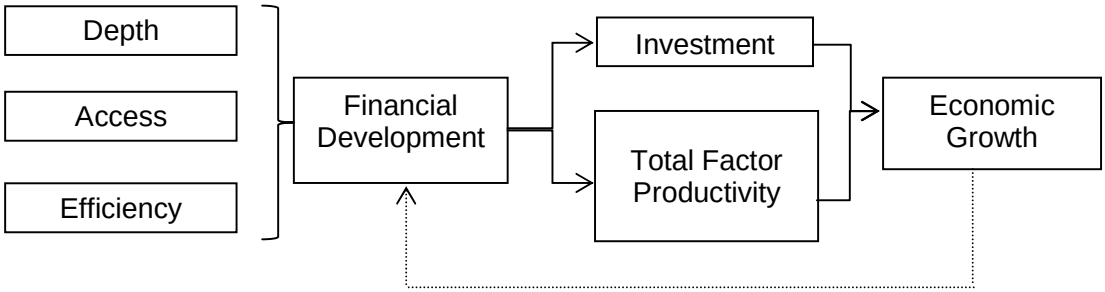
In 1776 Adam Smith analyzed the exchange process and its impact on productivity and growth.The division of labor increases labor productivity by narrowing the employee's range of activities. The specialized individual would find difficult to fulfill its needs with the merchandise he produces. He must then exchange it with other agents. Specialization requires thus continuous exchange. Although Smith referred to the transition from barter to monetary system of exchange,

[2]They emerge from the impossibility to know future events and from the high costs of creating complete contracts (Shleifer and Summers, 1988).

this is not the only mean of achieving lower transaction costs. For instance, Lamoreaux and Sokoloff (1996, p.1) hold that "the evolution of institutions that encouraged trade in technology (the patent system) and a growing division of labor between those who invented new technologies and those who exploited them commercially over the nineteenth and early-twentieth centuries increased productivity". De Gregorio (1996) remarks that the creation of financial instruments that reduced intertemporal transaction costs augmented the accumulation of human capital due to the facilitation of obtaining external funding. Greenwood and Smith (1997) state, however, that lower transaction costs could eventually boost the employment of standard productive processes and therefore discourage the search of new technologies[3].

Improvements of any of the financial system functions change the financial depth, access and efficiency and, therefore, they affect investment, total factor productivity and lastly economic growth.
Graph 1 gives a glimpse of the relationships between these variables.

Graph 1. Financial development and growth



3.2. Measuring financial development

Levine et al. (2000), Christopoulos and Tsionas (2004) and Bangake and Eggoh (2011) among others, refer to financial development by a set of indicators reflecting the deepness of the financial system only, e.g. the ratio private-sector credit/GDP or stock market capitalization to GDP. Their shortcoming is that they neglect key aspects of financial development, financial access and efficiency, and that their conclusions cannot be extrapolated to the financial development (as a whole)-economic growth relationship.

Svirydzenka (2016) emphasizes the importance of having a broad financial development index and postulateone by compiling depth, access and efficiency indicators of financial institutions (banks, insurance companies, investment funds and pension funds) and markets (stock markets and bonds) from 183 countries for the 1980-2014 period. The selection of indicators was narrowed to those who covered a wide range of countries and for an extended period of time. Altogether 20 variables were selected and combined into three indicators (depth, access and efficiency)[4], ranging between 0 and 1, by principal components;[5] a linear combination of these three indicators gives the financial development broad index.

[3] The parable of Fred and his truck factory gives a clear example of the five financial system functions in daily life; see Levine (1997, p.701).
[4] In line with

Table 1, 9 indicators correspond to financial depth, 4 to financial access and 7 to financial efficiency.

3.2.1. Financial development and economic growth

Although the methodology referring to the broad index and its sub-indices was published in 2016 by Svirydzenka (2016), Sahay et al. (2015) estimate, by the GMM approach, the effects of the financial development broad index (and its three dimensions) on the economic growth as well as on investment and total factor productivity.They find that the elasticity of economic growth to financial development increases up to some point of financial development, but then it diminishes and even turn negative; the last referring to the so called *too much finance* effect (see Arcand et al., 2012)[6].

Sahay et al. (2015) find evidence of a bell-shaped behavior of the elasticity of economic growth to financial development with the presence ofthe *too much finance effect.* After a certain level of financial development, although they highlight that the threshold varies between countries due to specific characteristics as the income level, institutions and regulatory framework. Thereare neither changesin the long-run relationship between financial development and economic growth amongst different income levels nor specific effects for emerging markets as suggested by previous studies.

Following Sahay et al. (2015) the *too much finance* effect is due mainly to the effects of financial development on total factor productivity, meaning that high levels of financial development donot have negative effects on capital accumulation but on the efficiency of investments and human capital allocation. They suggest it could be because the mobilize savings and facilitate transactions functions, after a threshold, are not affected by high levels of financial development, but the allocate resources and monitor managers and corporate control are performed less efficiently.

According to Sahay et al. (2015) the deepening of the financial sector plays a role on the bell-shaped form of the economic growth-financial development elasticities. They suggest that financial access has a positive and linear relationship with growth, but that the relationship between efficiency and growth is not clear. Thus, when a country reaches a threshold level ofdeepening, it might find beneficial to increase its financial development by augmenting access rather than deepening.

In line with Sahay et al. (2015), but using a different methodology, this paper estimates by the Dynamic OLS cointegration method the impact of financial development (the broad index and its sub-indexes) on investment, total factor productivity, and economic growth. The DOLS

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[5] The principal component analysis compiles different variables according to the correlation between them, the constructs a sub-indices with the variables that are highly correlated and a general index that is a linear combination of the previous sub-indices.

[6] Regarding the *too much finance* effect, Sahay et al. (2015) gathers information from different authors. Cecchetti and Kharroubi (2015) focus on the negative effect from the financial sector growth rate over total factor productivity. They argue that the accelerated growth of this sector might: a) crowd-out labour away from the real sector towards the financial sector (trade-off financial to real sector); and b) create inefficiencies in resource allocation benefiting low productivity projects (this effect is larger in the case of financial bubbles). Rajan (2006) suggests that the ability of the financial sector to absorb shocks may not be as significant as the theoretically is thought, and that on the contrary, the risks created by the financial system can induce higher procyclicality and even a *catastrophic meltdown.* De Gregorio and Guidotti (1995) suggest that high income countries may have reached a level in which higher depth does not contribute to improve the efficiency of investment.

methodtakes into account the unit root behavior of the variables involved in the analysis and enables us to estimate non-spurious long-run relationships. It also takes into account the heterogeneity of the cointegration relationship across countries.

4. Methodology

Although the GMM approach applied by various authors takes into account simultaneity biases, its estimations could be spurious in case of cointegration relationships.[7] The GMM approach do not indicate if its estimations represent a long run equilibrium relationship or a spurious one (Christopoulos and Tsionas, 2004); and, therefore,it could lead us to the wrong interpretation.

The DOLS approach, introduced by Saikkonen (1991) and Stock and Watson (1993): a) provides estimators asymptotically efficient;b)consists in a robust single equation approach that corrects the endogeneity between regressors, c) has advantages over the Johansen (1988) method since the latter is a complete information method so it's exposed to the issue that estimated parameters can be affected by a misspecification in other equation (see Sosvilla, Rivero and García (2003)); d) has a better performance in small samples than the Johansen (1988) and Engle and Granger (1987) procedures (see Stock and Watson (1993)); and e) surpasses the FMOLS (Fully modified ordinary least squares) and CCR (Canonical cointegrating regression) procedures (see Montalvo(1995)).

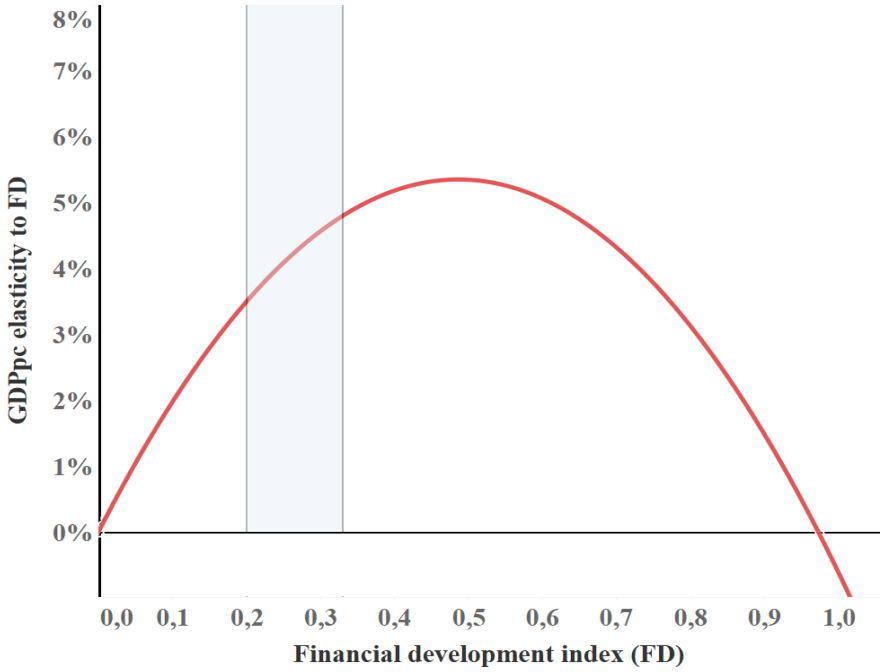
As explained by Narayan and Narayan (2004), the DOLS method regresses an integrated variable on a set of the variables(stationary or not) and their lags and leads. The regression we are interested in is defined as follows:

$$\ln GDPpc_t = \alpha + \beta_1 \ln FD + \beta_2 \ln TFP + \beta_3 \ln K + \sum_{i=-k}^{i=k} \gamma_i \Delta \ln FD_{t-i} + \sum_{i=-m}^{i=m} \phi_i \Delta \ln TFP_{t-i} + \sum_{i=-n}^{i=n} \varphi_i \Delta \ln K_{t-i} + \varepsilon_t \quad (1)$$

where:
GDPpc: gross domestic product per capita in constant 2010 dollars
FD, FDE, FA and FE refer to the financial development broad, depth, access and efficiency indexes, respectively.
TFP: total factor productivity
K: Capital stock (billions of constant 2005 dollars)
β_i are theelasticity parameters
k, m and n: lags and leads length.
We collected annual data for 100 countries and the period 1980-2012 on: a) GDP per-capita from the World Development indicators of the World Bank, b) financial development indicators from Svirydzenka (2016); and c) total factor productivity and capital stock from the EconMap 2.3 CEPII data base.
Although we apply panel unit root tests and panel cointegration tests, we do not apply panel data methods because in the 90% of the analyzed countries,the financial development index has a 0.13 average variation, which is small compared to the (0-1) total range of variation. A country by country estimation would not capture the hypothetic quadratic behavior of the relationship between financial development and growth. For instance, a country with a financial development index of 0,20 in 1980, ends up with 0,33 in 2012 (see Graph 2) and cannot reflect the full picture of a quadratic behavior.

Graph 2. Average range of information by country

[7]As explained by Engle and Granger (1987), cointegration represents a long-run equilibrium relationship between non-stationary variables.



Over time, few countries exhibit changes wide enough to provide data that guarantee a reliable estimation of the cointegrating relationship of the bell-shaped type. We deal with this problem by applying a two-stage method approach. First, a linear DOLS[8] is run for each country and obtain the economic growth to financial development elasticities ($\hat{\beta}_i$) valid within the range of variation of each country. The cross-section characteristic of our data allows us totake into account the idiosyncratic responses of each country.

Once the ($\hat{\beta}_i$) of each country is estimated, the 1980-2012 average of financial development is mapped against the estimated $\hat{\beta}_i$ elasticities and their bell-shaped relationship estimated by the ordinary least squares (OLS).

Next, the order of integration of the analyzed series is checked, and the corresponding cointegration tests are applied.

5. Empirical results

5.1. Unit root tests

The Dynamic OLS approach requires the explain variable to be integrated of at least the same order as one of the regressors, and allows adding I(0)as explanatory variables.

Given that the power of unit root tests is affected when the length of the time series is reduced (Christopoulos and Tsionas, 2004), it is recommended to use more powerful unit root tests for panel data, such as the Im, Pesaran and Shin (2003), and the Fisher tests (the Maddala and Wu (1999) and Choi (2001) tests), all of which account for the heterogeneity without assuming similar parameters across countries.

[8] We refer to the mean group DOLS estimators proposed by Pedroni (2001) since this would be the most appropriate method given the advantages that presents over other DOLS panel estimators.

Table2. Unitroottests (H_0: there is a unitroot)

Variables	Levels			Difference		
	IPS	Fisher tests		IPS	Fisher Tests	
		ADF	PP		ADF	PP
lnGDPpc	8.38 (1.0)	148.29 (0.99)	153.37 (0.99)	-31.26*** (0.00)	1259.32*** (0.0000)	1294.85*** (0.00)
lnFD	-0.44 (0.32)	200.79 (0.47)	232.58* (0.05)	-45.11*** (0.00)	1895.22*** (0.0000)	2113.63*** (0.00)
lnK	12.32 (1.00)	98.14 (1.00)	206.13 (0.36)	-10.21*** (0.00)	465.39*** (0.00)	382.34*** (0.00)
lnTFP	5.82 (1.00)	168.63 (0.94)	169.47 (0.94)	-35.32*** (0.00)	1446.34*** (0.00)	1527.12*** (0.00)
lnFDE	2.01 (0.97)	165.08 (0.96)	165.74 (0.96)	-42.86*** (0.00)	1796.78*** (0.00)	2046.45*** (0.00)
lnFA	5.37 (1.00)	171.50 (0.92)	202.05 (0.44)	-36.97*** (0.00)	1541.27*** (0.00)	1713.07*** (0.00)
lnFE	-5.48*** (0.00)	321.54*** (0.00)	327.99*** (0.00)	-	-	-

***, ** and * indicate that the null hypothesis is not rejected with a level of confidence 1%, 5% and 10% respectively.
The numbers between brackets represent the p-value.
IPS refers to the Im, Pesaran and Shin test, ADF refers to the Maddala and Wu observed statistics and PP refers to the Choi tests.

Under the null of one unit root,

Table2 summarizes the panel unit root tests applied to both the levels and their first difference of the analyzed variables. It suggests that the three tests do not reject the null of unit root in all series with a 1% level of confidence, except for financial efficiency variable which is stationary in levels. Although financial development is stationary by the PP Fisher test (at 10% significance levels), but not by the IPS and ADF Fisher; we adopt the suggestion of the latter tests. The unit root tests applied to the first differences reject the null hypothesis at the 1% significance level. We conclude that all series are I(1) except for financial efficiency which is I(0).

5.2. Cointegration tests

The idiosyncratic characteristics of each country justifythe application of Pedroni's (1999) cointegration test for heterogeneous panels, which proposes two groups of residual tests.The first group, which includes the panel *v*, ρ, *PP* and *ADF* statistics, assumes the homogeneity of the autoregressive coefficient of the residuals under the null hypothesis of cointegration. The second group, which includes the group ρ, *PP* and *ADF* statistics, is based on the average of the estimated coefficients for each country, allowing different autoregressive coefficients between countries. Pedroni (1999) shows that the tests associated to the ADF panel and group statisticsperform better than the other tests in small samples. This research relies on the ADF group test in order to take into account additional sources of heterogeneity. Following Table 3 there is a cointegrating relationship between lnGDPpc, lnFD, lnTFP and lnK. It implies that the relationship between these variables should be estimated by a cointegration procedure.

Table3.Cointegration test

	Statistic	Prob.

ADF Group	-6.338979	0.0000

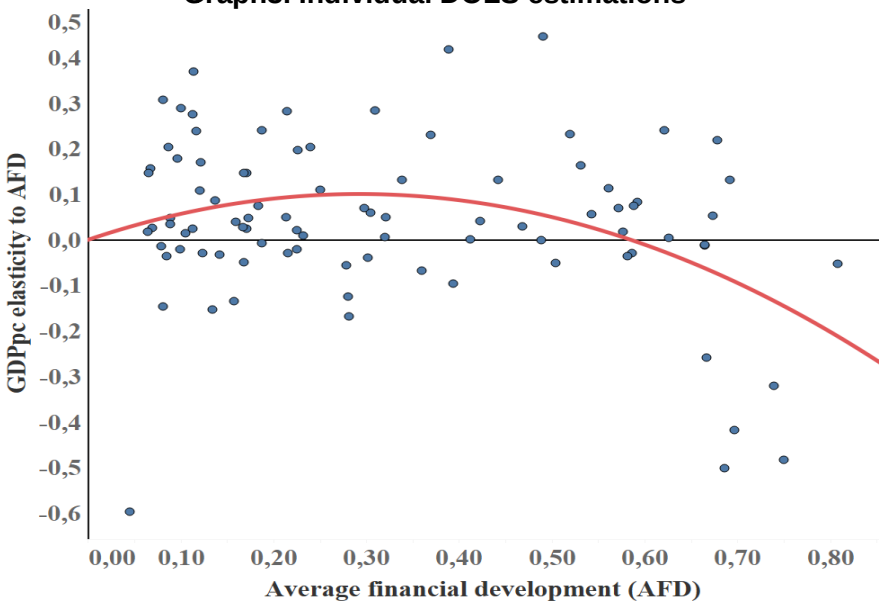
H_0: There is nocointegrated relationship.

5.3. Cointegration results

In this section equation (1) is estimated for each country by the standard Dynamic OLS for panel estimators; two lags and leads are added as is common practice in small samples to preserve freedom degrees (Herzer, 2014).

After the individual estimations, the per capita GDP to financial development ($\hat{\beta}_1$) elasticities are gathered: non-significant coefficients as well as extreme values coefficients (under the 5percentile and above the 95 percentile) are dropped. Graph 3 maps the estimated $\hat{\beta}_{1S}$against the 1980-2012 average of the financial development broad index.

Graph3. Individual DOLS estimations



Sahay et al. (2015) estimate how the response of economic growth to financial development varies between emerging markets and the rest of the countries of their sample, but our results provide an extended detail of them.Graph3 shows that the effect of financial development on economic growth is highly heterogeneous across countries. Additional variables, e.g. the regulatory framework, may explain such heterogeneities. Some information is also loosed when using average financial development measurement, e.g. the velocity of financial development. Based on the information mapped in Graph3, the following equation is estimated by the OLS method.

$$\hat{\beta} = \alpha + \beta_1 ADF + \beta_2 ADF^2 + \mu \qquad (2)$$

where $\hat{\beta}$ is elasticity of the per capita GDPto the financial development, and AFD is the 1980 – 2012 average financial development broad index.

Table4. AFD and GDPpc bell-shaped relationship

	Variable	Coefficient	Standard error	t-statistic	Prob.
Model 1	C	-0.036	0.054	-0.667	0.506
	AFD	0.903**	0.365	2.476	0.015
	AFD^2	-1.380***	0.465	-2.965	0.003
Model 2	AFD	0.684***	0.155	4.410	0.000
	AFD^2	-1.126***	0.265	-4.243	0.000

where*, ** and *** indicate that the null of a zero coefficient is rejected at the 10%, 5% and 1% level, respectively.

Table 4 exhibits also a model without the constant since it is not statistically significant, even at the 10% level. In line with Sahay et al. (2015), we found that both estimates have the expected signs and are significantly different from zero at the 5% level. The bell-shaped curve of Graph 3depicts the long-run effect of financial development on economic growth; itincreases at first, but then diminishes until it turns negative.

Using similar procedure, the relationship between TFP, investment and financial development is evaluated. The cointegration tests suggest a long-run relationship between TFP and financial development, but not between the latter and investment. Subsequently, the cointegrated relationship between the lnTFP and the lnFD is estimated. The rest of the procedure is identical to the one performed previously. For simplicity, from now on we will only show the final results, however the results derived from estimations and cointegration tests can be found in the appendix.

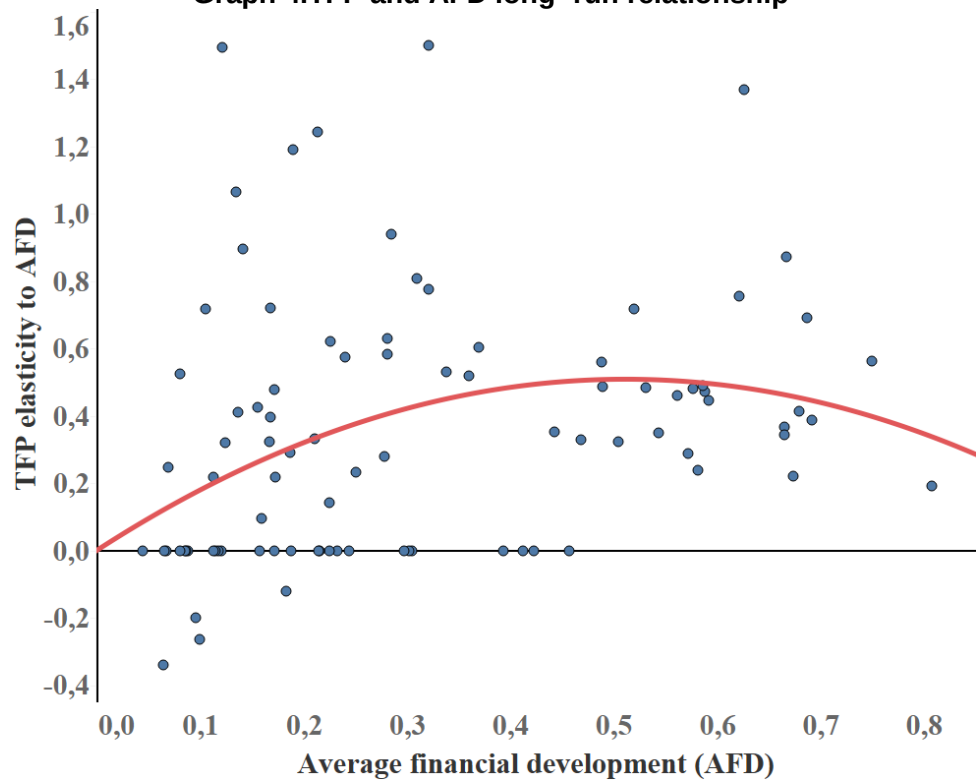
Using similar procedure the TFP and capital stock elasticities to financial development are also mapped against the average 1980 – 2012 financial development and their quadratic behaviour evaluated. Additionally, the relationship between growth and each one of the three components of financial development are analyzedin order to determine which one contribute to the bell-shaped form of the economic growth-financial development relationship.

Our results suggest that both financial depth and access exhibit a quadratic behaviour with growth; see graphs 5 and 6. These findings differ from those of Sahay et al. (2015), who found a linear relationship between access and growth; when access is higher, more agents are included in the financial system and obtain benefits from this (easing of transactions, funding, absorb shocks, etc.).

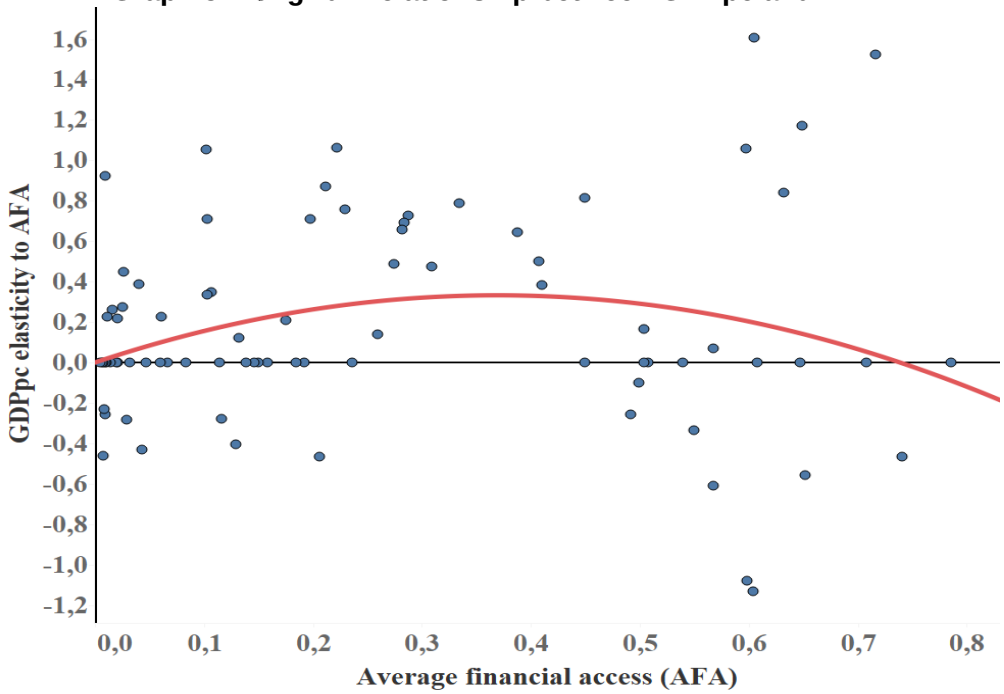
Graph 4 shows that the effect of financial development on TFP has also a bell-shaped form; which is expected since total factor productivity is a source of economic growth. Additionally, the relationship between growth and each one of the three components of financial development are analyzedin order to determine which one contribute to the bell-shaped form of the economic growth-financial development relationship.

Our results suggest that both financial depth and access exhibit a quadratic behaviour with growth; see graphs 5 and 6. These findings differ from those of Sahay et al. (2015), who found a linear relationship between access and growth; when access is higher, more agents are included in the financial system and obtain benefits from this (easing of transactions, funding, absorb shocks, etc.).

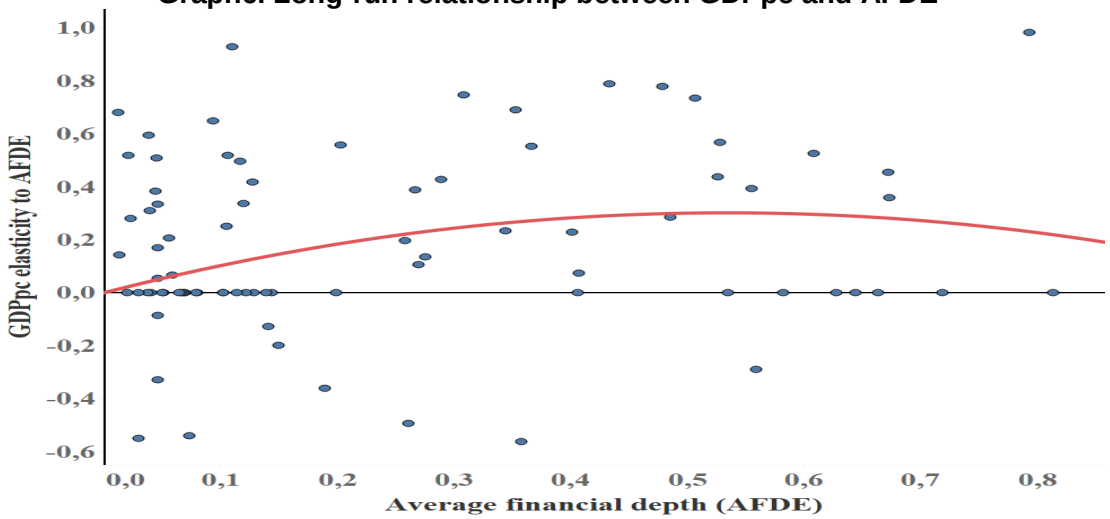
Graph 4.TFP and AFD long- run relationship



Graph 5. Long-run relationship between GDPpc and AFA



Graph6. Long-run relationship between GDPpc and AFDE



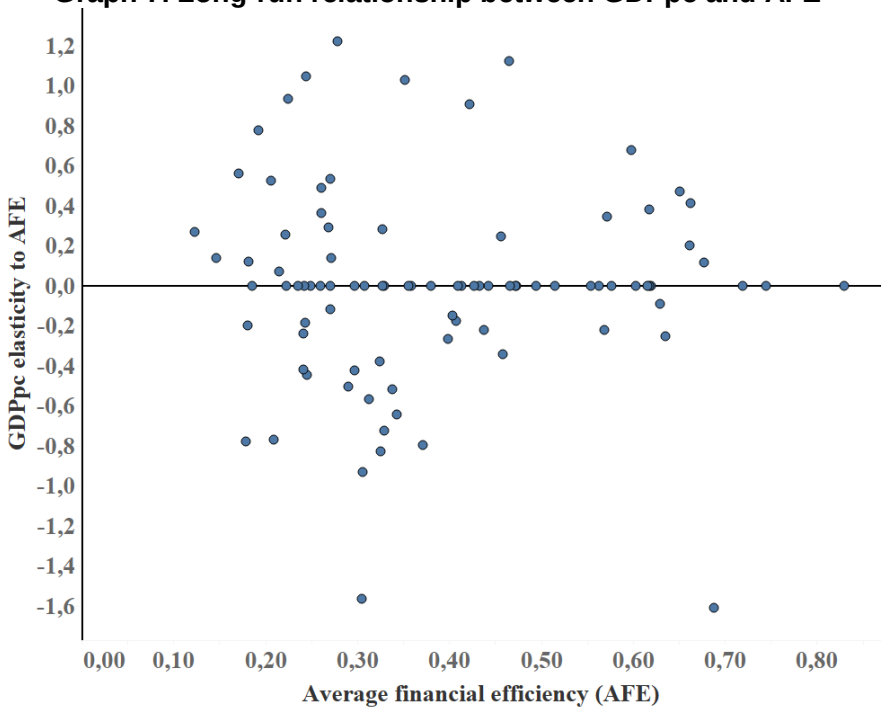
The quadratic relationship between access and growth could be due to the fact that some indicators that are linked to financial access can be seen as depth measures. As a result, it is likely that when we analyze access through these indicators, we actually include information about financial depth.[9]

As it was explained earlier, there are several hypotheses that highlight the negative effects of an excessive deepening so that a higher access indicator may not have the expected benefits.
Lastly, we do not find evidence of a long-run significant relationship between economic growth and financial efficiency; see graph 7.

Same as with the access indicator, it is probable that this is due to the fact that the efficiency variables donot simply reflect efficiency, but they also include additional information. For example, variables such as return on assets and return on equity do not reflect only how efficiently the financial system allocates resources; it also measures the degree of leverage of financial institutions and, although certain degree of leverage is beneficial, an excessive increaseimplies a higher fragility to shocks. Thus, an increase in the efficiency indicator may arise from an excessive degree of leverage or from a better resource allocation. Probably is more accurate to refer to this indicator as a profitability indicator and not efficiency.

[9] For instance, the percent of market capitalization outside of top ten large companies could be seen as depth measures; it captures the greater capacity of the ten non-large companies to access to additional funding, but it can also be interpreted as an increase of the size of the stock market and therefore of the liquidity. Another example refers to the number of branches of commercial banks per 100,000 adults; a higher number will surely imply that a greater amount of individuals will have a branch in a near location, but this also signals that banks are increasing their transactions and obtaining more deposits.

Graph 7. Long-run relationship between GDPpc and AFE



6. Conclusions

For a sample of 100 countries and for the period 1980 and 2012, this research estimates by the Dynamic OLS cointegration method the economic growth elasticity to financial development. The cointegration approach removes the issue of a probable spurious regression and allows us to estimate long-run relationships.

The estimated elasticities are then mapped against the average financial development to evaluate whether the economic growth – financial development relationship has a bell-shaped form in the long-run (in line with Sahay et al. (2015)) or not. We found evidence that supports the findings of Sahay et al. (2015). An extensive analysis indicates also that the effect of financial development on total factor productivity has also a quadratic form.

The analysis also reveals that the effect on growth differs from one component of financial development to another. Both the relationship of financial depth and access with growth seem to have the same shape that was found before when we analyzed financial development has a whole. This differs from the findings of Sahay et al. (2015) who found that access has a linear relationship with growth due to a higher number of individuals that take part in the financial system which allows mobilizing a greater amount of savings, provide funding to a great number of agents and ease even more the transactions. However, these paper findings may indicate that the decrease in the positive effect of access on growth may be caused by the ambiguity of the variables that form this indicator since they also reflect depth.

On the other hand, and according to Sahay et al. (2015), we weren't able to find a significant relationship between financial efficiency and growth. We also attribute this to the ambiguity of the variables that integrate this indicator, since they do not only reflect the efficiency of the

financial system, but also its profitability. We must remember the definition of efficiency that we presented earlier in this paper which implies providing financial services at low costs and with sustainable revenues over time.

While Bangake and Eggoh (2011) and Sahay et al. (2015) differentiate the effects of financial development on growth across groups of countries, they do not allow to appreciate the differences across individual countries which obstructs having a full comprehension about the heterogeneity of the long run relationship between financial development and growth across countries. In this paper, we presented the individual estimations and later analyzed in search for a long run relationship for the set of countries. This methodology enabled obtaining conclusions about the long run general relationship between financial development and growth without disregarding that the heterogeneity across countries implies that the conclusions related to a general analysis must be expressed with caution.

Policy prescriptions will vary according to the different degrees of financial development since there is a trade-off between economic growth and financial development that will establish the optimal relationship between both variables. However, due to the cross-country heterogeneity, the prescriptions must be made by analyzing in detail each country's economic situation and regulatory framework. Surely, in a country with strong institutions, the increase in financial development will be less likely to createcrisis episodes or deteriorate resource allocation. At the same time, the ambiguity of the used indicators means that the measures used are not precise, so new variables should be included to capture the real differences across countries. In summary, future research about this issue must incorporate variables that account for the institutional framework and that improve the measurement of the components of financial development in order to made precise policy prescriptions

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Appendix

A.1. Cointegration tests

Table A.1.Pedronicointegration tests:Ho: There is no cointegration.

	Variables	Group ADF-Statistic	Prob.
Model 1	lnGDPpc, lnFD, lnKandlnTFP	-6.338979	0.0000
Model 2	lnTFP, lnK and lnFD	-3.955708	0.0000
Model 3	lnTFP and lnFD	-1.942451	0.0260
Model 4	lnGDPpc, lnFA, lnFE and lnFDE	-2.028257	0.0213

Trend assumption: No deterministic trend

A.2. OLS estimations

Table A. 2. OLS estimations of the relationship between GDPpc, AFD, AFA, AFDE and AFE.

	Variable	Coefficient	Standard error	t-statistic	Prob.
Model 1	C	0.054	0.128	0.423	0.673
	AFD	1.659*	0.854	1.941	0.055
	AFD^2	-1.559	1.097	-1.420	0.159
Model 1.1	AFD	1.989***	0.344	5.775	0.000
	AFD^2	-1.945***	0.606	-3.206	0.001
Model 2	C	0.088	0.103	0.854	0.394
	AFA	1.027	0.870	1.179	0.241
	AFA^2	-1.484	1.267	-1.170	0.244
Model 2.1	AFA	1.587***	0.573	2.769	0.006
	AFA^2	-2.153**	0.996	-2.161	0.033
Model 3	C	0.115	0.078	1.480	0.142
	AFDE	0.637	0.635	1.002	0.318
	$AFDE^2$	-0.712	0.880	-0.809	0.420
Model 3.1	AFDE	1.396***	0.378	3.688	0.000
	$AFDE^2$	-1.610**	0.643	-2.503	0.014
Model 4	C	0.200	0.343	0.584	0.560
	AFE	-1.059	1.727	-0.612	0.541
	AFE^2	1.158	1.933	0.598	0.550
Model 4.1	AFE	-0.077	0.412	-0.188	0.850
	AFE^2	0.117	0.754	0.155	0.876
Model 4.2	AFE	-0.016	0.122	-0.135	0.892

Where *, ** and *** indicate that the null of a zero coefficient is rejected at the 10%, 5% and 1% level, respectively.