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THE RELATIONSHIP BETWEEN FINANCIAL DEVELOPMENT AND GROWTH: THE CASE OF EMERGING EUROPE

by Alessio Ciarlone[*]

Abstract

This paper provides evidence about the impact that changes in some specific indicators of financial development have on economic growth in a sample of 19 countries in Emerging Europe. Real per capita GDP growth, bank credit to the private sector, stock market capitalization and the outstanding stock of international debt securities – along with a series of other traditional determinants of economic development – are found to be co-integrated. By employing recent econometric techniques for heterogeneous panels, conclusions are drawn about the long- and short-run relationships between the variables of interest. The main result of the analysis points to the existence of non-linearities. There appears to be an inverted U-shaped relationship between bank credit to the private sector and economic growth. By contrast, both domestic stock market capitalization and the stock of international debt securities display a more traditional positive and monotonic relationship with economic growth. The results appear to be robust to an extensive series of tests and changes in the estimation methodology.

JEL Classification: C23, F43, G21, G23, O11, O16, O41, O47, P34.
Keywords: finance, economic growth, pooled mean group estimation, threshold effects, dynamic panel threshold, non-monotonicity, emerging Europe.
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Contents

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1. Introduction[1]

The objective of this paper is to contribute to the long-running debate about the finance and growth nexus by looking at how the relationship between economic and financial development has actually evolved in a sample of 19 Central, Eastern and South-Eastern emerging European economies.[2] These countries, in fact, represent an interesting test case in light of the deep reforms and radical institutional changes that their financial systems have undergone within the overall transition from centrally-planned to market-based economies since the early '90s.

Moving away from totally state-owned and severely segmented financial systems, during the 1990s all transition countries made substantial efforts to build market-oriented legal and financial structures and institutions designed to develop stabilization objectives in the short-term and to enhance supply-side responses in improving the allocation of resources in the longer-term. As a consequence of the gradual, but steady, process of international financial and trade integration, privatization and improvements in domestic legal and institutional set-ups, financial markets in emerging European countries underwent a dramatic development in a relatively short time span – especially those economies directly involved in the process of accession to the neighbouring euro area or European Union.

In the Appendix, the three panels of **Chart 1** provide an interesting snapshot of the values involved in this process. This chart shows five-year averages of three key measures of financial market development, i.e. the stock of banking credit to the private sector, the capitalization of domestic stock markets and the outstanding amount of debt securities issued on international markets by resident private non-financial corporations, each expressed as a ratio to GDP. In emerging Europe, the size of each of the three segments of the financial system has grown dramatically over the past 20 years or so (although starting from relatively low levels). The ratio of bank credit to GDP almost doubled on average in the 19 countries of the sample, while stock market capitalization and the outstanding amount of international debt securities grew approximately in line with real per capita GDP which, in turn, grew at an annual rate of around 6.0% over the same period. The panels also show that financial systems in emerging Europe have always been predominantly bank-based: as a ratio to GDP, in fact, the size of the domestic banking sectors is significantly larger than those of both the stock and the (international) bond markets. Overall, this evidence provides a strong motivation for trying to shed additional light on the relationship and the direction of causality between financial development and growth by looking at one of the most dramatic natural experiments of the last decades, i.e. the creation *ex-novo* of market-based financial institutions (Gaffeo and Garalova, 2014).

Because of this relatively rapid development, the overall breadth of the three segments of the financial system now stands close to the situation in other emerging areas, as shown in the three panels of **Chart 2**. Considering the 2012-2017 average, it appears that the outstanding amount of international bonds issued by private residents in emerging Europe (as a percentage of GDP) was in line with those of both South-East Asian and Latin American countries, while the size of the domestic credit markets compared favourably with those in Latin American economies. Stock markets, on the contrary, were still relatively underdeveloped relative to the other two emerging regions.

Of course, simply comparing indicators of financial development, in a time series or a cross-section set-up, does not provide any clue about whether the size of financial markets is "too cold, too hot or just right" (Barajas *et al.*, 2013); assessing the effects in terms of impact on growth, by contrast, might

[1] I wish to thank Giuseppe Parigi, Pietro Catte, Giorgio Merlonghi, Emidio Cocozza and two anonymous referees for their useful comments on earlier versions of this paper; any errors and omissions remain my own responsibility. The usual disclaimers apply.

[2] This group comprises: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, North Macedonia, Poland, Romania, Russia, Serbia, Slovak Republic, Slovenia, Turkey and Ukraine. In the following, 'emerging Europe' or 'emerging European countries/economies' will be used interchangeably to refer to this group of countries.

provide a useful benchmark. Against this backdrop, the three panels of **Chart 3** show the sample distribution of the bivariate relationship between each of the three indicators of financial market development and real per capita GDP growth. In each panel, two regression lines are also depicted and compared, the first one postulating a classic monotonic relationship and the second a possible non-linear one between the two variables. At first glance, the data suggest that the association between financial market size and real per capita GDP growth varies across forms of finance: it is negative in the case of bank credit to the private sector while it is mildly positive for the other two indicators of financial development (stock market capitalization and outstanding international bonds). The purpose of the econometric exercise that follows is to investigate in greater detail the sign and the shape (linear monotonic vs. purely non-linear) of the relationship between financial development and economic growth in the sample of emerging European economies, after accounting for any other factors that might confound such a relationship.

To the best of our knowledge, the analysis presented in this paper represents the most comprehensive study of the finance and growth nexus in emerging European countries. It also contributes to the existing literature along several dimensions. First of all, being based on data that also covers the post-crisis period, it provides an up-to-date perspective on the relationship between financial development and growth. Second, by applying modern econometric techniques – specifically designed for heterogeneous co-integrated panels – to analyse the long-run relationship between economic growth and the three different segments of the financial system, I am able to obtain more rigorous results than the few other available empirical studies on this topic for the same set of countries. Third, by taking the so-called *financial service* view of the finance and growth nexus and jointly considering the three measures of financial development, I can show that further increases in the capitalization of stock and bond markets yield gains in terms of higher economic growth, contrary to what happens when the credit market increases in size. I also allow for the existence of a non-linear relationship between financial development and economic growth, in order to investigate the possibility that emerging European economies may have reached a threshold where they suffer "too much credit". The results, which appear to be robust against alternative econometric techniques and model specifications, suggest that further developments of capital markets – though not the credit one – could convey net benefits to the region by stimulating economic growth without jeopardizing macroeconomic and financial stability.

The paper is organized as follows: after briefly summarizing the main branches of the existing literature on the finance and growth nexus which are more proximate to my research (Section 2), I will lay out the features of both the chosen econometric method (Section 3) and the data (Section 4). Afterwards, I will discuss the main results stemming from the preferred estimation procedure and provide evidence about the existence of a non-linear relationship between the stock of credit to the private sector and economic growth (Section 5). Once confirmed that the general results appear to be robust against an extensive set of tests (Section 6), I will lastly draw my conclusions and give the policy implications (Section 7).

2. The literature on the finance and growth nexus

The idea that well-functioning financial systems play an essential role in promoting economic development was originally put forward by Bagehot (1873) and Schumpeter (1911).[3] Since then, a large number of empirical studies have flourished using a vast array of econometric techniques (ranging from cross-country, time series, panel data and firm- or household-level studies) to assess whether the finance and growth nexus is in place and what the possible channels are through which it actually

[3] According to Levine (1997), financial markets and intermediaries can influence economic growth in five different ways: i) more savings will be mobilized; ii) a better supply of information will lead to a better allocation of resources; iii) there will be better opportunities for monitoring managers; iv) it will become easier to trade, hedge, diversify and combine risks; v) transactions concerning goods and services will be facilitated.

unravels. There is not enough space here to review the extensive body of research on the topic;[4] in what follows, attention will be focused upon the specific strands of the literature this research intends to deal with.

The first branch focuses upon the presumed changes in the size and sign of the impact that finance is supposed to exert on growth across time, sample of countries, degree of economic and financial development, for example. While the mainstream seminal papers (King and Levine, 1993a-b; Levine 1997, 2003; Levine *et al*., 2000; Beck and Levine, 2004; Beck *et al*., 2000a, 2005) have all demonstrated that there is a positive long-run association between certain indicators of financial and economic development – suggesting that well-developed financial markets are growth-enhancing and, therefore, consistent with the proposition of ''more finance, more growth'' – a non-negligible body of empirical work has started to cast doubts on the conclusion that the effect of finance on growth is necessarily monotonic. For instance, the claim that the level– be it high, intermediate or low – of financial development may play an important role in shaping the differential effect of finance on growth has been put forward by Rioja and Valev (2004a-b) and by Shen and Lee (2006).[5] At the same time, Rousseau and Wachtel (2011) and Demetriadis and Rousseau (2016) have become the proponents of the so-called "vanishing effect", observing that the positive correlation between finance and growth no longer seems to be as strong as it was in the original studies based on older data. However, it is especially after the 2008-2009 global financial crisis that the most serious criticisms have been launched against the presumed positive relationship between finance and growth: in particular, it has been suggested that bloated financial systems may become a drag on the rest of the economy. Against this backdrop, a series of papers have indeed concluded that more financial development is good only up to a point, and can be damaging to growth once it exceeds a certain threshold. This implies that the relationship between finance and growth may be a non-linear one or, more specifically, an inverted U-shape, where there is a clear turning point related to a "too much finance" issue (Cecchetti and Kharroubi, 2012; Beck *et al.*, 2014; Law and Singh, 2014; Arcand *et al*. 2015; Sahay *et al.*, 2015; Samargandi *et al.*, 2015).[6] There are three broad theory-based explanations for the supposed non-linearity in the finance and growth nexus uncovered in these studies (Popov, 2017). The first is related to the fact that at high levels of financial development, a further deepening of financial markets can be associated with a type of financial services that contribute less to growth, such as mortgage finance. The second explores the hypothesis that there is a trade-off between economic development and macroeconomic risk, and that developed financial intermediaries exacerbate this trade-off. The the third explanation is that financial markets deplete human capital from the real economy, thus reducing the rates of innovation and growth.

A second branch of the literature delves into the long-debated question related to *bank*-based vs. *market*-based financial systems, and the relative advantages and disadvantages that a specific financial structure may have on economic development.[7] From a theoretical point of view, there are different channels through which efficient, liquid and deep capital markets are supposed to promote real economic growth: on the one hand, they allow households and firms to smooth expenditures and share risks intertemporally, potentially increasing the amount saved and hence investments; on the other

[4] The interested reader can look at the excellent overviews of the literature on the finance and growth nexus contained in Levine (2003), Beck (2008), Panizza (2014) and Popov (2017).

[5] In countries with intermediate levels of financial development, the financial system has a large and positive effect on growth. In countries with a high level of financial development, the effect is positive but smaller. In countries with a low level of financial development, however, the financial system is insignificant in fostering economic growth.

[6] There appears to be a certain convergence of the different studies in pointing to a level of banking credit to the private sector of around 90-100% of GDP as the threshold beyond which financial development becomes a drag on growth. Similar evidence for the stock or bond markets is not provided by the existing empirical literature.

[7] It is to be acknowledged, nevertheless, that a neat distinction between *bank*- and *market*-oriented financial systems is extremely difficult to find in practice; the rapid changes in the financial industry in recent decades have further complicated any possible clear-cut distinction between types of financial systems, therefore any distinction only in an approximate way empirically.

hand, by encouraging information acquisition and capital allocation, they can promote growth by spurring technological innovation and improving capital accumulation; last, capital inflows – both foreign direct investment and portfolio investments – are potentially important sources of investment funds for emerging market and transition economies, so that the existence of sound market infrastructures facilitates capital inflows and a country's ability to finance current account deficits. Of course, this positive relationship should not be taken for granted: the rapid growth in financial innovation observed in recent decades has not only made the financial system more complex than it used to be, but also more fragile and susceptible to amplifying economic volatility, as witnessed by the 2008-09 financial crisis. Against this backdrop, although subject to a number of qualifications and countervailing views, most of the empirical evidence suggests that both banks and markets matter for economic growth (Levine, 2003). In fact, that these two independent components of the financial system *individually* shape growth is one of the most remarkable insights from the finance-and-growth literature (Popov, 2017). By contrast, conclusions regarding the role played by the financial structure as a whole (i.e. the mix of markets and intermediaries operating in an economy) in affecting economic development according to the *financial service* view are not as indisputable. Early research concluded that, conditional on the quality of a country's legal, regulatory and general institutional framework, there was no general rule that *bank*-based and *market*-based financial systems were better at fostering growth; what is particularly noteworthy is that this conclusion was reached using both aggregate, sectoral-level and micro-economic evidence (Arestis *et al.*, 2001; Levine, 2002; Demirgüç-Kunt and Maksimovic, 2002; Beck and Levine, 2002 and 2004). However, more recent research – and especially that focusing on the experience of the most recent financial crisis – has provided a reassessment of this view, suggesting that only *capital market* development has a positive effect on growth while *banking* development has an unfavourable one (Shen and Lee, 2006; Langfield and Pagano, 2016). Such evidence can be rationalized in light of another relevant insight from this line of research, i.e. that while both *bank*-based and *market*-based financial systems support economic growth on average, their role varies according to the extent of economic and financial development. In particular, as economies develop, the marginal contribution of *banks* declines, while that of *capital markets* increases, notably because market finance would be better at promoting innovation and productivity and at financing new sources of growth (Tadesse, 2002; Demirgüç-Kunt *et al.*, 2013; Gambacorta *et al.*, 2014; Hsu *et al.*, 2014). It is worth mentioning here that, from a practical point of view, the *market*-based view of the relationship between finance and growth has traditionally been made operational by looking at developments in domestic stock markets, and relying upon variables measuring both the relative size (capitalization) and their liquidity (turnover and/or total value traded). Only recently has attention started to be focused on bond markets as another essential source of external finance;[8] nevertheless, research in this area remains very limited in comparison with that concerning banks and stock markets.

The last strand of studies that is relevant from our point of view is the one that has attempted to uncover both the existence and the magnitude of the finance and growth nexus by means of (macro) time series techniques. The two modern pioneering cross-country studies in the field (Beck *et al.*, 2000a-b), in fact, made use of the dynamic panel GMM estimators put forward by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). As a consequence, these procedures have become the mainstream workhorse for the vast body of literature that has flourished since then. Nevertheless, as it will be made clearer in the section dedicated to the econometric specification, this approach is not free from disadvantages: first of all, the models used to interpret the data are typically models of steady-state growth, and so panel data – which, by definition, are a poor proxy for long-term relationships – may yield an imprecise assessment of the finance and growth link; second, the efficiency

[8] The broad expansion in debt security markets after the global financial crisis can be attributed to the combination of two factors: a steady retrenchment in bank lending and historically low interest rates. Banks were weakened by trading losses and credit provisions during the crisis, as well as being affected by stricter prudential regulation and higher capital requirements in its aftermath. As a result, they trimmed their lending, especially to risky borrowers. In contrast, demand for corporate debt securities expanded considerably in a low interest rate environment, offering NFCs ample alternative financing opportunities.

of employing dynamic panel techniques depends crucially on the availability of a sufficiently long time-span of data; finally, this approach is very sensitive to outliers and small model permutations. Being aware of these weaknesses, many authors have proposed alternative paths based upon time series analysis. Vector auto-regression frameworks, Granger causality tests, error-correction models and co-integration methods (used for both country-by-country and cross-country case studies) have proved to be a valid alternative in order to uncover both the direction of causality between the variables at stake as well as the actual dimension of the long-run relationship (Arestis and Demetriades, 1997; Xu, 2000; Rousseau and Wachtel, 2000; Fink *et al.*, 2003; Christopoulos and Tsionas, 2004; Arestis *et al.*, 2010; Peia and Roszbach, 2015; Pradhan *et al.*, 2014 and 2016; Luintel *et al.*, 2016). Against this backdrop, the two papers more proximate to mine are Loayza and Rancière (2006) and Samargandi *et al.* (2015), both of which also employ the dynamic panel pooled mean group (PMG) estimator developed by Pesaran *et al.* (1999).

3. The empirical model

In this paper, a (macro) time series approach to the estimation of the relationship between financial development and growth will be adopted, contrary to the procedure largely employed in the existing literature, which exploits a traditional GMM in both a cross-section and/or a panel framework with de-trended variables.[9] In particular, it will be assumed that – and tested if – a long-run co-integrating relationship exists between growth, the degree of financial development and other proxies of economic development; next, an error-correction specification of a growth function will be estimated for the available panel of 19 emerging European economies.

Based on Pesaran *et al*. (1999), a dynamic heterogeneous panel regression can be incorporated into an error-correction model using the autoregressive distributed lag ARDL(p,q) technique – where p is the lag of the dependent variable and q the lag of the independent variables – and stated as follows:

$$\Delta growth_{t,i} = \sum_{j=1}^{p-1} \gamma_j^i \Delta growth_{t-j,i} + \sum_{j=0}^{q-1} \delta_j^i \Delta X_{t-j,i} + \varphi^i \left[growth_{t-1,i} - \left(\beta_0^i + \beta_1^i X_{t-1,i} \right) \right] + \varepsilon_{t,i} \qquad (1)$$

$$i=1,2,...,N \qquad t=1,2,...,T$$

where $growth_{t,i}$ stands for the yearly change of real per capita GDP; $X_{t\text{-}j,i}$ is a set of independent variables including the three measures of financial development, i.e. the ratio between the outstanding stock of banking credit to the private sector and GDP; the ratio between the capitalization of domestic stock markets and GDP; and the ratio between the outstanding amount of (international) debt securities and GDP; γ and δ represents the short-run coefficients of lagged dependent and independent variables, respectively; β are the long-run coefficients and φ is the coefficient of the speed of adjustment to the long-run equilibrium. The subscripts i and t denote country and time, respectively. Finally, the term in square brackets contains the long-run growth regression. The error term $\varepsilon_{t,i}$ is assumed to be

[9] In the mainstream literature, the trend is eliminated by *averaging* which, as shown by Loayza and Rancière (2006), is affected by a series of significant limitations: i) *averaging* over fixed-length intervals (typically five years) may not eliminate business-cycle fluctuations; ii) *averaging* implies a loss of useful information; and iii) *averaging* may blur the dynamic relationship between financial intermediation and economic activity.

independently distributed across *t* and *i*, but the variances may be heterogeneous across countries.[10] By an appropriate choice of the *p* and *q* orders, estimation of equation (1) can help to solve the 'reverse causality' issue between growth and the measures of financial development.

4. Data description

The data set consists of an unbalanced panel of 19 countries in Central, Eastern and South-Eastern Europe (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, North Macedonia, Poland, Romania, Russia, Serbia, Slovak Republic, Slovenia, Turkey and Ukraine); the data frequency is yearly and the time frame spans the period from 1995 to 2017.

The dependent variable in all the estimated models is real per capita GDP growth: the original series of updated 2011 PPP levels have been collected from the Total Economy Database of The Conference Board, and growth rates have been calculated as log differences of yearly data.

Against the backdrop of the *bank*- vs. *market*-based perspective, the degree of financial development is measured by three different indicators. The *bank*-based view is operationalized by resorting to the standard ratio between credit to the private sector by domestic deposit money banks and GDP: the series from the World Bank's Financial Structure, Global Financial Development and World Development Indicators databases have been compared and merged together; where necessary, the series have been lengthened back and forward by using the IMF's International Financial Statistics database. As regards the *market*-based view, I take into account two segments of the overall financial system, i.e. the stock and the bond markets. The development of domestic stock markets is measured by the capitalization-to-GDP ratio, widely used in the extant literature: a country-by-country search of local currency-denominated domestic stock market indices has been performed by resorting to both the Datastream and the Bloomberg providers, which have been used to complement the time series provided by the World Bank's Financial Structure, Global Financial Development and World Development Indicators databases. The denominator of the previous two ratios, i.e. the annual series of nominal GDP in local currency, stems from the IMF's World Economic Outlook database. The outstanding amount of debt securities issued by private non-financial corporations on international markets – which are available from the BIS' Debt Securities statistics – represents another useful financing channel for the domestic private sector and can be used as a rough *proxy* for the development of bond markets, on account of both the developments observed in recent years and a problem of country availability.[11] These outstanding amounts have been related to the overall size of an economy by taking into account the ratio to nominal GDP, in current US dollars, provided by the IMF's World Economic Outlook database.

[10] The assumption of the cross-sectional independence of the error term is strong and restrictive, as macro time-series may exhibit a significant degree of cross-correlation between the countries in the panel as a result of the presence of common shocks and unobserved components that ultimately become part of the error term, spatial dependence and so on. One reason for this is given by the ever-increasing degree of economic and financial integration of countries and financial entities that has been observed during the last few decades. This has been accompanied by a dramatic rise in the interdependencies between cross-sectional units. The impact of cross-sectional dependence on dynamic panel estimators may indeed be quite severe: see Baltagi (2005) for a useful discussion of these issues.

[11] Since the global financial crisis, many large corporations around the world have shifted toward bond financing because commercial bank lending has been subdued due to large de-leveraging needs. Annual non-financial corporate bond issuance has increased 2.5 times over the past decade, creating a broader and deeper market in many countries. As a result, the total debt– which includes loans as well – of non-financial corporations has more than doubled, growing by $37 trillion to reach $66 trillion at end-2017, or 92% of global GDP. This growth is nearly equal to the increase in government debt, which has received far more attention. In a departure from the past, a large share of the growth in corporate debt has come from developing countries, and in particular China, which now has one of the highest ratios of corporate debt to GDP in the world.

To limit the risk of incurring into an omitted variable bias, I also include another set of standard determinants of economic growth: i) the investment rate – calculated as the ratio between gross fixed capital formation and GDP – to account for the increase in physical capital available for production purposes as suggested by traditional endogenous growth models; ii) the growth rate of the working age population, to proxy the variation found in both the dimension and quality of the stock of human capital;[12] iii) the degree of openness to trade – calculated as the imports plus exports-to-GDP ratio – to capture the importance of international factors in influencing economic activity; iv) the government expenditure-to-GDP ratio, to capture both the amount of public goods provided by the government and the distortionary effects of public spending and taxation; and v) the period average inflation rate, to measure the degree of macroeconomic stability. The sources of these variables are, again, the IMF's World Economic Outlook for the series of gross fixed capital formation, exports, imports, public expenditure and nominal GDP in current local currencies, the IMF's International Finance Statistics for the series of inflation rates and the Total Economy Database of The Conference Board for the total employment series.

In the Appendix, **Table 1** contains the usual statistics for each of the chosen variables while **Table 2** offers a first glimpse of the likely relationship between the variables involved by reporting a set of unconditional cross-correlations. In the sample of 19 emerging European economies and throughout the whole 1995-2017 time span, real per capita GDP growth turns out to be positively correlated to the openness to international trade, the investment rate and the growth in the number of employees, while negatively related to the share of public consumption to GDP and the inflation rate. More importantly from the perspective of the research question, real per capita GDP growth seems to be negatively correlated with the stock of banking credit to the private sector and positively correlated with both the capitalization of domestic stock markets and the outstanding amount of international debt securities. Of course, these are just *unconditional* correlations, which may or may not be confirmed by the conditional counterparts stemming from the econometric procedures employed in the following sections.

As a final remark, for estimation purposes all three indicators measuring financial market development and the other potential determinants of economic growth have been transformed into log-levels, such that the estimated coefficients could be genuinely interpreted as (semi-) elasticities of economic growth to changes of the right-hand side regressors.

5. Estimation results

Eq. (1) represents the starting point to carry out the estimation of the long-run relationship between real per capita GDP growth and financial development. In the equation, γ and δ are the parameters associated with the differenced terms and are supposed to measure the short-run dynamics; φ is the coefficient that accounts for the speed of adjustment towards the long-run equilibrium when a shock drives the economy away from it; the β's are the elements of the co-integrating vector, i.e. of the long-run equilibrium relationship between growth and its determinants which acts as a forcing equilibrium condition.

Pesaran and Shin (1999) show that panel ARDL(p,q) models can yield consistent and efficient estimates of the parameters in a long-run relationship and that inference on them can be conducted using standard tests. Furthermore, these methods avoid the need for pre-testing the order-of-integration conformability, given that they can be used even with variables with different orders of integration and irrespective of whether they are I(0) or I(1) or a mixture of the two. The main requirements for the validity of this methodology are that, first, there exists a long-run relationship among the variables of interest and, second, the dynamic specification of the model be sufficiently augmented to make the regressors strictly exogenous and the resulting residual serially uncorrelated.

[12] In fact, any attempt to include education (specifically, secondary school enrolment), as is customary in the extant literature based on the *averaging* approach, resulted in too many missing observations.

Finally, both short-run and long-run effects can be estimated simultaneously from a data set with a (relatively) large N – large T dimension.

In a panel setting like this, there are a number of alternative methods for multi-country estimation depending on the degree of parameter heterogeneity across countries.

At one extreme, country-specific effects can be controlled for by using a dynamic fixed-effect (DFE) specification. This procedure imposes homogeneity of all slope coefficients and error variances in the long-run, allowing only the intercept to vary across countries, and restricts the speed-of-adjustment coefficient and the short-run coefficient to be equal. Denoting with k the number of long-run parameters, DFE imposes $(N-1)*(2k+2)$ restrictions (including the short-run dynamics) on the restricted model in Eq. (1), i.e. k long-run coefficients, k short-run coefficients plus the convergence coefficient and the common variance. In a small N – large T regime – as is the case for most macro panel datasets – DFE estimation procedures, like the GMM, are likely to provide spurious results for two reasons: first, small N might lead to unreliable autocorrelation tests;[13] second, as the time span of the data gets larger, the number of instruments gets larger, distorting the Sargan test of over-identifying restrictions. Moreover, the GMM procedure is able to capture only the short-run dynamics while the stationarity of the variables tends to be ignored because these models are mostly restricted to short-time series. Thus, it is not clear whether the estimated panel models represent a structural long-run equilibrium relationship or a spurious one (Christopoulos and Tsionas, 2004). Finally, Pesaran and Smith (1995) show that, under slope heterogeneity, both LSDV- and GMM-DFE estimators of the speed of convergence are affected by a downward heterogeneity bias.

An alternative strategy would be to adopt a mean group (MG) estimator, which consists of estimating separate regressions for each country and calculating (unweighted) averages of the individual country-specific coefficients (Pesaran and Smith, 1995). This procedure does not impose any restriction at all, allowing coefficients to be heterogeneous in both the long- and the short-run. However, the necessary condition for the validity of this procedure is to have a sufficiently large dimension of the data: albeit consistent, in fact, the estimators are likely to be inefficient in relatively small T – small N samples. Moreover, for small N, any outlier or small model permutations could severely influence the averages of country coefficients (Favara, 2003).

An intermediate approach is the PMG estimator (Pesaran *et al*., 1999), which allows the intercepts, the speed of adjustment, the short-run coefficients and error variances to differ across countries, while imposing that long-run parameters be identical across groups (i.e. the 'long-run homogeneity' assumption termed by the authors). This is particularly useful when the long-run equilibrium relationship between the variables is similar across countries or, at least, a sub-set of them are. At the same time, the short-run adjustment is allowed to be country-specific; in other words, only $(N-1)*k$ restrictions will be imposed on Eq. (1) of the type $\beta_{.,i}=\beta$ for every i.

The PMG estimation technique is based on the following steps: first the long-run slope coefficients are jointly estimated across countries through a (concentrated) maximum likelihood procedure, which has been shown to be asymptotically normal for the case of both stationary and non-stationary regressors; the short-run coefficients (including the speed of adjustment φ_i), and country-specific error variances are estimated on a country-by-country basis, through maximum likelihood and using the estimates of the long-run slope coefficients previously obtained.

The choice between the MG and the PMG estimators involves a general trade-off between consistency and efficiency. The MG estimators are more efficient than the PMG ones if the cross-country restrictions are valid; if they are not, they would lead to downward biased estimates of the speed of adjustment (Pesaran and Smith, 1995). When the long-run homogeneity restrictions are indeed true, the PMG procedure would yield consistent and efficient estimates (Pesaran *et al.*, 1999); if the true

[13] The test of the (AR) by Arellano–Bond is based on the assumption that there is no second-order serial correlation in the residuals of the first difference equation.

model is heterogeneous and the long-run coefficients are not equal across countries, the PMG estimates would be inconsistent, whereas the MG estimator would still provide a consistent estimate of the mean of long-run coefficients across countries.

The long-run homogeneity restrictions can be tested for by means of a Hausman test (Hausman, 1978): under the null, the difference in the estimated coefficients between the unrestricted (consistent) MG and the restricted (efficient) PMG specification is not significantly different from zero. In this case, the PMG estimator is recommended; in the opposite case, the MG estimator would be more appropriate.

5.1 Unit root tests

A traditional series of tests were performed to check whether or not the variables under study contain zero frequency unit roots in their data generating process. In the literature, it is widely acknowledged that panel unit root tests have higher power than counterparts based on individual time series. A complete battery of tests was carried out, with different model specifications. On the one hand, the Levin *et al*. (2002) and the Hadri (2000) tests assume that there is a common unit root process, with the former employing a null of a unit root and the latter a null of *no* unit root. On the other hand, the Im *et al*. (2003) and the Fisher-type tests based upon the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests (Maddala and Wu, 1999; Choi, 2001) allow for individual unit root processes which are combined, in different ways, to derive a panel-specific result in order to assess, again, the null hypothesis of a unit root in the panel.[14]

The outcomes of such a battery of first generation panel unit root tests for our variables of interest are reported in **Table 3**. The growth rates of both real per capita GDP and employment, on the one hand, and the public consumption-to-GDP ratio and the inflation rate on the other, appear to be stationary I(0) variables. On the contrary, the hypothesis of a unit root cannot be rejected for the three indicators of: i) the degree of financial development; ii) the openness to trade; and iii) the investment rate.[15]

Overall, the mixed order of integration of the different variables confirms the appropriateness of the econometric procedure hereby implemented to study the long-run relationship between finance and growth, and it establishes that none of the variables are I(2).

5.2 Co-integration tests

The existence of a long-run co-integrating relationship among real per capita GDP growth, financial development and the set of other potential determinants of economic growth is a necessary condition for the validity of the ARDL (*p*,*q*) modelling approach implicit in the PMG estimator. The existence of co-integration will be verified first for a model where the three measures of financial development are used individually (according to a *bank*- vs. *market*-based view) and then jointly together (according to the *financial service* perspective).

Like the panel unit root counterparts, panel co-integration tests have also been motivated by the search for more powerful procedures than those obtained by applying individual time-series co-integration tests. While the latter, in fact, are known to have low power especially for short *T*, panel co-integration tests are noteworthy because they can be implemented with much shorter time spans of data, thus improving upon the small sample limitations of conventional non-stationary methods (Pedroni, 2001).

[14] These are all standard tests and all the technical details are skipped for the sake of exposition; the interested reader can refer to the references above for additional explanations and a much more rigorous treatment.

[15] The same tests applied to the first differences clearly show that they are I(0): results are not reported here for the sake of brevity, but are available from the author upon request.

Mirroring standard univariate time series techniques, there are different ways of testing the null hypothesis of no co-integration in a panel setting. Typically, these testing procedures are grouped into two broad families, the residual-based and the likelihood-based ones: the former, based on Engle and Granger (1987), use residuals of the panel static regression to construct the test statistics and to tabulate the relative distributions; the latter represent generalization in the panel setting of Johansen (1991, 1995, 1996) for vector auto-regressive models.

Within the residual-based family, Kao (1999) studied a family of DF and ADF tests for the null of no co-integration, and derived their limiting distributions when applied to spurious regressions in a panel setting under the rather strong hypothesis of homogeneous co-integrating vectors between the sample units, i.e. not allowing for coefficient heterogeneity. Kao showed that, after appropriate normalizations, these test statistics converge, by sequential limit theory, to random variables with normal distributions.[16] Kao's approach requires first to estimate the presumed long-run relationship by pooled OLS, obtain the residuals and finally implement a (normalized) pooled DF (or ADF) regression on these residuals; the test statistics, moreover, may contain nuisance parameters to account for possible weak exogeneity in the regressors and serial correlation in the residuals. **Table 4** displays the results for five test statistics of the Kao family – the DF_ρ, the DF_t, the DFT_ρ^*, the DFT_t^* and the ADF – [17] which clearly suggest the rejection of the null of no co-integration for all four specifications under consideration.

The validity of these results is confirmed even when I allow some coefficient heterogeneity, as suggested by Pedroni (1999, 2001, 2004): **Table 5** contains the value of his seven traditional test statistics, which provides further support to the existence of a co-integrating relationship among the variables at stake.

5.3 The estimated finance and growth nexus

Since OLS estimators are super-consistent in case of co-integrated variables, I compute static fixed-effects for the whole sample of countries, along with the usual battery of unit root tests on the residuals of the estimated equations (**Table 6**). The point estimates of the (semi-) elasticities of economic development to changes in the three measures of financial development are statistically significant using robust standard errors. While a further increase in the capitalization of domestic stock markets or in the outstanding amount of international bonds issued by the private sector is associated with a positive impact on growth, the opposite holds true for private sector credit, which instead appears to *detract* from growth. As regards the other potential determinants of real per capita GDP growth, signs and significance are always in line with the extant empirical literature.

However, traditional standard static panel models present serious shortcomings: i) they are based on strong homogeneity assumptions (fixed-effects models impose a single slope coefficient in the pooled estimation); ii) the parameter estimates are biased when some regressors are endogenous and correlated with the error term (Campos and Kinoshita, 2008); and iii) static panel estimators do not exploit the panel dimension of the data by distinguishing between the short- and the long-run relationship (Loayza and Rancière, 2006). In other words, the assumptions underlying static panel techniques appear to be too stringent in the case under study; specifically, when the time dimension increases, potential country heterogeneity may be modelled in a richer way than using simple fixed (or even random) effects models. This is done below by applying the PMG estimator, with the results shown in **Table 7**.

For the consistency and efficiency of the PMG estimates some conditions need to be satisfied, like regressors' exogeneity, absence of residual serial correlation, dynamic stability and homogeneity of the

[16] Gutierrez (2003) shows that, in homogeneous panels, Kao's tests are more powerful than other residual-based panel co-integration tests when the time dimension of the panel is relatively small, as in this setting.

[17] The starred test statistics contain nuisance parameters to account for the previous two problems.

long-run parameters across countries. The first two conditions may be addressed with a proper specification of the dynamic structure of Eq. (3); given the small amount of time-series observations, an *ex-ante* decision to include a maximum of two lags was needed so as to preserve a sufficient number of degrees of freedom; then, the actual dimension of the ARDL (p,q) model – common for all the countries in the sample though different across model specifications – is chosen by applying a classic Schwartz-Bayesian Criterion. The condition of dynamic stability (i.e. the existence of a long-run relationship) requires that the coefficient on the error-correction term be negative and within the unit circle, which are both satisfied (see the middle panel of Table 7).[18] Following Pesaran *et al*. (1999), a statistical test of the last condition requires us to compare two sets of coefficient estimates – obtained with the PMG and the MG procedures, respectively – by means of a traditional Hausman test, where the null implies that the difference in the estimated coefficients between the unrestricted (consistent) MG and the restricted (efficient) PMG specification be not significantly different from zero. The results reported in the lower part of Table 7 show that the hypothesis of long-term parameter homogeneity cannot be rejected and that the PMG estimator is indeed more appropriate for the data at hand.[19]

From the point of view of the main research question, the PMG procedure confirms the existence of a differential impact stemming from the three different segments of the financial system. In the long-run, in line with the *market*-based view, real per capita GDP growth is positively and significantly related to the two indicators used to proxy the development of the stock and the (international) bond markets. On the other hand, contrary to the prevailing results of the *bank*-based view, when the degree of financial development is proxied by the outstanding stock of bank credit to the private sector, the estimated relationship turns out to be negative; this would suggest that, on average *during* the 1995-2017 time span, the domestic banking sector in the selected emerging European economies may have reached a size such that its impact on growth is negative. These results maintain their validity even when the three measures of financial development are included together in the estimation procedure, according to the *financial service* view.[20] From an economic point of view, the interpretation of these estimates is that if bank credit to the private sector (or the level of stock market capitalization, or the outstanding amount of international debt securities) changes by 0.01 (i.e. the ratio changes by 1%), then the percentage change in the real per capita GDP growth is –0.04% (+0.005 or +0.003%, respectively). In other terms, an increase in the capitalization of stock markets from the 25th percentile of the distribution (6.0%) to the relative median (12.6%) is predicted to increase economic growth by 0.6 percentage points; similarly, if the ratio of outstanding international bonds to GDP increases from 4.7% to 7.5%, the per capita GDP growth rate increases by 0.2 percentage points. On the basis of these numbers, if Turkey had maintained its bank credit-to-GDP ratio more in line with the median of the whole distribution (37.0%) instead of allowing it to increase to its most recent value (66.5%), Turkish real per capita GDP growth would have been almost 2.0 percentage points higher.

As regards the control variables, the PMG procedure leads to standard results from the empirical growth literature. For instance, the openness to international trade has a positive and significant impact on economic growth in the long-run: this result is consistent with several theoretical predictions and empirical findings in the literature (Dollar, 1992; Frankel and Romer, 1999; Dollar and Kraay, 2003), and is a reflection of the favourable effects of policies encouraging trade liberalization and globalization pursued by the majority of the sample countries, as well as issues linking trade with technology

[18] The adjustment coefficients reported in the table are calculated as country unweighted averages, which are allowed to be heterogeneous by the PMG procedure. The individual countries' estimated adjustment coefficients are available upon request.

[19] The MG coefficient estimates are available upon request.

[20] These conclusions are consistent with those reported in other empirical studies that focus only on the stock markets (Rousseau and Wachtel, 2000; Caporale *et al*., 2004; Cooray, 2010), only on the bond markets (Fink et al., 2003; Ali Abbas and Christensen, 2010; Pradhan *et al*., 2016) and on a combination of them together with the banking sector (Arestis *et al*., 2001; Levine, 2002; Shen and Lee, 2006; Demirgüç-Kunt *et al*., 2013; Thumrongvit *et al*., 2013; Peia and Roszbach, 2015).

transfers, institutional quality and geographical factors. In the short-run, trade again has a positive impact on growth, although it turns out not to be statistically significant. In all the models, government expenditure negatively and significantly affects economic growth in both the long- and the short-run: this can happen because government consumption usually has distortionary effects, as it translates into present and/or future tax burden on citizens which, in turn, lowers private spending and investment (Barro, 1974, 1991). In line with much of the literature, the long-run impact of fixed capital formation and employment growth are found to be positive and significant in the regression representing the *financial service* view (i.e. the preferred one); at the same time, the inflation rate – traditionally used as a proxy for macroeconomic stability – dampens economic growth.

5.4 Is there evidence of a non-linear relationship between financial development and growth?

The results seem to be consistent with the relatively recent strand of literature which has argued that, in many countries, there is an issue of "too much finance", as suggested by Arcand *et al.* (2015). In order to check whether this is the case for the 19 emerging European economies examined here, different approaches to modelling non-linearity can be implemented, such as those using polynomials (i.e. adding squares) and threshold models.

The traditional polynomial approach proposed in the empirical literature (Cecchetti and Kharroubi, 2012; Beck *et al.*, 2014; Samargandi *et al.*, 2015; Arcand *et al.*, 2015; Cournède and Denk, 2015) consists in replacing the log-level of the three measures of financial development with their levels and its squares. The PMG estimates of the new model are shown in **Table 8**.[21] As far as bank credit to the private sector is concerned – and independently from the particular econometric technique actually implemented – [22] both the level of this variable and its squares are statistically significant, while their signs indicate an inverse U-shaped relationship with real per capita GDP growth. In particular, the negative contribution of financial development to growth appears when the stock of credit to the private sector reaches a ratio to GDP of 33.5%,[23] a relatively low value corresponding to the median of the sample distribution. The same inverse U-shaped relationship also applies to the stock market capitalization: in this case, the preferred PMG procedure suggests that the negative contribution appears when it reaches a ratio to GDP of almost 26.0% on average, well above the 75th percentile of the sample distribution (almost 21% of the observations display values larger than this threshold). Lastly, in the case of the outstanding amount of international debt securities, the PMG estimates would point to a U-shaped relationship, according to which the capitalization of international bond markets would start having a positive impact on growth when it reaches a share of GDP proximate to 18%, slightly above the 75th percentile of the sample distribution (almost 16% of the observations shows values larger than this threshold).

The results contained in Table 8 show that, when financial development is measured by the stock of bank credit to the private sector or the capitalization of domestic stock markets, the (conditional) correlation between financial development and economic growth is positive and statistically significant when financial depth is low, and negative and statistically significant when financial depth is high; the opposite holds true for the capitalization of international bond markets. Nevertheless, as pointed out in Arcand *et al.* (2015), these are necessary but not sufficient conditions for the presence of a non-monotonic relationship between financial development and growth.

Given a model of the general form

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[21] For the sake of simplicity, only models with a single measure of financial development are considered.

[22] In this particular case, the results of the Hausman test, in fact, lead us to favour the MG rather than the PMG results, even though the final estimated coefficients are almost identical.

[23] This share is easily calculated by making the first derivative equal to zero in relation to the creditto-the-private-sector variable of the estimated equation reported in column 1.

$$growth_{t,i} = \alpha FD_{t,i} + \beta FD_{t,i}^2 + \gamma Z_{t,i} + u_{t,i} \qquad (5)$$

– where $growth_{t,i}$ stands for the real per capita GDP growth, subscript i = 1,…,N indexes the country and t = 1,…,T the time, $FD_{t,i}$ represents each of the three different measures of financial development and $Z_{t,i}$ an m-dimensional vector of other explanatory variables – Lind and Mehlum (2010) point out that conventional econometric models are not suitable for testing the composite null hypothesis that, at the left side of the interval, the relationship is decreasing while at the right side, it is increasing, or *vice versa*. Rather, a test for the presence of an inverted-U relationship needs to be based on the following joint null hypotheses:

$$H_0: (\alpha + 2\beta FD_{min} \leq 0) \text{ and/or } (\alpha + 2\beta FD_{max} \geq 0) \qquad (6)$$

against the alternative:

$$H_1: (\alpha + 2\beta FD_{min} > 0) \text{ and } (\alpha + 2\beta FD_{max} < 0) \qquad (7)$$

where FD_{min} and FD_{max} are the minimum and maximum values of the particular indicator of financial development. If the null hypothesis is rejected, the existence of an inverted U-shaped relationship would be confirmed. Lind and Mehlum (2010) use Sasabuchi's (1980) likelihood ratio approach to build a test for the joint hypotheses given by the previous set of equations.

The first column of **Table 9** reports the results of the Sasabuchi–Lind–Mehlum (SLM) test based on the results of column 2 of Table 8. The top panel of the table shows that the marginal effect of bank credit to the private sector on economic development is positive and statistically significant at FD_{min} and negative and statistically significant at FD_{max}. The bottom panel of the table shows that the SLM test rejects H_0 and, thus, the results are consistent with the presence of an inverted−U relationship between this measure of financial development and real GDP per capita growth. This is not true for the capitalization of both the stock and the international bond markets: the SLM test statistic (second and third columns of Table 9), in fact, does not reject the null of a more traditional (positive) monotonic finance and growth nexus.

As an alternative approach to test for non-linearities in the finance-growth nexus I resort to the panel threshold estimator originally proposed by Hansen (1999, 2000) in a static context, and subsequently modified by Bick (2010) and Kremer *et al*. (2013) to account for some dynamic characteristics. Law and Singh (2014) observe that the squared term of the financial development variables implies that the effect of finance on growth is monotonically and symmetrically increasing/decreasing with the level of financial development. However, it may also be the case that a certain level of financial development has to be attained before triggering any change in the sign of the relative impact on growth. Regression models based on the concept of a threshold effect allow us to investigate the potential existence of such a discrete shift in a dynamic framework: the fitted model allows the finance-growth relationship to be piecewise-linear, with the levels of financial development indicators acting as a regime-switching trigger.

Accordingly, the structural equation of interest with one potential threshold, γ, is given by

$$growth_{t,i} = \mu_i + \beta_1 FD_{t,i} I(FD_{t,i} \leq \gamma) + \delta_1 I(FD_{t,i} \leq \gamma) + \beta_2 FD_{t,i} I(FD_{t,i} > \gamma) + \theta Z_{t,i} + \varepsilon_{t,i} \qquad (8)$$

where subscript i = 1,…,N indexes the country and t = 1,…,T represents the time; μ_i stands for the country specific fixed effects; $FD_{i,t}$ represents each of the three different measures of financial development, in log-levels; $I(.)$ is an indicator function which classifies the observations into two regimes depending on the threshold γ; δ_1 is the regime intercept, which is the same for all countries; and $Z_{i,t}$ is an m-dimensional vector of explanatory variables, including the lag of real per capita GDP growth rate and the remaining control variables (at time t).

The estimates of (8) are reported in **Table 10**. When financial development is measured by the stock of bank credit to the private sector, the estimated coefficients β_1 and β_2 have different signs above and below the threshold level: below the threshold, the estimated β_1 is positive and significant while, above the threshold, β_2 is negative and significant. This confirms that an increase in credit to the private sector below the threshold value has a positive effect on growth, whereas it becomes negative beyond the threshold. The results obtained for the capitalization of stock and the (international) bond markets are also consistent with those obtained by means of the SLM procedure).

The estimated threshold value after which the credit to the private sector starts to have a negative impact on growth is now estimated at around 60.0% of GDP,[24] which is lower than the 100% edge contained in seminal papers on non-linearities in the finance and growth nexus (Cecchetti and Kharroubi, 2012; Arcand *et al*. 2015).[25] Approximately 11.4% of the sample observations are above this threshold; however, by end-2017 only Estonia and Turkey exceeded it. In the former, notwithstanding the substantial private sector de-leveraging observed after the global financial crisis, the stock of bank credit to the private sector is still above the level that would be considered as healthy and conducive to growth; in the latter, notwithstanding the recent deceleration, bank credit growth is still running much faster than real GDP growth, with country reports by international financial institutions pointing to persistently high corporate debt as an important drag on investment and, therefore, on growth going forward (IMF, 2018).[26]

6. Robustness tests

An extensive series of robustness checks is computed to explore the sensitivity of the PMG estimates to alternative specifications. These tests can be divided into two main categories: on the one hand, alternative estimation methodologies are computed; on the other hand, both the set of countries and the variables included in the growth equation are modified.

The original models are estimated by means of the FMOLS estimator introduced by Pedroni (1999, 2001), which allow consistent and efficient estimation of co-integrating vectors by modifying the traditional OLS coefficients to account for endogeneity and serial correlation in the regressors. **Table 11** shows the results of the 'between-dimension' FMOLS estimator – i.e. the mean of the country-specific parameters – which tend to confirm the PMG estimates.

The PMG estimates are then computed by introducing alternative measures of financial development, such as: i) the ratio of liquid liabilities of the financial system to GDP (King and Levine, 1993); and ii) the outstanding amount of (both domestic and international) debt securities issued by the public sector (as in Pradhan *et al.*, 2016). Moreover, I also tried to change the composition of the sample of countries under analysis, removing Russia, Kazakhstan and Turkey: in the first two cases, one could argue that economic (but also financial) developments are strictly interrelated with the dynamics of oil prices, while Turkey may have followed quite different paths of economic and financial development from those of other countries in the sample. Estimation results related to these new settings (**Table 12** and **Table 13**, respectively) tend to confirm the overall conclusions reached thus far

[24] Since variables are measured in log-levels, this share has been simply calculated as exp(-0.512)*100.

[25] It is to be acknowledged, nevertheless, that the same 100% threshold does not represent a peaceful result. In a robustness test for their results based upon the exclusion of those countries with a very large financial sector (in particular, six economies that at any point in time had a level of credit to the private sector greater than 165% of GDP), the same Arcand *et al*. (2015) find a threshold of 69% of GDP above which the marginal effect of credit to the private sector becomes negative. Moreover, according to the analysis conducted in Karagiannis and Kvedaras (2016, p. 6) "*credit provided by banks has a non-linear effect on growth and, given the actual financing structure, the peak of positive impact (the turning point) is closer to 50% of GDP*".

[26] The underlying causes of the non-linear relationship between banking credit to the private sector and growth are discussed in Hung (2009), Philippon (2010); Bolton *et al*. (2011); Cecchetti and Kharroubi (2012); Beck *et al*. (2014).

about the different relevance that the development of the three segments of the financial system has for economic growth.[27]

A last check is intended to address the possibility that the results could be distorted by a common factor that may be driving output dynamics in all the countries in the sample and that may also be correlated with some of the indicators of financial development. In particular, since our sample includes the 2008-09 global financial crisis and the 2011-12 euro-area sovereign debt crisis it is conceivable that the econometric results may be driven by the large effects they had on the trajectory of (both global and regional) economic growth. As argued in Gambacorta *et al*. (2014), the impact of severe crises on GDP appears to have been three times as severe for bank-oriented economies (such as those in emerging Europe) as compared with more market-oriented ones. In order to address this concern, I ran again all the estimations related to the bank-based view of the finance and growth nexus after adding, as a further explanatory variable, the real GDP growth rate of the euro area to capture a possible unobserved common factor which might otherwise have become part of the error term and created a cross-correlation among the residuals. As is clear from the first column of **Table 14,** the euro area growth trajectory appears to be a significant predictor of the trajectories of the individual emerging European countries, but without altering the relationship between financial development and growth as shown above.

7. Concluding remarks and policy implications

In this work, I estimate the impact that changes in certain indicators of financial development have on economic growth in a sample of 19 countries in emerging Europe. Per capita GDP growth, the stock of banking credit to the private sector, the capitalization of domestic stock markets and the outstanding amount of international debt securities – along with a series of other determinants of economic growth – are found to be clearly co-integrated. Thanks to some recent econometric techniques for heterogeneous panels, inference is drawn about the long- and short-run relationship between the variables of interest.

The main result of the analysis suggests the existence of a "too much credit" issue. In fact, the results obtained when imposing a linear relationship show that bank credit to the private sector and economic growth are negatively associated in the long run in the available sample of countries. The possible existence of a non-monotonic impact of the former on the latter has been further explored by means of two different methodologies, a quadratic polynomial and a dynamic threshold model. The findings demonstrate that bank credit to the private sector and economic growth are not linearly related but show evidence of an inverted U-shaped relationship, with the threshold found around a share of 60.0% of GDP. At the same time, combining the results of the long-run co-integrated relationship with the tests for non-linearity, the capitalization of domestic stock and bond markets turns out to have a positive and monotonic relationship with real per capita GDP growth, in line with the *market*-based view of the finance and growth nexus.

Overall, further financial development along these two paths appears able to bring net benefits to the region by stimulating economic growth without jeopardizing macroeconomic and financial stability. These results, therefore, would provide support to the calls to further develop domestic capital markets, which still appear significantly below the levels consistent with the countries' macroeconomic fundamentals (Adarov and Tchaidze, 2011). Economies characterized by still underdeveloped stock and/or bond markets could benefit from a stronger macroeconomic environment, sounder institutional and legal frameworks able to promote investor rights, market-friendly debt management and issuance strategies and, more generally, policies with the aim of increasing market size. Such a process, of course,

[27] All the possible combinations between the old and new variables have been re-estimated by means of the OLS, the PMG and the FMOLS procedures, leading to almost the same conclusions. The results are not presented here for the sake of brevity, but are available upon request.

is likely to be only gradual, since when financial development proceeds too fast it can lead to economic and financial instability, especially where regulation and supervision do not keep pace (Loayza and Rancière, 2006; Demetriades and Rousseau, 2016). Hence, developing regulation and supervision that are consistent with the existing level of financial development and that embed enough flexibility to address future challenges in financial deepening would represent an important safeguard. Moreover, the sequencing of reforms could also be important: care should be taken not to promote excessive market development when domestic financial institutions are still underdeveloped, since this may put at risk the same beneficial effects that are expected from a further increase in financial deepening.

The analysis contained in this paper has no presumption to be complete. First of all, financial development is a complex multidimensional process, while many of its different facets are not explicitly taken into account: for instance, the concepts of depth (size and liquidity of markets), access (ability of individuals to access financial services) and efficiency (ability of institutions to provide financial services at low cost and with sustainable revenues, and the level of activity of capital markets) put forward by Sahay *et al*. (2015), Almarzoqi *et al.* (2015) and Svirydzenka (2016). Second, the paper is silent about the actual reasons behind the observed downward concave relationship between banking credit to the private sector and economic growth, as well as about the actual channels through which a further development of domestic stock or bond markets may be conducive to higher growth, be it total factor productivity rather than capital accumulation or innovation or higher savings, along the lines suggested by Madsen and Ang (2016). All these aspects are left for future research.

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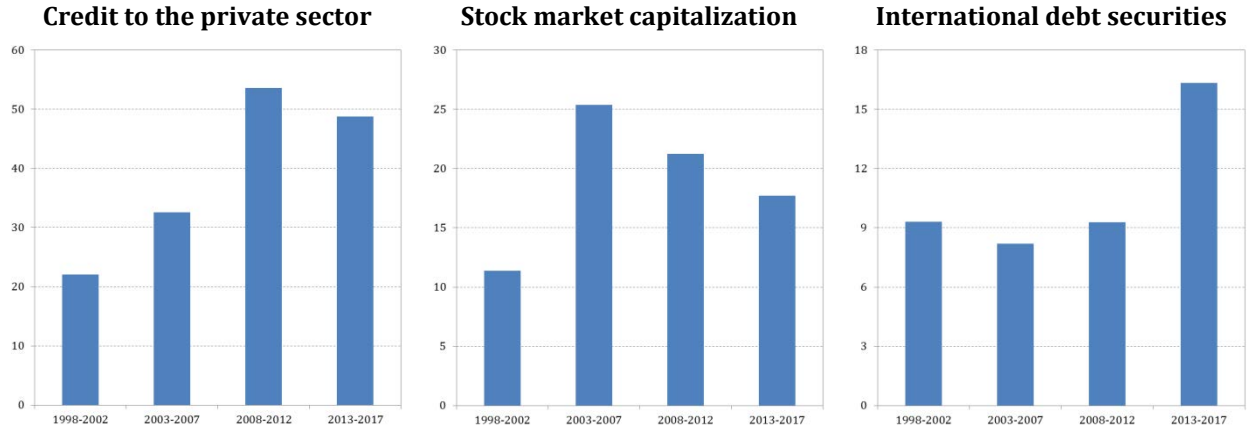
Appendix. Charts and Tables

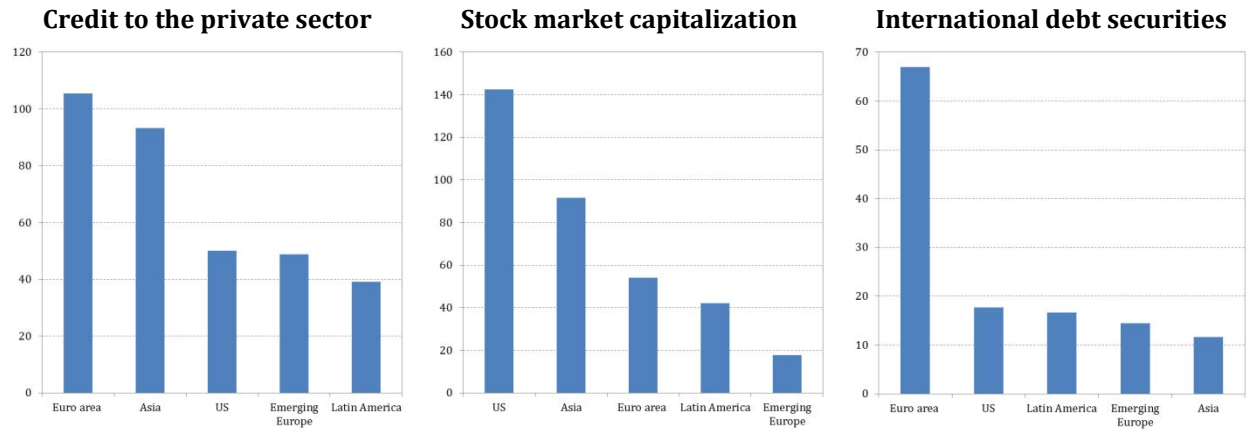
Chart 1. Selected measures of financial market development



Note: The panels report the cross-country five-year average of the selected financial market indicators, each expressed as a percentage of nominal GDP.

Sources: IMF – International Financial Statistics; BIS debt securities statistics; Bloomberg; Datastream; WB-Financial Structure database.

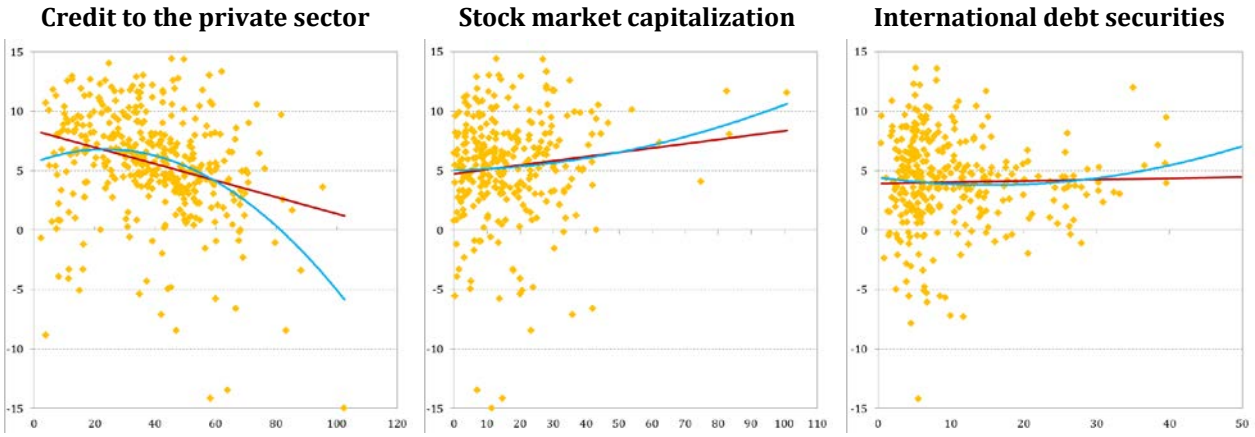
Chart 2. Comparison of the 2012-2017 average levels of selected measures of financial market development



Note: The panels report the 2012-2017 averages of the selected financial market indicators, each expressed as a percentage of nominal GDP, for the US and the other four regional aggregates; 'Asia' includes the following countries: China, Korea, India, Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam; 'Latin America' includes the following countries: Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay and Venezuela; 'Euro area'refers to its initial 11-country composition.

Sources: IMF – International Financial Statistics; BIS debt securities statistics; Bloomberg; Datastream; WB-Financial Structure database.

Chart 3. Sample relationship between growth and financial development indicators



Note: The sample real per capita GDP growth rates are reported, in percentages, on the vertical axis; the horizontal axis shows the stock of private sector credit, the capitalization of domestic stock markets and the outstanding amount of international debt securities, each as a percentage of nominal GDP.

Sources: IMF – International Financial Statistics; BIS debt securities statistics; Bloomberg; Datastream; WB-Financial Structure database.

Table 1. Descriptive statistics

	Obs.	Mean	Std. Dev.	Min	Max
Employment growth	437	0.11	2.88	-14.35	10.47
Public consumption	468	18.53	5.92	4.34	49.72
Investment rate	445	22.87	5.66	8.21	42.97
Openness to trade	468	93.41	37.22	24.40	216.34
Credit to the private sector	465	37.56	19.15	0.92	102.53
Stock market capitalization	345	16.20	14.17	0.03	100.83
International debt securities	400	10.69	8.94	0.26	54.51
Inflation rate	470	13.31	55.21	-11.72	1,058.37
Real GDP per capita growth	437	3.69	5.12	-17.72	53.66

Table 2. Cross-correlations

	Employment growth	Public consumption	Investment rate	Openness to trade	Credit to the private sector	Stock market capitalization	International debt securities	Inflation rate	Real GDP per capita growth
Employment growth	1								
Public consumption	-0.22	1							
Investment rate	0.23	-0.32	1						
Openness to trade	0.11	-0.23	0.20	1					
Credit to the private sector	-0.01	-0.22	0.45	0.47	1				
Stock market capitalization	0.11	-0.09	0.20	-0.14	0.22	1			
International debt securities	0.04	-0.23	-0.31	0.34	0.14	-0.06	1		
Inflation rate	-0.07	0.09	-0.26	-0.17	-0.20	-0.11	0.21	1	
Real GDP per capita growth	0.48	-0.07	0.14	0.01	**-0.28**	**0.08**	**0.02**	-0.10	1

Table 3. Panel unit root tests

Variable	Levin-Lin-Chu	Im-Pesaran-Shin	ADF Fisher χ^2	ADF Choi Z-statistic	Hadri
Employment growth	-9.93	-10.65	185.47	178.71	-0.02
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.51)*
Public consumption	-3.34	-2.94	79.86	83.48	10.02
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
Investment rate	-1.01	-0.86	39.46	53.83	6.74
	(0.16)	*(0.20)*	*(0.58)*	*(0.10)*	*(0.00)*
Openness to trade	1.24	4.88	15.80	22.04	13.89
	(0.89)	*(1.00)*	*(1.00)*	*(1.00)*	*(0.00)*
Credit to the private sector	-1.78	0.28	34.95	31.10	8.23
	(0.04)	*(0.61)*	*(0.77)*	*(0.89)*	*(0.00)*
Stock market capitalization	-1.92	-0.88	35.18	38.16	4.69
	(0.03)	*(0.19)*	*(0.32)*	*(0.21)*	*(0.00)*
International debt securities	1.61	2.75	25.02	21.80	7.79
	(0.95)	*(1.00)*	*(0.95)*	*(0.98)*	*(0.00)*
Inflation rate	-136.14	-169.66	505.77	497.27	6.64
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
Real GDP per capita growth	-8.84	-8.62	148.36	146.54	1.19
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.12)*

Note: All *p*-values (in parenthesis) are reported such that Ho is rejected if *p*-value<0.05; models include an intercept.

Table 4. Kao's co-integration tests

	Model (1)	Model (2)	Model (3)	Model (4)
		DF statistic		
DF_ρ	-16.98	-13.31	-9.99	-12.16
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
DF_t	-12.63	-11.47	-12.05	-12.61
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
DF_ρ*	0.26	-0.09	1.47	-0.11
	(0.40)	*(0.46)*	*(0.07)*	*(0.46)*
DF_t*	-3.18	-4.01	-3.46	-5.37
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
		ADF statistic		
1 lag	-5.55	-5.29	-4.39	-6.89
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*

Table 5. Pedroni's co-integration tests

	Model (1)	Model (2)	Model (3)	Model (4)
Panel v	1.16	0.26	11.71	-2.74
	(0.12)	*(0.40)*	*(0.00)*	*(0.00)*
Panel ρ	-5.13	0.28	-3.97	-0.70
	(0.00)	*(0.39)*	*(0.00)*	*(0.24)*
Panel PP	-8.79	-6.93	-7.56	-10.10
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
Panel ADF	-9.40	-7.63	-7.32	-9.63
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
Group ρ	-4.19	-0.26	-3.01	0.62
	(0.00)	*(0.40)*	*(0.00)*	*(0.27)*
Group PP	-9.88	-9.34	-9.12	-11.10
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
Group ADF	-10.52	-8.74	-8.97	-12.58
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*

Note: The null hypothesis (Ho) is the estimated equation and is not co-integrated; models (1) to (3) take into account one indicator of financial development at a time (in order: credit to the private sector, stock market capitalization, bond market capitalization) together with all the other five determinants of real GDP per capita growth, while model (4) takes into account all the eight variables together; all models include an intercept; all *p*-values (in parenthesis) are reported such that Ho is rejected if *p*-value<0.05.

Table 6. Preliminary evidence based on static fixed effects

	Model (1)	Model (2)	Model (3)	Model (4)
Constant	-0.006	-0.046	0.183	0.098
	(0.046)	*(0.061)*	*(0.060)****	*(0.055)**
Credit to the private sector	-0.043			-0.030
	*(0.015)****			*(0.014)***
Stock market capitalization		0.006		0.009
		*(0.003)**		*(0.003)****
International debt securities			0.006	0.005
			*(0.002)****	*(0.003)**
Openness to trade	0.003	-0.032	0.028	0.023
	(0.009)	*(0.010)****	*(0.010)****	*(0.011)***
Investment rate	0.059	-0.023	0.021	0.037
	*(0.017)****	*(0.019)*	*(0.015)*	*(0.019)***
Public consumption	-0.048	-0.031	-0.047	-0.056
	*(0.021)***	*(0.021)**	*(0.028)**	*(0.021)****
Employment growth	0.816	0.973	0.799	0.843
	*(0.230)****	*(0.258)****	*(0.197)****	*(0.194)****
Inflation rate	-0.042	-0.003	-0.005	-0.002
	*(0.026)**	*(0.002)*	*(0.002)****	*(0.002)*
Total panel (unbalanced) observations	431	345	392	338
Cross sections included	19	16	18	16
Adjusted R^2	0.41	0.35	0.39	0.48
Levin-Lin-Chu	-13.79	-13.43	-14.49	-14.19
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
ADF-Fisher χ^2	215.39	212.64	239.41	223.09
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
ADF-Choi *Z*-statistic	226.60	224.22	242.49	239.08
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*

Note: In the upper panel, robust standard errors are provided in parenthesis with ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; in the lower panel, *p*-values are reported in parenthesis such that Ho is rejected if *p*-value<0.05 and unit root tests on the residuals do not include an intercept nor a trend.

Table 7. The long- and short-run effects of financial development on growth: the PMG estimator

	Model (1)	Model (2)	Model (3)	Model (4)
Long-run coefficients				
Constant	-0.076	-0.099	-0.001	0.049
	(0.135)	*(0.009)****	*(0.008)*	*(0.006)****
Credit to the private sector	-0.028			-0.043
	*(0.004)****			*(0.005)****
Stock market capitalization		0.003		0.005
		*(0.002)**		*(0.002)***
International bonds outstanding			0.003	0.003
			*(0.001)***	*(0.002)**
Openness to trade	0.008	-0.001	-0.059	0.014
	*(0.005)**	*(0.006)*	*(0.008)****	*(0.010)**
Investment rate	0.020	-0.082	-0.009	0.071
	*(0.010)***	*(0.015)****	*(0.011)*	*(0.011)****
Public consumption	-0.047	-0.034	-0.012	-0.036
	*(0.012)****	*(0.011)****	*(0.015)*	*(0.015)***
Employment growth	0.320	0.245	0.846	0.317
	*(0.066)****	*(0.059)****	*(0.068)****	*(0.071)****
Inflation rate	-0.015	-0.030	-0.002	-0.101
	*(0.003)****	*(0.008)****	*(0.029)*	*(0.023)****
Error correction coefficient	-0.771	-0.651	-0.886	-0.897
	*(0.040)****	*(0.062)****	*(0.078)****	*(0.061)****
Short-run coefficients				
Δ Growth (-1)		-0.097		
		*(0.064)**		
Δ Credit to the private sector	0.034			-0.016
	*(0.011)****			*(0.022)*
Δ Stock market capitalization		0.011		0.028
		*(0.005)***		*(0.017)**
Δ International bonds outstanding			-0.003	-0.013
			(0.003)	*(0.009)*
Δ Openness to trade	0.091	0.069	0.225	0.074
	*(0.030)****	*(0.049)*	*(0.066)****	*(0.060)*
Δ Investment rate	0.068	0.115	0.107	0.032
	*(0.026)****	*(0.028)****	*(0.032)****	*(0.028)*
Δ Public consumption	-0.264	-0.390	-0.266	-0.291
	*(0.069)****	*(0.088)****	*(0.097)***	*(0.079)****
Δ Employment growth	0.138	0.201	-0.155	0.027
	*(0.076)**	*(0.094)***	*(0.067)***	*(0.094)*
Δ Inflation rate	-0.001	0.053	0.009	0.011
	(0.057)	*(0.053)*	*(0.054)*	*(0.078)*
Total panel (unbalanced) observations	409	318	374	318
Cross sections included	19	16	18	16
Test for long-run homogeneity				
Hausman test statistic	8.51	11.13	9.88	4.60
p -value	*(0.20)*	*(0.08)*	*(0.13)*	*(0.70)*
Degrees of freedom	6	6	6	8

Note: In the upper panel, standard errors are provided in parenthesis with ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; in the lower panel, *p*-values are reported in parenthesis such that Ho is rejected if *p*-value<0.05.

Table 8. Evidence of a non-linear impact of financial development on growth

	Credit to the private sector		Stock market capitalization	International debt securities
	PMG	MG		
Long-run coefficients				
Constant	0.057	-0.239	-0.004	0.092
	*(0.006)****	*(0.183)*	*(0.004)*	*(0.010)****
Credit to the private sector	0.024	0.455		
	*(0.049)**	*(0.275)**		
Credit to the private sector ^{2}	-0.107	-0.678		
	*(0.059)**	*(0.316)***		
Stock market capitalization			0.057	
			*(0.025)***	
Stock market capitalization ^{2}			-0.111	
			*(0.032)****	
International bonds outstanding				-0.186
				*(0.051)****
International bonds outstanding ^{2}				0.522
				*(0.116)****
Openness to trade	0.011	-0.022	-0.025	-0.039
	*(0.005)***	*(0.044)*	*(0.005)****	*(0.007)****
Investment rate	0.020	-0.002	0.000	0.036
	*(0.011)**	*(0.030)*	*(0.010)*	*(0.010)****
Public consumption	0.005	-0.059	-0.013	0.010
	(0.016)	*(0.080)*	*(0.011)*	*(0.014)*
Employment growth	0.399	0.711	0.503	0.660
	*(0.066)****	*(0.197)****	*(0.068)****	*(0.074)****
Inflation rate	-0.080	-0.335	-0.012	-0.041
	*(0.010)****	*(0.279)*	*(0.004)****	*(0.043)*
Error correction coefficient	-0.756	-1.358	-0.749	-0.749
	*(0.068)****	*(0.148)****	*(0.056)****	*(0.061)****
Short-run coefficients				
Δ Growth (-1)	-0.090	0.082		
	(0.075)	*(0.084)*		
Δ Credit to the private sector	0.244	-0.043		
	*(0.091)****	*(0.218)*		
Δ Credit to the private sector ^{2}	-0.294	0.204		
	*(0.158)**	*(0.351)*		
Δ Stock market capitalization			0.462	
			*(0.180)***	
Δ Stock market capitalization ^{2}			*-1.996*	
			*(1.092)**	
Δ International bonds outstanding				0.234
				(0.322)
Δ International bonds outstanding ^{2}				-2.053
				(3.101)
Δ Openness to trade	0.088	0.103	0.072	0.149
	*(0.042)***	*(0.043)***	*(0.035)***	*(0.030)****
Δ Investment rate	0.077	0.068	0.078	0.079
	*(0.024)****	*(0.035)**	*(0.021)****	*(0.035)***
Δ Public consumption	-0.165	-0.181	-0.338	-0.375
	*(0.080)***	*(0.058)****	*(0.080)****	*(0.083)****
Δ Employment growth	0.201	-0.221	0.072	-0.104
	*(0.109)**	*(0.152)*	*(0.089)*	*(0.122)*
Δ Inflation rate	-0.055	0.002	0.031	0.159
	(0.134)	*(0.170)*	*(0.035)*	*(0.099)**
Total panel (unbalanced) observations	412		328	374
Cross sections included	19		16	18
Test for long-run homogeneity				
Hausman test statistic	14.61		7.34	11.85
p -value	*(0.04)*		*(0.29)*	*(0.06)*
Degrees of freedom	6		6	6

Note: In the upper panel, standard errors are provided in parenthesis with ***p < 0.01, **p < 0.05, *p < 0.1; in the lower panel, p-values are reported in parenthesis such that Ho is rejected if p-value<0.05.

Table 9. Test for an inverse U-shape

	Credit to the private sector	Stock market capitalization	International debt securities
Slope at FD_{min}	0.158	0.103	-0.162
	*(1.280)**	*(2.340)***	*(-1.590)**
Slope at FD_{max}	-0.317	-0.011	0.151
	*(-2.388)**	*(-0.164)*	*(1.041)*
SLM test for inverse U shape			
test statistic	1.28	0.16	1.04
p -value	*(0.09)*	*(0.44)*	*(0.16)*

Note: This table reports the results of the Sasabuchi-Lind-Mehlum test for an inverse U-shaped relationship; in the upper panel, robust standard errors are provided in parenthesis with ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; in the lower panel, *p*-values are reported in parenthesis such that Ho is rejected if *p*-value<0.05.

Table 10. Results of dynamic panel threshold estimations

	Credit to the private sector	Stock market capitalization	International debt securities
Threshold estimate			
γ	-0.512	-2.507	-1.857
95% Confidence interval	[-0.541; -0.511]	[-2.509; -2.493]	[-1.861; -1.832]
Financial development			
β_1	0.018	0.007	0.011
	*(0.018)**	*(0.004)**	*(0.005)***
β_2	-0.022	0.016	0.018
	*(0.007)****	*(0.005)****	*(0.008)***
Impact of covariates			
Constant	0.243	-0.014	0.177
	*(0.047)****	*(0.062)*	*(0.073)***
Growth (-1)	-0.031	0.113	-0.005
	(0.047)	*(0.059)**	*(0.060)*
Openness to trade	0.027	-0.030	0.026
	*(0.012)***	*(0.012)****	*(0.014)**
Investment rate	0.058	-0.033	-0.004
	*(0.016)****	*(0.019)**	*(0.019)*
Public consumption	-0.034	-0.009	-0.043
	*(0.021)**	*(0.025)*	*(0.023)**
Employment growth	0.658	0.895	0.843
	*(0.071)****	*(0.103)****	*(0.099)****
Inflation	-0.006	-0.025	-0.058
	(0.020)	*(0.028)*	*(0.028)***
Total panel (unbalanced) observations	415	336	381
Cross sections included	19	16	18

Note: Robust standard errors are provided in parenthesis with ***p < 0.01, **p < 0.05, *p < 0.1.

Table 11. The finance and growth nexus: FMOLS estimator

	Model (1)	Model (2)	Model (3)	Model (4)
Credit to the private sector	-0.045			-0.038
	*(0.003)****			*(0.002)****
Stock market capitalization		0.004		0.011
		*(0.002)***		*(0.001)****
International bonds outstanding			0.008	0.003
			*(0.002)****	*(0.002)***
Openness to trade	0.002	-0.035	0.112	-0.009
	(0.005)	*(0.005)****	*(0.011)****	*(0.003)****
Investment rate	0.058	-0.031	-0.032	0.037
	*(0.008)****	*(0.008)****	*(0.009)****	*(0.006)****
Public consumption	-0.056	-0.023	-0.177	-0.055
	*(0.010)****	*(0.011)***	*(0.013)****	*(0.006)****
Employment growth	0.780	0.955	0.910	0.650
	*(0.040)****	*(0.042)****	*(0.039)****	*(0.023)****
Inflation rate	-0.029	-0.026	-0.046	-0.006
	*(0.012)***	*(0.013)***	*(0.016)***	*(0.002)***
Total panel (unbalanced) observations	431	345	392	338
Cross sections included	19	16	18	16
Adjusted R^2	0.41	0.26	0.47	0.40
Levin-Lin-Chu	-14.18	-13.07	-13.70	-14.50
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
ADF-Fisher χ^2	210.66	199.53	207.48	243.57
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
ADF-Choi *Z*-statistic	220.47	205.78	219.21	259.03
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*

Note: In the upper panel, models contain a constant, and robust standard errors are provided in parenthesis with ***p < 0.01, **p < 0.05, *p < 0.1; in the lower panel, *p*-values are reported in parenthesis such that Ho is rejected if *p*-value<0.05 and unit root tests on the residuals do not include an intercept nor a trend.

Table 12. Changing the indicators of financial development

	Model (1)		Model (2)
Long-run coefficients		Long-run coefficients	
Constant	0.014 *(0.005)****	Constant	0.046 *(0.007)****
Liquid liabilities	-0.030 *(0.010)****	Credit to the private sector	-0.036 *(0.005)****
Stock market capitalization	0.007 *(0.002)****	Stock market capitalization	0.007 *(0.002)****
International bonds outstanding	0.007 *(0.002)****	Public bonds outstanding	0.003 *(0.002)**
Openness to trade	-0.015 *(0.011)*	Openness to trade	0.005 *(0.010)*
Investment rate	0.011 *(0.014)*	Investment rate	0.057 *(0.009)****
Public consumption	-0.019 *(0.017)*	Public consumption	-0.030 *(0.015)***
Employment growth	0.411 *(0.088)****	Employment growth	0.358 *(0.065)****
Inflation rate	-0.064 *(0.020)****	Inflation rate	-0.123 *(0.025)****
Error correction coefficient	-0.749 *(0.061)*	Error correction coefficient	-0.903 *(0.071)****
Short-run coefficients		Short-run coefficients	
Δ Growth (-1)		Δ Growth (-1)	-0.050 *(0.051)*
Δ Liquid liabilities	-0.056 *(0.019)****	Δ Credit to the private sector	-0.011 *(0.016)*
Δ Stock market capitalization	0.020 *(0.007)****	Δ Stock market capitalization	0.016 *(0.006)***
Δ International bonds outstanding	0.000 *(0.010)*	Δ Public bonds outstanding	-0.007 *(0.008)*
Δ Openness to trade	0.102 *(0.051)***	Δ Openness to trade	0.065 *(0.063)*
Δ Investment rate	0.061 *(0.033)**	Δ Investment rate	0.049 *(0.027)**
Δ Public consumption	-0.284 *(0.096)****	Δ Public consumption	-0.325 *(0.079)****
Δ Employment growth	-0.039 *(0.112)*	Δ Employment growth	0.036 *(0.111)*
Δ Inflation rate	0.029 *(0.052)*	Δ Inflation rate	0.054 *(0.096)*
Total panel (unbalanced) observations	268	Total panel (unbalanced) observations	292
Cross sections included	19	Cross sections included	18
Test for long-run homogeneity		Test for long-run homogeneity	
Hausman test statistic	10.46	Hausman test statistic	12.1
p -value	*(0.16)*	*p* -value	*(0.15)*
Degrees of freedom	7	Degrees of freedom	8

Note: In the upper panel, standard errors are provided in parenthesis with ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$; in the lower panel, p -values are reported in parenthesis such that Ho is rejected if p -value<0.05.

Table 13. Changing the countries belonging to the sample

	Model (1)	Model (2)	Model (3)	Model (4)
Long-run coefficients				
Constant	-0.050	-0.093	0.030	0.054
	*(0.006)****	*(0.011)****	*(0.006)****	*(0.009)****
Credit to the private sector	-0.030			-0.048
	*(0.004)****			*(0.005)****
Stock market capitalization		0.003		0.005
		*(0.002)**		*(0.002)***
International bonds outstanding			0.004	0.000
			*(0.002)***	*(0.002)**
Openness to trade	0.013	-0.009	-0.062	0.022
	*(0.005)***	*(0.007)**	*(0.007)****	*(0.013)**
Investment rate	0.019	-0.064	0.023	0.078
	*(0.010)**	*(0.016)****	*(0.011)***	*(0.010)****
Public consumption	-0.048	-0.043	-0.026	-0.037
	*(0.011)****	*(0.011)****	*(0.014)**	*(0.015)***
Employment growth	0.269	0.222	0.531	0.314
	*(0.062)****	*(0.061)****	*(0.077)****	*(0.073)****
Inflation rate	-0.015	-0.031	-0.213	-0.206
	*(0.002)****	*(0.009)****	*(0.055)****	*(0.053)****
Error correction coefficient	-0.833	-0.655	-0.857	-0.997
	*(0.044)****	*(0.078)****	*(0.057)****	*(0.092)****
Short-run coefficients				
Δ Growth (-1)		-0.119		0.016
		*(0.066)**		*(0.061)*
Δ Credit to the private sector	0.031			0.018
	*(0.009)****			*(0.019)*
Δ Stock market capitalization		0.014		0.019
		*(0.007)***		*(0.008)***
Δ International bonds outstanding			-0.016	-0.005
			*(0.005)****	*(0.008)*
Δ Openness to trade	0.068	0.065	0.147	0.040
	*(0.032)***	*(0.058)*	*(0.073)***	*(0.062)*
Δ Investment rate	0.075	0.107	0.057	0.022
	*(0.026)****	*(0.030)****	*(0.021)***	*(0.025)*
Δ Public consumption	-0.202	-0.370	-0.284	-0.271
	*(0.062)****	*(0.102)****	*(0.094)****	*(0.078)****
Δ Employment growth	0.097	0.190	-0.036	0.095
	*(0.057)**	*(0.091)***	*(0.051)*	*(0.103)*
Δ Inflation rate	-0.014	0.073	0.106	0.218
	(0.058)	*(0.061)*	*(0.067)*	*(0.127)**
Total panel (unbalanced) observations	343	257	309	257
Cross sections included	16	13	15	13
Test for long-run homogeneity				
Hausman test statistic	6.16	10.09	2.75	4.60
p -value	*(0.40)*	*(0.12)*	*(0.84)*	*(0.70)*
Degrees of freedom	6	6	6	8

Note: In the upper panel, standard errors are provided in parenthesis with ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; in the lower panel, *p*-values are reported in parenthesis such that Ho is rejected if *p*-value<0.05.

Table 14. Taking into account the presence of common shocks

	Model (1)	Model (2)		Model (3)
		PMG	MG	
Threshold estimate				
γ				-0.545
95% Confidence interval				[-0.543; -0.538]
Financial development				
β_1				0.018
				*(0.016)**
β_2				-0.018
				*(0.006)****
Long-run coefficients				
Constant	0.028	0.039	0.061	0.154
	*(0.004)****	*(0.005)****	*(0.027)***	*(0.040)****
Growth (-1)				0.071
				*(0.041)**
Credit to the private sector	-0.017	-0.114	0.089	
	*(0.004)****	*(0.044)****	*(0.0623)**	
Credit to the private sector ^{2}		0.062	-0.176	
		(0.051)	*(0.081)***	
Openness to trade	-0.011	0.011	0.019	0.016
	(0.008)	*(0.005)***	*(0.007)****	*(0.010)**
Investment rate	0.031	0.022	0.024	0.044
	*(0.011)****	*(0.010)***	*(0.013)**	*(0.014)****
Public consumption	-0.007	-0.018	0.013	-0.006
	(0.011)	*(0.012)*	*(0.016)*	*(0.018)*
Employment growth	0.447	0.368	0.252	0.499
	*(0.070)****	*(0.058)****	*(0.089)****	*(0.062)****
Inflation rate	0.029	-0.012	-0.009	0.000
	(0.022)	*(0.002)****	*(0.001)****	*(0.017)*
Euro area real GDP growth rate	0.205	0.262	0.280	1.465
	*(0.076)****	*(0.082)****	*(0.137)***	*(0.125)****
Error correction coefficient	-0.731	-0.746	-0.779	
	*(0.063)****	*(0.056)****	*(0.041)****	
Short-run coefficients				
Δ Credit to the private sector	0.024	0.248	0.193	
	*(0.009)****	*(0.131)**	*(0.088)***	
Δ Credit to the private sector ^{2}		-0.238	-0.173	
		(0.217)	*(0.110)**	
Δ Openness to trade	0.061	0.039	0.057	
	*(0.033)**	*(0.035)*	*(0.021)****	
Δ Investment rate	0.071	0.067	0.104	
	*(0.025)****	*(0.025)****	*(0.015)****	
Δ Public consumption	-0.239	-0.104	-0.127	
	*(0.069)****	*(0.065)**	*(0.023)****	
Δ Employment growth	-0.051	0.088	0.076	
	(0.074)	*(0.082)*	*(0.057)*	
Δ Inflation rate	-0.021	-0.040	0.004	
	(0.053)	*(0.045)*	*(0.001)****	
Δ Euro area real GDP growth rate	0.332	0.294	0.224	
	*(0.107)****	*(0.087)****	*(0.086)****	
Total panel (unbalanced) observations	409	409		415
Cross sections included	19	19		19
Test for long-run homogeneity				
Hausman test statistic	6.16	38.16		
p -value	*(0.40)*	*(0.00)*		
Degrees of freedom	7	8		
Slope at FD_{min}			0.089	
			*(1.596)**	
Slope at FD_{max}			-0.221	
			*(-3.614)****	
SLM test for inverse U shape				
test statistic			1.60	
p -value			*(0.06)*	

Note: In the upper panel, standard errors are provided in parenthesis with ***p < 0.01, **p < 0.05, *p < 0.1; in the lower panel, p-values are reported in parenthesis such that Ho is rejected if p-value<0.05.