Non-linear growth effects of financial development: Does financial integration matter?[♠]

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Abstract

This paper analyses the nonlinear effects of development of national financial markets and international financial integration on economic growth in Europe, using both macro and industry-level data. We model explicitly threshold effects with respect to the depth of financial markets as a measure of economies' absorption capacity. Results reveal evidence of significant non-linear effects, with less developed European countries gaining more from financial development. In contrast, benefits of international financial integration become significant at higher levels of financial development. Monetary integration in Europe significantly contributed to a higher degree of financial integration. Entry of New EU members in the European Monetary Union may thus be the mechanisms ensuring a virtuous circle, as the adoption of the Euro may allow the development of domestic financial markets and financial integration to go hand-in-hand.

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1. Introduction

The aim of the paper is to analyze the likely effects of the process of fulfilling the Maastricht criteria and Euro adoption on financial development and growth in new EU member countries. About two decades ago the new EU members started the process of transition to market economies that also led to the creation of previously non-existent financial markets. Starting with Slovenia in 2007, it is now evident that the most advanced countries in the group may soon join the European Monetary Union. Because this process is and will be the strongest driving force of further financial integration of these countries with the rest of the "old" EU, the likely economic consequences of this process represent a challenging subject of investigation.

Two decades of European monetary integration lead to a process of significant liberalization of capital flows and integration of financial markets. An additional impetus has been provided by the introduction of the Euro (Beal et al., 2004). Progress in financial integration brought benefits also to new EU members. Indeed, it allowed them to run sizable current account deficits, facilitating faster growth and convergence of living standards. Large share of capital inflows in the form of FDI implies favorable risk sharing and transfer of technology that may represent one of the most important factors of catching up (Lane and Milesi-Ferretti, 2006b). It must be noted, however, that the process resulted in levels of negative foreign asset positions that are by international standards relatively high. As a consequence, future adjustments in the current account will be necessary (Lane and Milesi-Ferretti, 2006b). However, drawing from a recent experience of European countries and the stimulus that creation of EMU gave to further financial integration (see Figure 3 below), we may also expect an even increased dynamics in terms of financial integration as most of new EU members progress on their path of Euro adoption. This may increase the sustainability of observed net foreign asset position on its own, and to the extent that it promotes further financial development also increase the ability to generate surpluses in the future. Investigating whether there is empirical evidence for such theoretical predictions is the centre of our analysis.

Significant effects of national financial development on growth are well documented in several empirical studies. In contrast, the evidence of the effect of financial integration is mixed. While it is generally acknowledged that higher degree of openness is associated with economic success, it is also very difficult to empirically confirm a positive effect of financial integration on growth. Recent studies argue that positive effects of financial integration on growth arise only when financial integration is combined with an appropriate institutional framework (Prasad et al., 2003). This implies that the empirical analysis of such phenomena should pay special attention to non-linearities and threshold effects.

We contribute to the literature along five lines. First, our analysis concentrates on European countries. Because these countries are more homogenous in terms of institutional characteristics of their economies this makes our analysis less affected by other unobserved determinants of growth that may affect the results in studies using large cross-country panels. Moreover, because we focus on the likely contribution of the

adoption of the Euro for the financial integration–growth nexus, our country sample includes the most comprehensive coverage of Central and Eastern European countries thus far used in the literature. For new EU members we construct also an industry-level dataset obtained from a large database of firm-level data, which includes as well two large formerly planned economies, Russia and Ukraine. Second, using macroeconomic data we analyze the growth effects of both of the development of national financial markets and that of international financial integration.[1] Third, to provide convincing evidence of the robustness of our results we complement the macro-level analysis with industry-level analysis of the effects of financial development on growth using also industry-level data. Fourth, we use panel estimation to account for the dynamics of development of national financial markets and financial integration. Such an approach, advocated also by other authors (Edison et al., 2002), allows us to address the issue of endogeneity by choosing the appropriate GMM estimator. Last but not least, both for the macro and industry-level analysis we consider the possibility of threshold effects of financial integration and domestic financial development. We combine the industry-level approach of Rajan and Zingales (1998) and Hansen's (1999) methodology to estimate financial development thresholds in the finance-growth relation.

Using the overall level of financial development as the threshold variable, we find compelling evidence of explicit threshold effects, which in addition result to be a key factor in the analysis of financial development and financial integration on growth. Our estimations show that less developed countries in our sample (transition countries) benefit more from development of domestic financial markets relative to direct effect of financial integration, as financial integration per se does not have an obvious positive effect. Financial integration becomes beneficial for growth only after development of national financial markets passes a certain threshold, emphasizing the importance of institutional quality and domestic financial sector development. The most advanced new EU member countries have already achieved the levels of development where further financial integration stimulates growth. Overall, the main conclusions of the paper appear rather robust, as they rely on results obtained from several empirical models and on data at different levels of aggregation.

We infer from these results that the process of Euro adoption as a catalyst of financial integration could have a stimulating effect on growth in new EU members both directly through access to foreign finance and increased macroeconomic stability and through stimulus given to the development of national financial markets. Benefits will be larger if financial integration is accompanied by the strengthening of the institutional framework. The process of Euro adoption may again be seen as the main source of stimulus for institutional development that makes financial integration beneficial for growth.

[1] Our analysis does not consider more specific qualitative measures of financial integration such as restrictions on equity transaction (see Levine and Zervos, 1998b; Henry, 2000; and Bekaert, Harvey and Lundblad, 2001).

The paper is structured as follows. Section 2 offers a brief overview of the literature and a theoretical discussion of the link between development of national financial markets and growth on one hand, and financial integration and growth on the other. Section 3 compares the current state and recent development in financial market development between EU15 and CEEC. Section 4 describes our empirical methodology and the data. Section 5 contains the discussion of estimation results. Section 6 concludes.

2. The effect of financial development and international financial integration on growth

The predominant view in the literature exploring the relationship between financial development and economic growth is that increased availability of financial instruments and institutions reduces transaction and information costs in the economy. Well-developed financial markets help economic agents to trade, hedge and pool risk, which by rising investment stimlates economic growth. Using large cross-country data sets many studies highlighted the importance of financial development for macroeconomic growth, even after controlling for most of the factors that have been usually considered as determinants of growth (King and Levine,1993a, b and c). Levine and Zervos (1998) found a positive effect of banking development and stock market liquidity, while obtaining no robust link between economic growth and the size of the stock market and price-based measures of financial integration. A very influential study by Rajan and Zingales (1998) offered an innovative solution to the endogeneity problem using industry-level data and reached similar conclusions. Using the Rajan and Zingales approach Guiso et al. (2004) focus on the issue of financial integration in Europe, emphasizing how financial integration can contribute both to development of domestic financial markets and higher access to finance by foreign financial intermediaries. They argue that further financial integration in Europe will yield a significant growth dividend both to old and new EU members.

An important issue in estimation of the growth effect of financial development is the potential nonlinearity of the effect across the levels of financial development. Indeed, many studies showed that the effect of finance on growth is not uniform and linear. De Gregorio and Guidotti (1995) report that financial development leads to improved growth performance, but such effect varies across countries and over time and can also become negative. Odedokun (1996) finds that growth-promoting effects of financial intermediation are more pronounced in low-income than in high-income less developed countries. Berthelemy and Varoudakis (1996) were among the first to emphasize threshold effects with respect to financial depth in the relationship between growth and financial depth. Similarly, Rioja and Valev (2004) identified three different regions of financial development and showed that the relationship between finance and growth changes depending on in which region the country belongs to.

From a theoretical point of view financial integration may positively affect growth in several ways. Direct positive effects could come through risk sharing. More importantly, financial integration may improve the

allocation of capital (Obstfeld, 1994). Moreover, financial integration can stimulate growth indirectly, through its effect on development of national financial markets. This occurs in two ways. First, increased competition from foreign financial intermediaries leads to reduced cost of intermediation and higher efficiency (Levine, 2001). This stimulates demand for funds and increases the size of domestic financial markets. Financial integration affects domestic markets also through improvements in the institutional framework, i.e. improved regulation and corporate governance that enhances the overall stability and reduces problems of asymmetric information. Consequently, the effect of financial integration should be reflected through size-based measures of financial development.

The second channel through which financial integration affects financial development is by allowing access to foreign financial markets in the form of direct lending by foreign financial intermediaries and listing on foreign stock markets. These financial flows do not show up in the size-based measures of financial development.

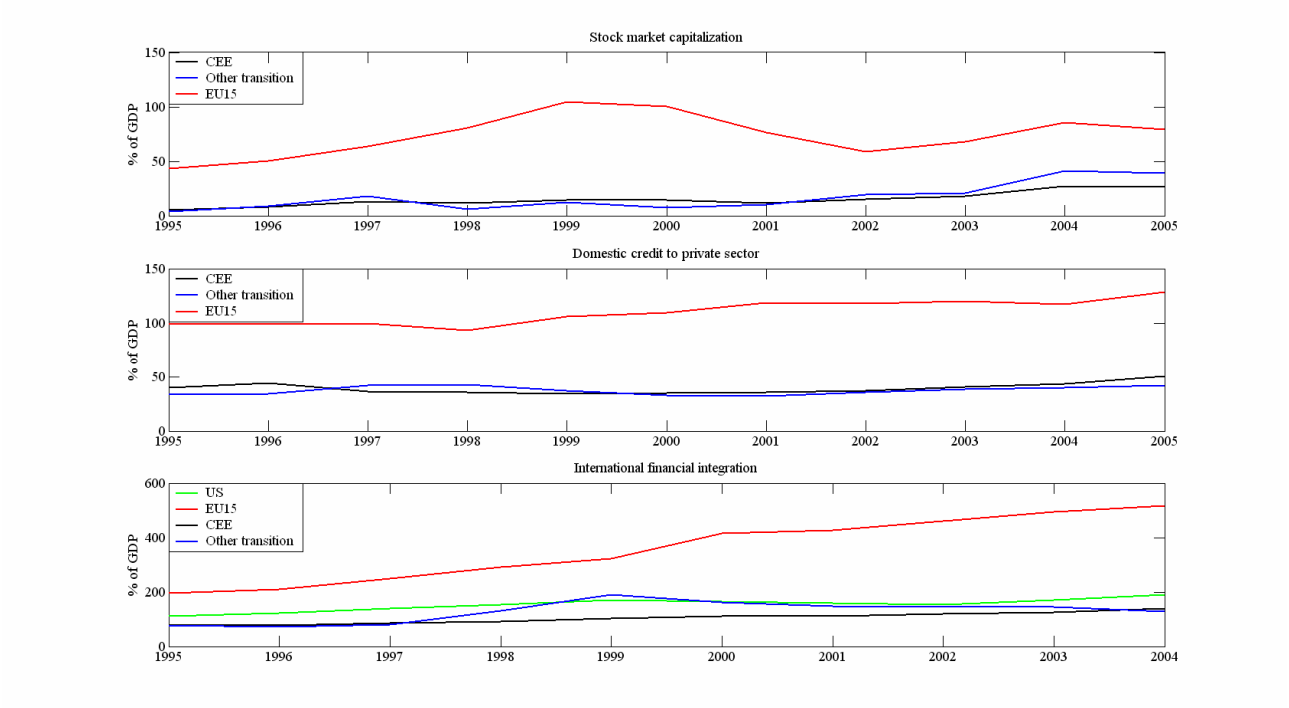
Positive effects of financial integration on growth has been reported, for example, by Klein and Olivei (2000) and Bekaert et.al. (2001)), but a more general message that emerges from the literature is that whether a positive effect of financial development on growth materializes depends on market imperfections and distortions, with weak financial institutions and legal system playing a key role (Boyd and Smith, 1992). Empirically, these considerations seem to matter considerably. Some authors find that financial market integration is beneficial for growth in developed countries and potentially detrimental for poorer countries (Edwards, 2001). In the analysis of foreign direct investment on growth Alfaro et al (2001) emphasize the role of sufficient financial development as a proxy of countries' absorptive capacity.[2,3] Edison et al. (2001) combine various measures of financial integration with different econometric techniques to test how the effect of financial development on growth may depend on financial, institutional and policy factors of economic development. Their analysis does not produce robust results, which indicates that international financial integration does not cause higher growth per se, even though it should not be overlooked that higher openness is accompanied by economic success. The presence of threshold effects of financial integration both for growth and macroeconomic volatility in the view of Prasad et al. (2003) demonstrates that sound macroeconomic policies and improved institutions are crucial for a country to attract less volatile and growth-enhancing capital flows.

[2] See Aitken and Harrison (1999) and Bailliu (2000) for similar conclusions.
[3] Country's absorbtive capacity can be represented as depth of financial markets, human capital, quality of governance and macroeconomic policies.

3. Financial market development and degree of financial integration in transition economies

Transition countries started the transition process with levels of development of financial markets much lower than in comparable emerging markets. Similar finding applies to the degree of international financial integration (Lane and Milesi-Ferretti, 2006b). A fast pace of development from the onset of transition was thus expected. Two main facts emerge from Figure 1. First, the level of financial development in transition countries more than fifteen years from the start of transition still remains well below the corresponding levels in EU15. Second, in the period 1995 - 2005 the pace of development of financial markets in CEE countries (measured in terms of size) has not exceeded that of EU15 countries, implying that no significant convergence occurred during this period in terms of financial depth.

Figure 1: Evolution of financial development and international financial integration in EU15, CEE countries and other transition countries, 1995 - 2005 (arithmetic means)



Note: CEE countries: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia; Other transition: Russian Federation, Croatia, Bosnia and Herzegovina, Macedonia and Serbia and Montenegro
Source: WDI database and Lane and Milesi-Ferretti (2006a)

Such low degree of financial depth cannot be explained by large incomes per capita differentials. Countries involved in previous EU enlargements, like Portugal, Spain and Greece, had income per capita at the time of entry not higher than some of the most advanced NMs, as Slovenia for instance, but their credit-to-GDP ratios were more than twice as large as those of NMs.

The reasons for the underdevelopment of financial markets has probably to do with the initial design of liberalization and reform policies and with objective difficulties in developing financial markets in the midst of enormous structural change and transformation of the economy. Partly stimulated by the literature on transition, it is now acknowledged that institutional development plays a key role in macroeconomic performance, both on growth rates and on their volatility (Roland, 2000; Acemoglu et al., 2002 among others).

Accession to the European Union provided a strong impetus for institutional change. Indeed, in recent years we see a faster increase in credit-to-GDP ratios. An even more important stimulus may come from the process of euro adoption that is an institutional obligation of all new EU members. The bottom panel of Figure 1 suggests that the process of monetary integration culminating in the introduction of the euro has been accompanied by a marked increase in the degree of international financial integration in EU15 (measured by the share of the sum of total foreign assets and liabilities in GDP). It virtually tripled in the period 1993 - 2004, while it only roughly doubled in CEEC, even though CEEC started from a considerably lower initial position and had a significant margin to close.[4] Financial integration in EU15 countries sharply accelerated in 1999 with the introduction of the euro in financial markets. The bottom panel of Figure 1 also plots the corresponding data for the US and shows that the increase observed in EU15 countries is not shared by other most important developed countries. Lane and Milesi-Ferretti (2006b) report a similar finding for other emerging markets that also witness the increase in financial integration similar to CEE countries. In summary, evidence suggests that the process of monetary unification and establishment of EMU has played a determining role in a marked increase in financial integration we observe in the data.

Empirical evidence thus suggests that for CEEC countries convergence in incomes per capita towards EU levels has not been accompanied by convergence in the level of financial depth. We argue that further development of national financial markets and higher degree of international financial integration may be seen as a source of future growth and a factor of further real convergence. In this respect, euro adoption may work as a catalyst, fostering both the size of national financial markets and development of a better institutional framework.

4. Empirical analysis

Our empirical analysis is divided in two parts. First we use a cross-country panel of macroeconomic data to evaluate the potential effect of financial integration on growth. Second, we take the analysis of financial integration on growth one-step further and follow Rajan and Zingales (1998) in using industry-level data to

[4] See Lane and Milesi-Ferretti (2006a) for details about the composition of these flows. The most pronounced difference is in the shares of FDI and portfolio investment. The first is dominant in CEEC, while the latter dominates in EU15.

asses how increased availability of external finance stimulates growth in the economy. The industry-level approach has a number of methodological and conceptual advantages over the classical macro approach (see detailed discussion below) and thus strengthens our conclusions. As emphasized by Guiso et al. (2004) financial integration can importantly contribute to development of national financial markets and thus affect growth indirectly. This indirect effect is better captured in the industry-level analysis.

4.1. Macro level analysis of the effect financial integration on growth and development of national financial markets

Using aggregate-level annual data for 31 European countries (EU27, Croatia, Ukraine, Russian Federation, Iceland and Norway) for the period 1996 - 2004 we estimate the following equation:[5]

$$\Delta y_{it} = \alpha_i + \rho \Delta y_{i,t-1} + \beta IFI_{it} + \gamma' X_{it} + \delta_t + u_{it}, \qquad (1)$$

where the dependent variable, Δy_{it} , equals real GDP per capita growth in country *i* and period *t*. α_i are fixed effects that allow us to control for time-invariant determinants of growth such as human capital (the literature usually proxies this with measures of educational attainment, but given a short time period under analysis we assume it is fixed), institutional factors (protection of property rights, administrative barriers, etc.) and other time-invariant unobservable factors that my otherwise bias the coefficients. δ_t are common time effects that capture business cycle effects that may otherwise cause spurious correlation between growth and explanatory variables. *IFI* measures international financial integration. Finally, *X* is a vector of control variables that includes inflation rate and size-based measure of financial development.[6] Following Rajan and Zingales (1998) and Guiso et al. (2004), among others, we use the share of market capitalization and domestic credit provided by the banking sector in GDP (denoted by *totfin*) and domestic credit as share of GDP alone (denoted by *dom_cre*).[7] As a robustness check we used in place of financial development also the growth in gross fixed capital formation as a ratio of the labor force. This modification left the main results unchanged.[8]

[5] With some modifications this part of the analysis follows the approach used by Edison et al. (2002).
[6] We added also fiscal deficit, which resulted to be insignificant.
[7] Size-based measures of financial development may be of limited quality in cases of poor market discipline and weak financial supervision. High credit activity can in such cases also be seen as reflecting weaknesses in the financial system and lead to financial crises of the sort experienced by some South-East Asian countries in 1997. However, for our sample of countries it can be argued that this is not the case. All new EU members adopted EU financial standards in the process of EU accession. Quality of financial system in transition countries we consider has improved, while their sizes are still converging to equilibrium levels (EBRD Transition Report 2006). Nevertheless, we included in our empirical model corresponding dummy variables in order to check whether Czech financial crisis in 1997 and Russian financial crisis in 1998 influence our results. It was comforting to find these episodes did not affect our main results.
[8] Detailed results available from the authors upon request

There are three main sets of measures of financial integration, price-based, news-based and size-based measures (Beale et al., 2004). For the purposes of our analysis, it is important to use a measure that exhibits sufficient time variation.[9] We prefer to use size-based measures because their construction does not depend on econometric methodology used in the analysis of price co-movements and can therefore be based on more objective statistical grounds.

Stock rather than flow size-based measures are better indication of integration (see Prasad et.al. (2003)). Stocks are less volatile between years and are less prone to measurement error (assuming that such errors are not correlated over time) than measures based on capital flows. Moreover, they are closer to the theoretical concept of financial openness that emphasizes both the ability of foreigners to invest into and lend to a country, and domestic agents to borrow from and invest abroad. The source of such stock size-based measures of financial integration is the dataset constructed by Lane and Milesi-Ferretti (2006a).[10]

For robustness we consider several measures of financial integration. The first variable, *tfinint*, is the stock of total foreign assets and liabilities as percent of GDP. Secondly, we use total liabilities as percent of GDP, *tliab*, that puts the emphasis on financial sources obtained from abroad. For CEE economies Lane and Milesi-Ferretti (2006b) single out FDI inflows as the most important source of capital flows. For this reason, we use also the sum of stocks of FDI inflows and outflows as a share of GDP (*tfdi)*, and the stock of FDI inflows as a share of GDP (*fdiin*). In contrast, Lane and Milesi-Ferretti find portfolio flows much more dominant for EU15. Therefore, the final two measures of financial integration are the sum of stocks of portfolio equity and other debt inflows and outflows as a share of GDP (*tped*), and the corresponding share of inflows (*pedin*).

In order to capture the persistence of GDP growth we specify our growth equation dynamically and include lagged GDP per capita growth on the right hand side of the equation. In such a case, however, elimination of fixed effects from the equation in any standard OLS-based estimation procedure implies the violation of the orthogonality condition between the error term and explanatory variables in the transformed equation. For this reason we estimate equation (1) with the GMM procedure developed by Arellano and Bond (1991). It is also very convenient that the GMM procedure at the same time allows us to control for endogeneity bias induced by reverse causality running from GDP growth to financial integration, development of national financial markets and other explanatory variables.

[9] Bekaert and Harvey (1995), analyzing the behavior of stock-market expected returns as a price-based measure, demonstrate that many emerging markets exhibit time-varying integration.

[10] The rest of the data, including size-based measures of financial development, come from World Bank's World Development Indicators database.

4.1.1. Modeling non-linear effects

The presence of non-linear effects of financial integration on growth is investigated in two ways. Because transition countries in the sample differ from more developed European countries in many aspects, ranging from significant difference in general economic development to depth and institutional development of financial markets, and history of transition from centrally planned to market economies, we estimate equation (1) by allowing the coefficient β to differ between transition and non-transition countries. Significant differences in coefficients across two groups of countries can be seen as evidence of non-linear effects of financial integration on growth.

In our second approach we check whether the effect of financial integration on growth depends on the overall level of development of national financial markets and economies' absorptive capacity that is in our application proxied by depth of financial markets. In principle, one could estimate threshold effects with the method of Hansen (1999) that we use in industry-level analysis. However, on panel of macro level data this would not be valid because of the dynamic specification of the model and because in such a context we cannot assume financial development to be strictly exogenous. Nevertheless, we make a tentative estimation of threshold effects by estimating the following model:

$$\Delta y_{it} = \alpha_i + \rho \Delta y_{i,t-1} + \beta IFI_{it} + \mu IFI_{it} \times D_k + \gamma' X_{it} + \delta_t + u_{it}, \qquad (2)$$

where D_k is a dummy variable taking on value one if the depth of national financial markets (measured as the share of market capitalization and domestic credit provide by banking sector in GDP)[11] is larger or equal *k*, and zero otherwise. *k* ranges between 40 and 250 % of GDP in steps of 10 percentage points. Coefficient β measures the effect of financial integration on growth for observations with depth of financial markets smaller than *k* percent of GDP. Even though such a procedure does not yield a precise and consistent estimate of threshold values, inspection of estimates of β across different values of *k* yields a *prima facie* evidence of possible threshold effects.

4.2. Industry level analysis of financial development and growth

Although we can estimate the effect of development of domestic financial markets on growth already on macro level in model (1), we check the robustness of our findings also using industry level data. The main reason for this is the fact that different production technologies across industries imply different need for external sources of finance. On macro level such differences cannot be identified and hence the effect of

[11] In this paper we consider only the size of financial markets as the threshold variable because we believe that such a variable is the most appropriate measure of financial development and absorptive capacity of the economy for the purposes of our empirical analysis. Additionally, we could consider other more descriptive measures; however, this is left for our future work.

financial development on growth is less efficiently estimated. By the same token, such an analysis can capture better also the indirect effect of financial integrations through development of national financial markets.

The major challenge in the literature on financial development and growth is how to address the potential endogeneity problem between growth rate of firm-level output and the use of external finance. Using industry-level data Rajan and Zingales (1998) (RZ hereafter) propose a solution to the problem by using the dependence on external finance by different sectors in the US as the benchmark, which makes it perhaps the most influential recent empirical analysis of the relationship between finance and growth. The idea is that the financial markets in the US can be assumed to be close to perfect and thus the financial structure of firms is determined by an optimal choice that is not constrained by supply factors. In addition, RZ argue that differences across firms of the same sectors are minor, and thus sectoral indicators are a good proxy for firm level dependence on external finance. The US indicators can be considered an exogenous indicator of financing needs. Cross-country analysis of growth of real sales of firms, excluding the US, can then be used to determine the role of financial development on growth. The sectoral US financial dependence indicator is multiplied by the level of financial sector development in different countries to construct what is by now a familiar indicator in the literature, the RZ indicator. In our estimations we interact the RZ measure of external finance dependence with the percentage share of total finance (market capitalization of listed firms and domestic credit) in GDP. We concentrate on this measure of financial development because it is the most general among the measures used in the literature. As a robustness check, we report the estimates also using only the share of domestic credit. A positive coefficient on the RZ indicator implies that firms that need more external finance grow faster in countries with a more developed financial sector.

As Fisman and Love (2003) (FL hereafter) pointed out, there is the issue of sufficient financing for the firms with high returns in countries with less developed financial market. Petersen and Rajan (1997) argued that alternative funds could be raised by borrowing from suppliers. FL made a natural extension of Petersen and Rajan's reasoning by constructing a measure of trade credit using a similar approach to RZ. In order to obtain an industry-level measure of trade credit usage, they employ the ratio of accounts payable to total assets calculated for the US firms for different sectors. Also this measure is multiplied by the level of financial sector development in different countries. A negative sign of the coefficient is consistent with the hypothesis that firms that are more dependent on trade credit have a relative advantage in countries with less developed financial intermediaries, which implies a substitutability between trade credit and bank credit. On the other hand, if the coefficient is positive, there is a complementarity between the two forms of financing. In our case inclusion of FL measure significantly improves the quality of estimated models and reveals that not only trade credit is likely to play a major role in transition countries, but, more generally, it seems more appropriate to consider external finance not only for capital expenditure, but also for working capital, that is the main determinant of enterprise debt.

Even if RZ solve the problem of endogeneity of the financial indicator, there is still a problem of possible reverse causality from growth of output to the level of financial development. As emphasized by Guiso et al. (2004), a potential problem of RZ is that financial development may affect both the growth rate of firms and industries and the pattern of industry specialization. As a consequence, firms in financially less developed markets may adopt technologies that make them less dependent on external finance. When estimating the effect of financial development on growth using industry-level data, RZ tackle this endogeneity problem by including in the estimated equations the beginning-of-period industry share in value added. This has been used also by other authors, including Guiso et al. (2004).

We tackle the problem by exploiting the panel structure of our data. Note that initial period industry shares in total value added are simple fixed effects. The same holds for institutional determinants of financial development (legal origin, protection of creditor rights, financial market regulation, etc.) that many authors considered as instrumental variables in estimation (Rajan and Zingales, 1998; Guiso et al., 2004). This means that a simple within estimator corrects for the potential bias induced by the correlation between industry specialization pattern and financial development. However, in the analysis of the contemporaneous relation between financial development and growth there is in general still a potential problem of endogeneity bias because financial development may be demand and not only supply determined. It may be argued that in our case this problem is not pernicious since our original units of observation on sales are firms who may have only a very limited effect on aggregate supply of finance. The aggregate effect of all firms together may also be limited since we concentrate on manufacturing sector, which normally accounts for less that half of aggregate value added. In addition, a significant share of credit may be supplied to households. Measures of financial development are also interacted by exogenous measures of notional demand for external finance and use of trade credit. These are all indications that the endogeneity problem in our estimations may be very limited.[12]

Keeping in mind all qualifications mentioned above, we estimate the following baseline empirical model:

$$\Delta y_{ict} = \alpha_{ic} + \beta(RZ_i \times FD_{ct}) + \gamma(FL_i \times FD_{ct}) + \delta_t + u_{ict} \qquad (4)$$

where Δy_{ict} denotes growth of real sales in industry *i*, country *c* and year *t*. RZ_i represents the Rajan and Zingales (1998) measure of external finance dependence, while FL_i stands for the corresponding measure of the use of trade credit assembled by Fisman and Love (2003). Note that trade credit as an additional source of external finance is not accounted for in the analysis of Rajan and Zingales (1998) and Guiso et al., 20004).

[12] As a robustness check we nevertheless tried to estimate model (4) by GMM. In this respect note that usual instrumental variables that other authors use, namely time-invariant institutional indicators, cannot yield the identification of parameters in model (4) that explicitly allows for time variation. With this constraint the only set of instruments at hand were lagged values of variables in model (4). However, such instruments resulted to be weak and invalid. While we acknowledge that the problem of simultaneity bias may still exist in model (4), we must also admit that given the data that is available we cannot offer a satisfactory remedy.

FD_{ct} is a measure of financial development (sum of stock market capitalization and private credit as percentage share of GDP or share of domestic credit in GDP). α_{ic} is a full set of industry-country fixed effects, while δ_t denote common time effects.[13, 14]

To investigate whether the effect of financial development on growth is nonlinear and depends on overall stage of development of countries we consider two extensions of model (4). First, as in the macro-level analysis we interact each of the variables with a dummy variable that partitions the countries in our sample into the group of transition countries (ten transition economies that became members of the EU (Bulgaria and Romania entered in 2007), Croatia, Ukraine and Russian federation) and other countries (EU-15, Norway and Iceland).[15]

Second, we also take a more systematic approach to modeling non-linearities in the effect of financial development conditional on the level of financial development itself. Following Hansen (1999), we estimate for a multiple threshold model, using the measure of financial development as the threshold variable. To compactly write the multiple threshold model, let ΓX_{cit} generically denote the right hand side of (4) (without deterministic terms). Then we have

$$\Delta y_{ict} = \alpha_{ic} + \delta_t + \sum_{j=1}^{3} \Gamma_j X_{cit} I\left(\tau_{j-1} < FD < \tau_j\right) + u_{ict} \qquad (5)$$

This corresponds to a double threshold model with τ_0 and τ_3 unspecified. The threshold variable is the measure of financial development. In line with the discussion above we treat it as exogenous, which means that the model setting fits the assumption in Hansen (1999). Estimation of threshold levels and their confidence regions follows the multi-step procedure described in Hansen (1999).

Our sample of industry-level data covers 30 European countries and 26 three-digit ISIC Rev. 2 manufacturing industries for the period 1996 – 2003. The countries in the sample are EU 25 countries to which we added also data for Iceland, Norway, Croatia, Russian Federation and Ukraine. Since the time span of data is not uniform across countries we are dealing with an unbalanced panel of data.[16]

Data on external finance dependence at the industry level (three-digit ISIC Rev. 2 level) are taken from Rajan and Zingales (1998). Similarly, we take measures of dependence on trade credit from Fisman and Love (2003). As above, data on financial market development are taken from WDI database.

[13] Note that the Rajan and Zingales (1998) in their original specification estimated a different model. Growth of output was measured as the average over a period, while financial development was taken from the initial period.
[14] In contrast to models used with macro data, this model is not dynamically specified. The reason for this is that industry-level average growth of sales does not exhibit significant persistence. Results are available upon request.
[15] Rioja and Valev (2004) use a similar approach.
[16] Hansen's (1999) method is designed for balanced panels, while we operate with an unbalanced panel. In such a case it must be noted that it is unknown whether all the Hansen's results regarding inference carry completely through.

Growth of industry output is calculated from firm-level data on sales drawn from the Amadeus database of the Bureau Van Dijck, which includes also small and medium-sized firms. Sales are deflated with the producer price index obtained from the IMF IFS database. All observations with growth of real sales that exceeded 100 % were treated as outliers and thus excluded from the database. After cleaning the data we used roughly two million firm-level observations to calculate industry-level growth of output as a simple average within industries. This resulted in a final dataset of 4429 observations, comprising of 628 country-industry units with an average 7 years of time observations.

5. Results

Macro-level results

Table 1 summarizes the estimates of equation (1). All estimated equations appear statistically well specified. Choice of dynamic specification is confirmed by highly significant coefficients on lagged GDP per capita growth. At the same time, all equations show no signs of residual autocorrelation.[17] Moreover, Sargan tests for overidentifying restrictions confirmed the validity of the instrument sets used in GMM estimation. Inflation rate as a control variable for overall macroeconomic instability is, as expected, significantly negative.

Without differentiating the effects between transition and non-transition countries it follows from column (2) that the depth of national financial markets positively affects growth of GDP per capita only at 10 % significance level. The effect of financial integration, however, turns out to be negligible and highly insignificant. As robustness check, column (3) estimates the same equation only with domestic credit to GDP ratio as a measure of financial development and leaves the conclusions unchanged. These results are in line with the findings of Edison et al. (2002), for example. In columns (4) - (9) we allow the effect of both financial development and financial integration to differ between transition and non-transition. Leaving the results regarding the control variables unchanged, we can consistently observe insignificant effects of financial development and financial integration for non-transition countries. Financial integration for transition countries, however, shows significant positive effects regardless of which measure of financial integration we consider. The effect for the accumulated stock of FDI inflows appears larger than for the other measures of integration (see also Lane and Milesi-Ferretti (2006b) on this point).[18]

[17] Note that we report test for first and second order autocorrelation in differenced residuals. Absence of residual autocorrelation is confirmed when the first test, m1, rejects and the second, m2, accepts. Both are asymptotically normally distributed.

[18] As robustness check column (5), similarly to column (3), uses only domestic credit to GDP ratio as a measure of financial development. Again this does not affect the results. For other equations in Table 1 (results available upon request) similar observations hold.

Table 1: Financial integration and GDP growth - GMM estimates of model (1), dependent variable: annual GDP per capita growth

	Measure of financial integration/financial development								
	tfinint tot_fin	***tfinint dom_cre***	***tfinint tot_fin***	***tfinint dom_cre***	***tliab tot_fin***	***tfdi tot_fin***	***fdiin tot_fin***	***tped tot_fin***	***pedin tot_fin***
(1)	(2)	(3)	(4)	(5)	(5)	(6)	(7)	(8)	(9)
GDP_{pc}	.428***	.463***	.373***	.416***	.379	.359***	.367***	.424***	.410***
growth(t-1)	(.095)	(.062)	(.050)	(.061)	(.055)	(.058)	(.058)	(.057)	(.057)
Inflation	-.012***	-.010***	-.014***	-.012***	-.014***	-.012***	-.012***	-.012***	-.012**
	(.005)	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
FD_tran			-.014	-.027	-.005	.0026	.009	.012	-.000
	.024*	-0.015	(.024)	(.029)	(.025)	(.024)	(.024)	(.023)	(.024)
FD_ntran	(.013)	(.020)	.011	.003	.010	.008	.006	.004	.007
			(.007)	(.015)	(.008)	(.008)	(.007)	(.008)	(.008)
IFI_tran			.048***	.049***	.052**	.073***	.080***	.037**	.054**
	-.0001	-.0002	(.012)	(.011)	(.017)	(.028)	(.031)	(.015)	(.026)
IFI_ntran	(.0005)	(.0005)	-.000	.006	-.000	.000	.000	-.001	-.001
			(.000)	(.051)	(0.001)	(.001)	(.002)	(.001)	(.002)
# obs	212	212	212	212	212	212	212	212	212
N	31	31	31	31	31	31	31	31	31
Sargan test	21.16	24.27	16.75	19.22	16.75	17.36	16.75	20.06	20.37
$\chi^2(102)$ prob	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)
M1	-1.43	-2.45	-2.60	-2.44	-2.60	-2.64	-2.74	-2.39	-2.43
M2	-1.76	-1.40	-1.41	-1.31	-1.41	-1.42	-1.44	-1.30	-1.59

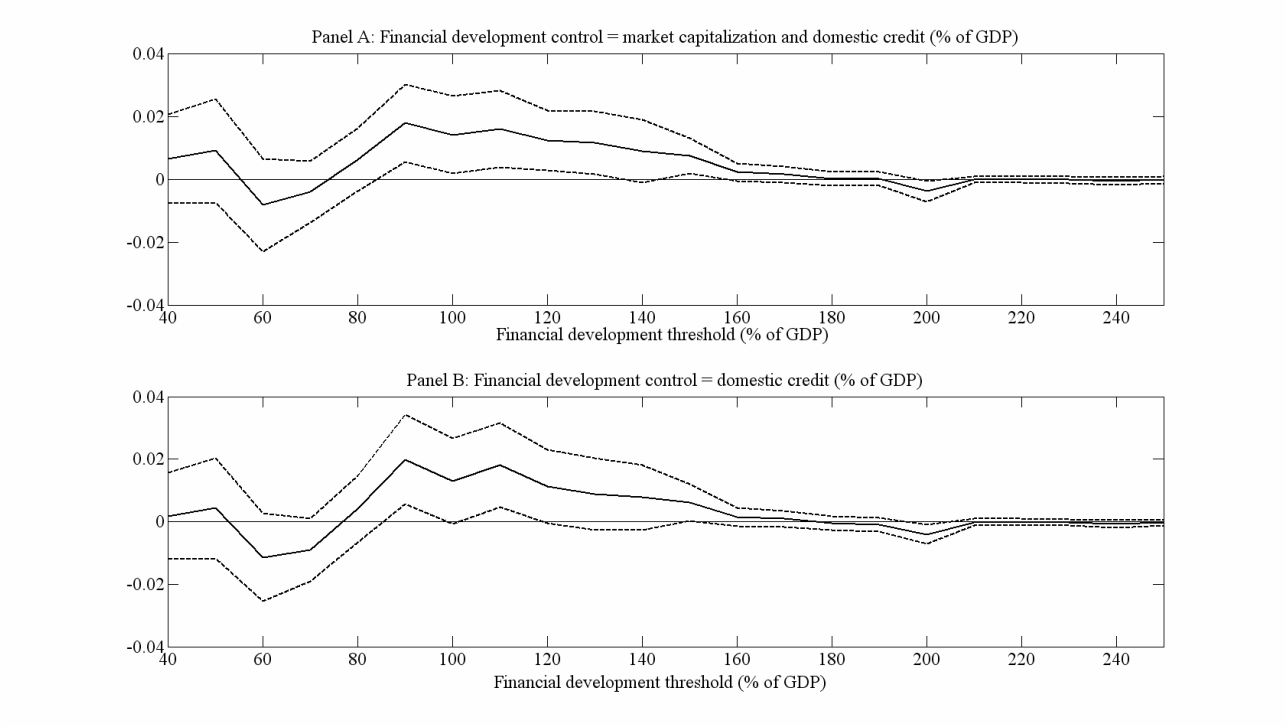
Notes: First step GMM results. All regressions include common time effects. Standard errors in parentheses. ***, ** and * denote statistical significance at 1, 5 and 10% respectively. Three lags of all variables used as instruments in the GMM procedure. Sargan test of overidentifying restrictions (obtained from second-step results) tests the validity of the instrument set. m1 and m2 are tests for first and second order autocorrelation in differenced residuals. Constant not reported.

Mnemonics: *_tran* and *_ntran* endings of variable names denote interaction with a dummy variable for transition and non-transition countries respectively. *tfinint* - sum of total assets and liabilities, *tliab* - total liabilities, *tfdi* - sum of FDI inflows and outflows, *fdiin* - FDI inflow, *tped* - sum of portfolio equity and other debt instruments inflow and outflow, *pedin* - portfolio equity and other debt instruments inflow. All variables are end-of-period stocks, expressed as percent of GDP. The measures of financial development (*FD*) are *tot_fin* - sum of stock market capitalization and domestic credit in percent of GDP, and *dom_cre* - domestic credit in percent of GDP.

The effect of financial integration is further investigated in Figure 2 that reports estimates of the coefficient β from equation (2), upper panel using market capitalization and domestic credit in GDP as a measure of development of national financial market, while the bottom panel as a robustness check uses only domestic credit. This coefficient measures the effect of financial integration on growth below a given threshold value of the depth of national financial markets. By plotting the recursive estimates of coefficient β we can gain insights on the potential threshold effects in the model. As it turns out, the presence of threshold effects is clearly evident. As can be seen from the upper panel, the coefficient becomes significantly positive once the threshold value of financial development passes 90 % of GDP, gradually declines, and becomes insignificant at threshold values exceeding 160 % of GDP. Similar observations emerge from the bottom panel of Figure 2. Even though this is not a statistically rigorous test of threshold effects, we can nevertheless infer that positive effect of financial integration on growth obtains for countries whose depths of national financial markets lie between 60 and 150 % of GDP. For countries with less developed financial markets it may also have an adverse affect, while it does not yield any significant growth dividends for the most advanced

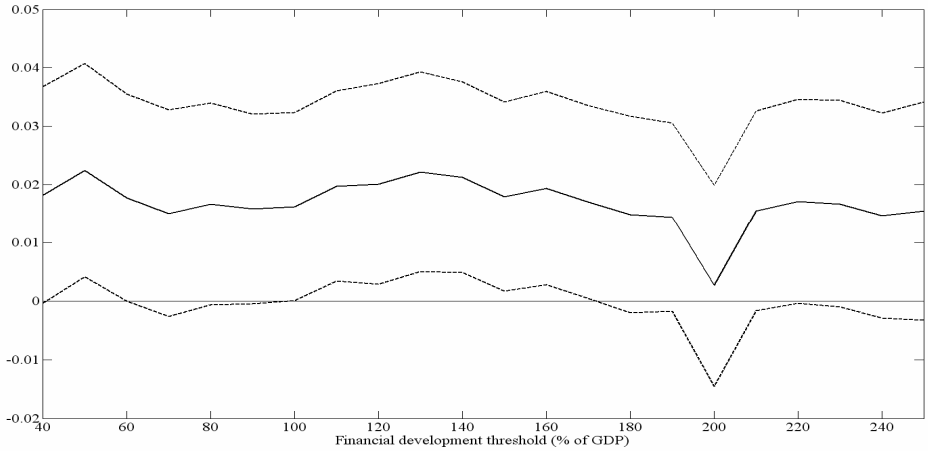
economies. New EU members are presently all in the "positive" region, which indicates that they could benefit from the process of further financial integration.

Figure 2: The effect of financial integration on growth below a given threshold value of financial development (stock market capitalization and domestic credit as % of GDP) - recursive β from eq. (2)



Note: dashed line = 95% confidence interval.

Figure 3: Overall effect of financial development on growth given the threshold effect of financial integration on growth



Note: dashed line = 95% confidence interval.

It is also worth noting from Figure 3 that for the models with threshold values of financial development set between 90 and 170 % of GDP, also the effect of national financial development on growth becomes significant at 5% level, while this is not the case if a uniform effect of financial integration is assumed (see Table 1). Allowing for threshold effects of financial development on growth in the empirically most plausible region thus improves the empirical fit of the models to the extent that financial development positively affects GDP growth at conventional levels of statistical significance.

Industry-level results

In line with the discussion in Section 4.2, and in order to check the robustness of the positive effects of financial development on growth obtained at the macro level analysis, we perform a similar analysis using industry-level data. Estimation results of model (4) are reported in Table 2. It can be noted from column (2) that a positive effect of financial development on growth found by Guiso et al. (2004) - applying the Rajan and Zingales (1998) methodology - is not confirmed on our dataset, not even when we control for trade credit as another source of external finance. Further results show that this may be due to nonlinearities of the effect.

Table 2: Effects of financial development on growth - within estimation of model (4), dependent variable: growth of real sales

	Measure financial development (% of GDP)		
	Stock market + domestic credit	Stock market + domestic credit	Domestic credit
(1)	(2)	(3)	(4)
$RZ \times FD \times D_{tran}$	.026 !(.019)	.218 ** (.071)	.245** (.116)
$RZ \times FD \times D_{ntran}$		.011 (.020)	-.022 (.049)
$FL \times FD \times D_{tran}$	-.401***! (.097)	-.628* (.351)	-.331 (.572)
$FL \times FD \times D_{ntran}$		-.392*** (.101)	-.485** (.242)
# obs	4429	4429	4429
N	628	628	628

Notes: Standard errors in parentheses. Constant not reported. Tests reveal significant presence of fixed effects in all specifications. Time dummies are included in all models. Dummy variables D_{tran} and D_{ntran} denote transition and non-transition countries respectively.
! The coefficients refer to variables that are not interacted with D_{tran} and D_{ntran} respectively.

Column (3) reveals that allowing the coefficients to differ between transition and other countries by interacting explanatory variables with transition and non-transition dummies considerably improves the estimation results. The effect of financial development on growth turns out to be significant and, contrary to the findings of Guiso et al. (2004), is considerably different across the two groups of countries. As expected, for transition countries, which are still characterized by considerably lower levels of economic development, the effect is much higher, in fact higher than previously found in the literature. As shown by the smaller

coefficient for developed countries the effect may decline quickly as development progresses. The coefficients of trade credit (bottom two lines) are significantly negative. Trade credit thus acts as a substitute to external finance provided by financial intermediaries, but significantly more so in transition countries. This result can be again attributed to lower level of financial development. Results in column (4) show the robustness of these findings to the use of different measure of financial market depth.

These results confirm that financial development positively affects growth. However, it is worth noting that this result obtains only after we control for trade credit as an alternative source of external finance and, more importantly, after we allow for non-linearity of the effect. In this respect, we find that financially less developed countries benefit considerably more from financial development, in line with our discussion in section 3.

The threshold model

Evidence of non-linearity in the effect of financial development on growth is more refined in the estimated threshold model (see Table 3). The model uses financial development as the threshold variable and 15 % trimming of observations. The two estimated thresholds are found to be at levels of 53 and 70 % share of market capitalization and domestic credit in GDP.

Table 3: Threshold effects of financial development on growth – double threshold model, dependent variable: growth of real sales

Threshold	52.93		70.29
95% conf. int.	[40.94, 52.99]		[70.29,70.34]
F_2 * (p value)	25.84 (.03)		
Parameters	$FD < \tau_1$	$\tau_1 < FD < \tau_2$	$FD > \tau_2$
RZ	.308	.052	.020
	(.113)	(.161)	(.018)
FL	-1.53	2.78	-.43
	(.56)	(.78)	(.09)

* Test for presence of thresholds using 300 bootstrap replications. Standard errors of coefficients in parentheses. Time dummies included in the model. *FD* is the sum of stock market capitalization and domestic credit as a percentage share of GDP.

In line with our priors, the largest effect of financial development on growth is found for countries that have a financial development ratio below the first threshold. Indeed the coefficient is even larger than found for transition countries in Table 2. Above that threshold the coefficient declines and it becomes insignificant and close to zero for levels of financial development above the upper threshold. All developed Western European countries in the sample were above that threshold throughout the period under investigation. It is important to note that the most advanced transition countries passed the threshold in recent years as well, implying that

considerably smaller growth dividends than those observed in the past can be expected from further financial development.[19] However, taking into account also the results of macro-level analysis they cannot be completely ruled out. Moreover, positive growth dividend of development of national financial markets may be importantly stimulated by further international financial integration. The process of euro adoption in new EU member countries, to the extent it spurs a similar increase in the level of international financial integration as can be observed in the "old" EU in the last decade, can thus be seen as an important stimulus to growth; both through it direct effect on growth and indirect effect through development of national financial markets.

5. Concluding remarks

This study analyses potential effects enlargement of the Euro area may have on growth in acceding countries through increased financial integration and development of national financial markets. We complement a standard macro-level approach of studying the growth effect of financial integration with the use of augmented empirical approach by Rajan and Zingales (1998) on industry-level data. The analysis covers both the group of developed "old" EU and several transition countries, among them all the new EU members and hence also future members of EMU. Our results confirm a positive effect on growth both from development of national financial markets and financial integration. However, the effects are highly non-linear. First, we observe that the positive effect on growth of development of domestic markets is higher in less developed countries, represented by a group of transition countries in our case. The effect may vanish as financial development approaches the levels characterizing EU15. In addition, we find that financial integration may not have a positive effect on growth per se, as its effects depend on the development of national financial markets, macroeconomic stability and quality of institutions. Indeed, our estimates detect a significant positive effect of financial integration on growth only for countries with sufficient absorptive capacity, measured by the level financial development. The absence of such effect for less developed economies can be attributed to lower level of financial development, institutional design and macroeconomic volatility. However, most new EU members have already achieved a level of financial development that enables them to benefit from further financial integration, both directly and indirectly through development of national financial markets. Joining the European Monetary Union, by accelerating the process of financial integration, may thus have large positive effect on growth in new EU member countries.

[19] This statement is confined to measures of development that we use in the sample, i.e. the depth of financial markets. The effects of other, mainly institutional characteristics, that may or may not be correlated with the depth of financial markets and can contribute to growth, were not accounted for in present empirical analysis.

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