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Financial development and economic growth

A European perspective

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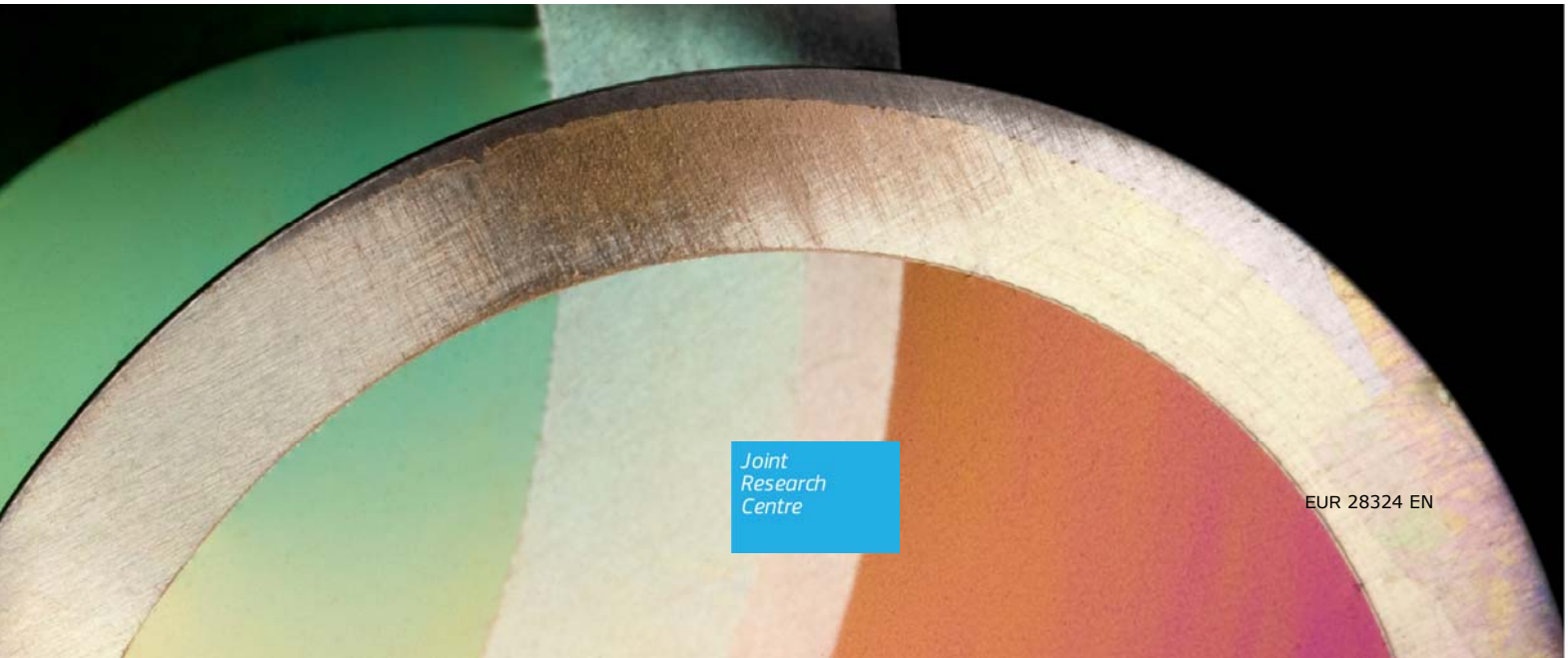

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Title Financial development and economic growth. A European perspective.

Abstract
This report provides empirical evidence on the relationship between financial development and economic growth in the European Union and the Euro area. Results indicate that the type of financing fund receiver matters in the financial depth-growth link.

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Executive summary

Although much debated in the recent literature, the link between financial development and economic growth is still of upmost importance, as it attempts to answer how and why the varying level of development of financial systems affects growth differentials among countries. Evidence on the relation are still ambiguous, as early studies support the existence of a positive association, while more recent contributions suggest a nonlinear (U-shaped) correspondence.

This report empirically examines the association between financial development and economic growth in several regions, emphasizing the European Union (EU) and the Euro area (EMU) context. In detail, the following analysis is offered in order to increase the understanding of the potential association. First, an investigation of the finance-growth nexus, with emphasis on possible non-linear effects. Second, an extension of this analysis incorporating a disaggregation of the financial structure by type of financing (bank credit, debt securities, and stock market) as well as type of fund receivers (households, non-financial corporations, and financial corporations), in order to further extend our understanding of the potential associations. Third, an analysis is included of the effects of upswings or downswings of asset prices of various intensity and specifically on the relative market-based and bank-based financing impact on economic growth during periods of moderate and extreme price volatility in housing and stock markets . Finally, a simulation of the impact on economic growth due to the reallocation of credit available in the economy among different sources is provided (i.e. banks and the stock market). To the best of our knowledge there is a lack of studies investigating this relationship at the EU and EMU level, while there is no research studying the importance of financial deepening and structure while considering jointly the type of instruments of financing and the type of fund receiver.

Results obtained from the empirical analysis indicate that an economy's financial structure has a central role in the association between financial development and economic growth. Specifically, it is shown that credit provided by banks (as a % of GDP) has a non-linear effect on growth and, given the actual financing structure, the peak of the positive impact (turning point) is close to 50% of the GDP. Therefore most of the European countries would have benefited in terms of economic growth rates if bank credit penetration relative to the gross domestic product were smaller during the analyzed period.

The type of financing matters in the financial depth-growth link, as bank credit appears to have the most negative impact (conditionally on substantial financing of households) and stock market a more positive one. The type of fund receiver is also important, as credit to

households and outstanding debt securities to financial corporations appear to exhibit a negative and significant impact on economic growth, whereas credit to nonfinancial firms tends to have a positive one. An interesting result obtained indicates that the unconditional impact of outstanding debt securities is negative, whereas larger share of debt securities can even foster economic growth when GDP growth rates are low relative to lending interest rates and/or stock market volatility is high.

With respect to varying impact during swings of asset prices, an increase in bank credit during housing market booms affects economic growth negatively and, in general, economic growth rates are hindered by larger credit to deposit ratios. Finally, empirical simulations indicate that the impact of changes in the financial composition on economic growth rates is economically significant, but depends on the general penetration of finance and the initial conditions of a particular economy in a specific period. Namely, the impact depends both on the size and structure of finance (both in terms of type of financing instrument and fund user) in a particular year and the actual distance from the level of credit yielding the largest contribution to growth (the 'turning point').

1. Introduction

The relation between financial development and economic growth is much debated. As hypothesized by Schumpeter (1934) and supported by King and Levine (1993) with numerous papers thereafter, the varying level of development of financial systems affects economic growth differentials among countries. The impact channels vary from just additional financial funds, available to finance investment projects due to larger volumes of savings, to more efficient reallocation of funds, thus reaching proper entrepreneurs and leading to higher productivity (see e.g. Beck et al., 2000). The initial literature (see an overview in Panizza, 2014) suggested a positive association between financial depth (measured e.g. by the amount of domestic credit as a percentage of gross domestic product[1]) and economic growth, while more recent empirical work provides evidence of nonlinear (often an inverse U-shaped) relationship as documented in Arcand et al. (2015), Cecchetti and Kharroubi (2012), Law and Singh (2014), and Sahay et al. (2015). It is not excluded that the relationship is even more complex and the impact varies with a country's level of economic and institutional development or level of integration (Demirgüç-Kunt et al., 2013; Masten et al., 2008), quality of the financial system or its structure (Beck et al., 2014; Gambacorta et al., 2014), and other factors.

The recent overall finding of non-linearity of relationship between financial development (mainly bank credit) and economic growth points to a seeming presence of 'too much finance', potentially connected to large financing of households (see e.g. Beck et al., 2012). These findings have been derived mainly using the aggregate credit data of financial institutions and relying on large sets of countries. Some recent research concentrated also on smaller sets of more homogeneous countries like members of the Organization for the Economic Co-operation and Development (OECD) or some groups of developing countries (see e.g. Cournède et al., 2015, and Samargandi et al., 2015, correspondingly). It is of further interest therefore to find out if the results are similar for the European Union (EU) countries and/or the Euro area (EMU) member states that are relatively more homogeneous, especially the later ones. Furthermore, we aim also at establishing the impact not only of the total financial deepening, but also of its structure both in terms of the type of instrument of financing[2] and the type of fund receiver[3] (beneficiary of financing), as well as to further evaluate if and how the finance-growth dependence is

[1] Abbreviated as GDP hereafter.

[2] Namely, private domestic credit by banks, private outstanding debt securities issued domestically, as well as the stock market capitalization of listed domestic companies. Loosely speaking, we could refer to them as bank credit, debt securities, and stock financing.

[3] Namely, by separating credit to households and credit to non-financial corporations as well as splitting the outstanding debt securities into those issued by financial and non-financial corporations.

sensitive to the growth/slump of asset prices (namely, the stock market and housing prices) in the EU member states.

Consequently, the report focuses on three issues. The first relates to the relationship between financial depth, the structure of the financial systems and economic growth. Namely, it includes: (i) the replication, update and extension of the seminal paper of Arcand et al. (2015) on the finance-growth nexus, with emphasis on possible non-linear effects; (ii) the disaggregation of the financial structure by types of instrument of financing in order to estimate their relative effects on growth, and (iii) the differentiation between the type of fund receiver with the estimation of their effects on growth.

The second relates to the investigation of the effects of swings in financial asset prices and specifically the empirical analysis of financing impact during periods of moderate and extreme volatility (i.e. house and stock market growth and slumps, and booms and busts). To do so we reproduce and extend the relevant part of the paper offered by Langfield and Pagano (2016).

The third relates to the estimation of the potential growth effects in the EU countries due to the possible realignment of the financial sector composition, as regards the quantity of credit they provide in the economy. In other words, we simulate the possible impact on economic growth due to the reallocation of credit provided in the economy among different sources (i.e. banks, private debt securities or the stock market).

Although the report concentrates on the EU and EMU cases, we also present the estimation results of the same specifications for the OECD, as well as for all countries having the relevant data. This aims at evaluating if previous results apply for various countries and at establishing patterns robust across different groups of countries, which would allow being more confident in results obtained for the EU and EMU (that also have smaller samples). Furthermore, we use for comparison both the World Bank (WB) and the Bank for International Settlements (BIS) data since the former has larger country coverage, whereas the later provides series adjusted for structural-breaks. Since the usual specifications of growth equations imply implicitly that the equations are dynamic, we employ the dynamic panel models. The Anderson and Hsiao (AH, 1982), the Generalized Method of Moments (GMM) by Arellano and Bond (1991), or more specifically the system GMM of Arellano and Bover (1995) and Blundell and Bond (1998), and fixed Effects (FE) estimators are used for parameter estimation. The AH estimator is preferred in our case, but the GMM is useful to test for admissibility of properly lagged series as instruments. Furthermore,

under endogeneity, FE and instrumental variables-based estimates are expected to differ substantially. Hence, we employ all of them in the sensitivity analysis.

Our econometric research strategy of measurement of financial deepening impact on growth rates is to start from the simplest specification and then to introduce gradually richer ones with more detailed structure and/or non-linearity. Namely, we first consider the impact only of bank credit a la Arcand et al. (2015). Then, besides bank credit, we introduce other instruments to capture financing through debt securities and stock market, since omitted variables might bias the findings otherwise. Afterwards, we consider further decomposition including not only the different types of financing instruments, but also separating between various fund receivers. Finally, we consider specifications merged both non-linearity as well as different types of instruments and fund receivers. The gradual approach thus reveals the whole picture and sensitivity to different specifications without also falling into potential problems connected with relatively small number of degrees of freedom and possible overfitting, which would be connected with the consideration only of the richest specification.

Benefitting from panel data estimation techniques mainly over the 1989-2013 period stemming from different datasets, our empirical results present a robust picture on the link between financial development, its structure, and economic growth in the EU and EMU. Specifically, the obtained estimations demonstrate that:

- credit provided by banks (as a % of GDP) has a non-linear effect on growth and, given the actual financing structure, the peak of positive impact (turning point) is closer to 50% of GDP (substantially lower than that established in Arcand et al., 2015);
- the turning point depends on financing structure: if all bank credit were directed towards financing of non-financial corporations, the peak of positive impact would shift to around 65% in the core EMU countries, with estimates derived from the EU sample being somewhat smaller;
- the type of financing (private bank credit, outstanding private debt securities, stock market capitalization) matters in the financial depth-growth link: conditionally on the historical pattern of credit composition, bank credit appears to have the most negative impact and stock market a more positive one;
- findings do not seem to be specifically related to or generated by the last financial crisis and hold when examining various horizons of future economic growth;
- the type of fund receiver is very important: credit to households appears to exhibit a negative and significant impact on economic growth, whereas credit to nonfinancial firms tends to have a

positive one; outstanding debt securities to financial corporations also have a significantly negative impact on growth, whereas that of non-financial corporations tend to be insignificant, consequently, bank credit to non-financial corporations contributed to the economic growth and, on average, was more effective in terms of promoting it as compared with debt securities of non-financial corporations;

- although the unconditional impact of outstanding debt securities is negative, when GDP growth rates are low relative to lending interest rates and stock market volatility is high, larger share of debt securities can even foster economic growth;
- increased bank credit during housing market booms affects economic growth negatively and, in general, economic growth rates are hindered by larger credit to deposit ratios;
- the impact of changes in the financial composition on economic growth rates depends on the initial size (penetration) and structure of finance of a particular economy.

The rest of this report is organized as follows. Section 2 provides a literature review on the financial development-growth relation. Section 3 presents the data and the empirical strategy. Section 4 presents the results while Section 5 concludes.

2. Literature review

This section discusses some empirical literature investigating the link between finance and economic growth. To this end, findings presented below concentrate on the issue of financial depth and its relation with non-linearities, the quantity of credit available in the economy and the different sources that provide it (bank vs. non-bank credit or firm- and household-oriented credit).

The presence of nonlinearities in the finance – growth relationship

Recent research on the linkages between economic growth and financial development, measured in terms of private credit, revealed the presence of possible nonlinearities of the relationship[4]; this questions the previously established consensus of positive impact of financial development on economic growth (see e.g. an overview in Panizza, 2014). For instance, Arcand et al. (2015), Cecchetti and Kharroubi (2012) and Law and Singh (2014) using cross-sectional and longitudinal data of a mixture of developed and developing countries demonstrated the potential presence of inverse-U-shaped relationship and/or existence of thresholds after which growth is negatively affected by further financial development. Studying the experience of middle income countries Samargandi et al. (2015) and Coricelli et al. (2012) as well find the presence of such a relationship relying on longer time series panels and firm-level data. However, Gambacorta et al. (2014) do not find a statistically significant impact for high-income countries. Similarly, for the sample of OECD countries considered in Cournède et al. (2015), the estimated turning point of financial penetration impact on economic growth is about twice smaller than that estimated in Arcand et al. (2015), which was obtained from a global set of countries.

Considering the level of economic growth in non-homogeneous samples

The aforementioned non-linearity could be a feature more relevant for developing countries or could also be an outcome of mixing different types of countries, according to Masten et al. (2008). This suggests that the development level could be an important additional factor to be taken into

[4] Although other kinds of non-linearity were also considered in the literature (see e.g. Ketteni et al., 2007, who point out that non-linearity in initial conditions is present and, after taking it into account, the impact of finance on growth is linear), in more recent years the attention was focused on nonlinear impact of financial development on economic growth.

consideration and should be either properly modelled or, more generally, countries should be pre-classified before the analysis.

Since this report concentrates on the EU and EMU, the level of development of its member states (MS) is of great importance for two reasons. First, the impact of financial development on growth in the EU countries can be different from that observed in other countries. Second, the EU itself consists of quite inhomogeneous countries and, correspondingly, it is not certain that a single unambiguous conclusion could be drawn for the whole EU or even the EMU. Hence, we use the more homogeneous group of EMU countries named EMU1999 i.e. countries that became members of the Euro zone since 1999 (their list is presented in Table 2A in Appendix A). Nevertheless, the empirical estimations should be read with caution as they might not fully relate to all member-states.

Intensity of structural change and time varying parameters

There might be certain underlying causes behind such a different impact in e.g. low- and high-income countries. For instance, in developing countries the (unconstrained) structural change is likely to happen more swiftly. Therefore, the potential structural change coupled with adequate financial development leads to greater benefits in terms of economic growth, whereas the structural change in developed countries is smoother and such constraints are often less important.

In the same way, too much finance in developing countries - as compared to that required for the potential needs of structural change - does not increase growth rates any further. For example Ductor and Grechyna (2015) find that impact becomes negative when rapid growth in financial development is not accompanied by sufficient growth in real output. This complements the idea considered in Demirgüç-Kunt et al. (2013) regarding the optimal structure of finance given the different development level of a country.

The above results point to the potentially time-varying 'optimal level' of financial development that depends on the intensity of (potential) structural change in a country. Accounting for potential time-varying parameters is also relevant in general, given that the previously estimated positive impact of financial development on economic growth vanishes after the 1990s period (see Rousseau and Wachtel, 2011). Furthermore, a question remains if the recent sever financial crisis had an influence on parameters and the impact of finance on economic growth.

Sources and channels of financial development

Financial development can take various forms, therefore its impact might also depend on the particular sources of financing used in an economy. Relevant empirical evidence argue that the stock-market-based financial development contributes more to economic growth than the bank-based financial development (see Valickova et al., 2015). In addition, the contribution of bank-based credit to growth diminishes, while stock-based contribution to growth increases with the level of development (see Demirgüç-Kunt et al., 2013).

However, these findings often represent average implications and might depend on specific circumstances and certain constraints. For instance, if economic growth is constrained by the absence of sufficient human capital, it is quite likely that the bank-based loan system can relax this constraint by providing resources needed for education, whereas it is less clear how improvements of stock- or bond-market-financing conditions would contribute to it, at least directly.

On the other hand, capital constraint can be relaxed using any of these sources of financing that enhance investment. Thus not only the financing sources (e.g. stocks, bonds, loans), but also the channels through which the financial penetration is taking place can be of great importance.

Fund receivers' vs type of financing

Beck et al. (2012) and Cournède et al. (2015) stress that private credit towards firms and households can have different impact on economic growth. Arcand et al. (2015) reconfirm in their sensitivity analysis that firm credit does not have a significant non-linear indication, as measured by the quadratic term of financial development indicator (also cautioning to potential problems of small sample).

These findings correlate well with those established for stocks-based financing. Although stocks, bonds, and loans differ not only by the type of fund receiver but also in many other ways (among others, in terms of control power and guaranties available to funds providers, duration, riskiness, etc.), the fact that stocks and enterprise credit are served to firms and not households could point to important behavioral differences of household and firm fund receivers, potentially, with less importance of which particular kind of financing was used as a source of funds i.e. bank or market-based.

Direct and indirect effects are present

In many cases, financing facilitates economic growth indirectly by performing specific functions, for example through additional investments, relaxation of working capital constraints that bind the expansion of firms, the facilitation of international trade and the enhancement of investments in education (Beck, 2012). As a result, the impact of financial development on economic growth is often estimated to be lower when the investment variable is included (see Valickova et al., 2015). Overall, we can infer that in order to understand the relevant mechanisms of the financial development-growth impact and to separate their direct and indirect effects, not only the linear analysis of these factors is needed but also the study of their interactions.

Crises and regime change

Financial development and particular the structure of financing can impact not only economic growth, but also the resilience of the financial system per se to sever shocks. Breitenlechner et al. (2015) report that larger financial sectors lead to significantly worse economic outcomes in the case of a banking crisis, even if a positive effect on growth was observed during non-turbulence periods. Furthermore, the impact of sever crises on gross domestic product is three times as sever for bank-oriented economies in comparison with the market-oriented ones (see Gambacorta et al., 2014). On the other hand, it might be also related not only to the structural, but individual healthiness of financial institutions. For instance, Balta and Nikolov (2013) state that the more developed financial markets could have even helped to cushion the impact of the crisis, but this is conditional on a sound balance sheet structure of banks. Therefore, it is worth investigating further the resilience of economic system with different financial structures in extreme regimes, allowing for regime-dependent impact parameter changes and taking into account specific soundness of the system.

These aspects are especially important to understand given that: (i) the changes of financing patterns after the last crisis seem to be long-lasting (or even permanent) and, (ii) firms that exchanged bank loans towards bonds and equities have benefited from faster growth after the crisis (see e.g. Balta and Nikolov, 2013).

3. Empirical Strategy and Data

Let $i \in \{1,2,\ldots,N\}$ and $t \in \{1,2,\ldots,T\}$ stand for country and period indices, correspondingly. For a fixed value of future horizon h, the following econometric model with country and period fixed effects ($\lambda_{i,h}$ and $\mu_{t,h}$, respectively) is under consideration:

$$\tilde{y}_{i,t+h}^{(h)} = \lambda_{i,h} + \mu_{t,h} + \alpha_h y_{i,t} + \boldsymbol{\theta_h}' \boldsymbol{x_{i,t}} + \varepsilon_{i,t+h}^{(h)}, \quad (1)$$

where $\tilde{y}_{i,t+h}^{(h)}$ stands for the average GDP per capita growth rate over the $h \geq 1$ periods ahead[5], $y_{i,t}$ denotes the natural logarithm of income per capita, $\boldsymbol{x_{i,t}}$ includes explanatory variables to be discussed shortly, α_h and $\boldsymbol{\theta_h}$ are the corresponding real-valued parameter and a vector of parameters, whereas $\varepsilon_{i,t+h}^{(h)}$ stands for the usual zero mean error term. It should be pointed out that the model is dynamic because future values $y_{i,t+j}, j > 0$, enter $\tilde{y}_{i,t+h}^{(h)}$. Furthermore, since $\tilde{y}_{i,t+h}^{(h)}$ contains only future values, both, $y_{i,t}$ and $\boldsymbol{x_{i,t}}$ are predetermined thus avoiding at least contemporaneous endogeneity in eq. (1).

In the sequel, we present the results of estimation of model (1) using several parameter estimators. Namely, we employ the AH, GMM, and FE estimators. The box below contains some details of the choice of the preferred estimator in our situation.

Estimation of parameters

When the number of periods T grows to infinity, $\boldsymbol{\theta}_h$ in eq. (1) can be consistently estimated by e.g. the FE estimator. However, when T is fixed, due to incidental parameters problem consistent estimation of $\boldsymbol{\theta}_h$ cannot be directly obtained from eq. (1) and the first difference based instrumental variable estimators of Anderson and Hsiao (1982), or generalized method of moments based Arelano and Bond (1991) or Arellano and Bover (1995) and Blundell and Bond (1998) are usually applied because of their consistency.

In larger samples, the GMM estimator is known to be more efficient when T is fixed, but the AH estimator is consistent under both N and T asymptotics (Phillips and Han, 2014). The last property is very important in our case, because we attempt to estimate the impact of financial deepening on economic growth in the EMU which has a very limited number of countries thus forcing us to rely more on $T \to \infty$

[5] Namely, $\tilde{y}_{i,t+h}^{(h)} = 100 \cdot \frac{1}{h} \sum_{j=1}^{h} \Delta y_{i,t+j}$, where for all i and t the first difference $\Delta y_{i,t} = y_{i,t} - y_{i,t-1}$. It should be pointed out that very similar results appear when geometric mean of gross growth rates is used instead (the gross rates are here needed as straightforward growth rates may also be negative).

rather than on $N \to \infty$ asymptotics. Because of this and in order to increase the number of observations, we also avoid aggregation of initial data into e.g. 5 or 10 years periods, which would not only substantially reduce the number of effective periods (to about 2-4), but also might impose pre-aggregation bias, while the removal of business cycle effects is also questionable, since the length of business cycles might vary both in time and among different countries.

Consequently, the AH instrumental variable estimator will be used hereafter as the main one (using $y_{i,t-2}$ to instrument $y_{i,t}$). For additional robustness checks, we also report the results obtained employing the system GMM and FE estimators. In all the cases the inference is based on standard errors adjusted for clustering.

The vector of explanatory variables $\boldsymbol{x_{i,t}}$ contains various linear and nonlinear terms (logarithms, their squares, interactions, etc.) of economic series. The two main groups will be that of control variables and the financial series.

The included control variables are standard in the literature and, besides the (logarithm of) initial level of income $y_{i,t}$ (which in tables below will be abbreviated by LGDP), comprise also logarithm of enrolment in secondary education (LEDU), logarithm of government consumption (LGC), logarithm of trade openness (LOPEN) and the inverse hyperbolic sign transform[6] (IHST) of inflation (LINF). The precise definition of variables is given in Appendix B and the sources of original data are explicated in Table 1A of Appendix A. The data period varies depending on particular specifications due to availability of more detailed data on the financing structure. Apart from the replication of Arcand et al. (2015), the typical data sample is 1990 to 2013 and is constrained by the availability of data related to a finer structure of finance.

Regarding the explanatory financial variables (all measured as a % of GDP) we use various transformations of the private credit (PC) by deposit money banks, outstanding domestic private debt securities (PDS) and stock market capitalization (SMC). In addition, in several cases we also use various sub-components of these aggregate variables. See Appendix B for the exact definition and transformations to be used in different tables that will follow hereafter.

[6] We apply the IHST instead of the natural logarithm in the cases where the values take also zero and/or negative values.

In order to perform the above empirical estimations several datasets provided by the World Bank and the Bank for International Settlements are utilized (see Table 1A in Appendix A), while the results presented also refer to different groups of countries (all available countries, OECD, EU and EMU1999) [7] and time periods that vary depending on specific variables under investigation (e.g. data on debt securities and stock market initiates only since 1989-1990, while the data from the Global Financial Development Database restricts sample of original series to 2013). We use both the WB and BIS data since the former has larger country coverage, whereas the later provides structural-breaks-adjusted series.

Our econometric research strategy of measurement of financial deepening impact on growth rates is to start from the simplest specification and then to introduce gradually richer ones with more detailed structure and/or non-linearity. Namely, we first consider the impact only of bank credit a la Arcand et al. (2015). Then, besides bank credit, we introduce other instruments to capture financing through debt securities and stock market. Afterwards we consider further decomposition including not only the different types of financing instruments, but also separating between various receivers of finance (households, non-financial firms, and financial firms). Finally, we consider a merged specification covering both non-linearity as well as different types of instruments and fund receivers.

Please note that data series discussed above come with a number of limitations regarding their availability in terms of time, continuity and respective structural breaks. The limitations and the respective implications for modelling are presented analytically in the box below.

Some reservations and sensitivity analysis

Although we attempted to take some complications listed below into account by various means, the presented results should be considered with some caution due to several reasons.

First, the sample size is relatively limited (data on debt securities and stock market capitalization are available only since 1989-1990). Consequently, we use yearly data without pre-averaging that would further shrink the number of observations. This is necessary because we aim at measuring impacts in the EMU and thus the number of countries is very limited and we cannot count on methods relying on asymptotics where the number of countries increase to infinity. Nevertheless, for the sensitivity analysis, we also present results relying on the system GMM and the FE estimators. In addition, to increase the number of observations we consider also larger groups of countries and, given consistent results among them, we are more confident in the findings established for the EMU. Note that larger groups cover also potentially less homogenous countries where impact of financial deepening and/or its structure might differ. Also, we have included in our estimations several additional indicators like credit to deposits ratio,

[7] Please refer to Table 2A in the Appendix for the description of the different groups of countries.

interaction of bank credit with income per capita and the share of different industries (as % of GDP), but they turned out to be less robust in the final specifications than other reported series.

Second, a preliminary analysis of the data on bank credit available from the Global Financial Development Database of the World Bank (WB) revealed not only some gaps in the observations, but also a number of structural breaks. Given this, we perform an additional sensitivity analysis by using also the Bank for International Settlements (BIS) database, where the credit data is also adjusted for breaks. It should be pointed out that we use both sources, because the country coverage in the WB databases is larger. Thus, the choice is between a larger country coverage with WB data or likely less noisy series with BIS data.

Third, estimations that rely on this particular period (1989-2013) are informative about processes that took place during these years but might be less relevant for other ones (either past or future), particularly if relative situations substantially changed e.g. there were important changes in financial structure or their inter-dependence. In order to account for this, we aim at including all components of interest, which however limits the degree of freedom, especially when additional control variables are further included. Consequently, there is a tradeoff between weak inferences versus potential biases due to omitted variables. Therefore we present several specifications by starting from the coarse one which is extended to more detailed structure and/or richer non-linearity.

Fourth, and related to the third, even though the period we use is not very long, it is not free of crises, and in particular the latest financial crisis which was relatively sever. Omitting the data of 2008-2013 would further shrink the number of observations. Instead of this we investigate the stability of parameter estimates by including financing sources interaction terms with the crisis period dummies. Because in the main estimations we use the five year ahead periods of growth rates as defined in eq. (1), we include interaction terms starting from 2003, then 2004, 2005, etc. For instance, year 2003 five year average growth rate includes only the 2008 crisis period. Thus, the crisis impact might be varying. It should also be pointed out that there is no need to include additional dummies without interaction, since our specifications already include fixed period effects.

Fifth, although for the identification of nonlinearities we use nonparametric estimators at the exploratory stage of analysis, due to insufficiently large number of observations and the known dimensionality problem, we prefer to parameterize the identified non-linearity instead of estimating it non-parametrically. It might however induce certain estimation bias if parameterization does not completely capture the non-linearity. To that end, we present several alternative parametric specifications. Furthermore, we should note that for the EU and EMU, the statistical inference that relies on clustering by countries often was based on singular estimated covariance matrix of moment conditions because of insufficient degree of freedom. To mitigate this issue we considered estimation of models without period effects, but the results were barely affected (as for example illustrated in Table 7).

4. Empirical Results

This section first presents the empirical results on the financial depth – growth nexus by gradual introduction of more and more detailed structure of finance coupling it also with the non-linear impact of finance on economic growth. Afterwards, the sensitivity is explored of bank-based and market-based financing impact on growth to the conditions in housing and stock markets. Finally, the simulations of growth differences are presented due to a hypothetical change of composition of financing.

4.1. The financial depth – growth nexus

4.1.1. Replicating and extending the literature

As a first step in the investigation of the relationship between financial depth and growth we reproduce the Arcand et al. (2015) study with a focus on different groups of countries (see countries covered by various groups in Table 2A of Appendix A), including the OECD, EU, and EMU1999 (see Table 1, below). Using the same specification, codes and data[8] we reproduce the empirics for the full sample of countries, where credit to the private sector as a % of GDP (PC) is found to have a positive and significant relation with growth, while its quadratic (non-linear) term (PC2) exhibits a negative one (see column 1). This result is in line with the findings of Arcand et al. (2015) and previous related research (Beck and Levine, 2004). However, when we limit our sample to OECD, the ESM[9], EU or EMU1999 MS the effect is no longer present in all our estimations for both variables (see columns 2 to 6, respectively)[10] and even the switches of signs appear. From this set of empirical estimations we can infer that financial deepening-growth relation is possibly region- and/or country-specific, which in our case refers to more developed economies. It should be pointed out that such a change of the shape cannot be completely explained by the supposition that all more developed economies have larger financial penetration and therefore are on the downwards-sloping part of the inversed-U curve[11]. First, in the beginning of the period the credit to GDP ratios in a number of them were barely around a quarter or even one fifth of the GDP. Second, not all of investigated

[8] Following Arcand et al. (2015) the five year averages are used. The original data and codes are available from the journal's site. See http://link.springer.com/article/10.1007%2Fs10887-015-9115-2

[9] The European Single Market, covering the EU countries, Iceland, Liechtenstein, Norway, and Switzerland.

[10] Please note that GMM two step results are not available for EMU1999 MS due to the limited number of observations (column 5) thus one step estimations are provided (column 6).

[11] It is also of interest to point out that estimation with the OECD countries excluded from the sample yields positive impact of private credit on GDP growth rates with highly significant linear and negative, but insignificant square term.

countries had large ratios of private credit to GDP even in the end of the previous century. This finding also provides grounds to further explore the financial depth – growth nexus.

In order to better understand the relation in question and the obtained estimation we do not restrict ourselves only to the quadratic shape and proceed further by plotting the nonlinear effect[12] of credit to the private sector on economic growth for all countries, EU and EMU MS in two different time periods (1960-2010 & 1990-2010) (see Figure 1, below). Results obtained provide a quite differentiated picture. For the full sample estimations the concentration of the effects provide grounds for the justification of nonlinearities found in Arcand et al. (2015) (see Fig. 1A & 1B, for 1960-2010 & 1990-2010, respectively). Whereas the picture for both EU and EMU is mixed, with none or less obvious nonlinearities present (see Fig. 1C & 1D and Fig. 1E & 1F). So, following Arcand et al. (2015) and the available empirics, the pattern of financial depth impact on economic growth in Europe appears to be quite different from that established previously for all the countries, while a less apparent non-monotonic relationship is supported as well.

It should be also pointed out that the previous results might be unstable also because a single financial development indicator of private credit is used ignoring the contribution and potential relevance of other kinds of financing. Consequently, due to omitted variables, the results might hinge on the correlation structure between private credit and, say, debt securities and/or stock market indicators as well as their relative historical development. This is the issue that we investigate next.

[12] It is obtained from the respective semiparametric models where the shape of private credit link to growth is estimated non-parametrically and the other standard control variables enter log-linearly.

	(1)	(2)	(3)	(4)	(5)	(6)
	GMM	GMM	GMM	GMM	GMM	GMM (one step)
VARIABLES \ Countr.:	All avlb.	OECD	ESM	EU	EMU1999	EMU1999
LGDP	-0.728**	-2.612	-2.129***	-8.598	0.189	-0.900***
	(0.310)	(2.918)	(0.455)	(12.74)	(1.359)	(0.348)
LEDU	2.270***	1.470	-4.180	7.168*	0	-0.223
	(0.615)	(5.124)	(5.851)	(3.773)	(0)	(0.789)
LGC	-1.461**	-6.029**	-2.702	-2.673	0	-2.571***
	(0.742)	(3.039)	(3.424)	(3.531)	(0)	(0.879)
LOPEN	1.087**	-1.265	-0.655	-3.857	0	0.670**
	(0.511)	(3.954)	(2.511)	(5.283)	(0)	(0.293)
LINF	-0.273	-0.0311	-1.177***	-1.414***	5.756	-0.702**
	(0.210)	(0.367)	(0.414)	(0.420)	(6.489)	(0.285)
PC	**3.628****	**-1.360**	**-3.651**	**-0.618**	**0**	**-1.350**
	(1.726)	(5.474)	(5.892)	(13.91)	(0)	(2.208)
PC2	**-2.021*****	**-1.541**	**1.340**	**-1.173**	**-8.180**	**0.243**
	(0.729)	(2.705)	(2.200)	(8.355)	(7.191)	(1.208)
Observations	917	278	225	195	108	108
Number of id	133	33	30	27	11	11

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1: Arcand et al. (2015) results: regional sensitivity. Dependent variable: GDP per capita growth rates (5 year average). Data and code source: Arcand et al. (2015). Estimator: Generalized Method of Moments. Period coverage: 1960-2010 (5 year averages).**Figure 1:** Nonparametric part of credit impact on growth in a semiparametric regressions with all countries, the EU, and the EMU1999 countries (by columns) in 1960-2010 and 1990-2010 periods (by rows). Arcand et al. (2015) panel data and specification.

Figure 1: Nonparametric part of credit impact on growth in a semiparametric regressions with all countries, the EU, and the EMU1999 countries (by columns) in 1960-2010 and 1990-2010 periods (by rows). Arcand et al. (2015) panel data and specification.

Fig. 1A: All available (1960-2010)

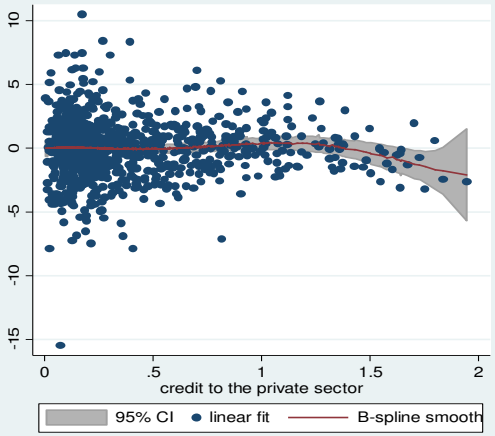


Fig. 1C: EU (1960-2010)

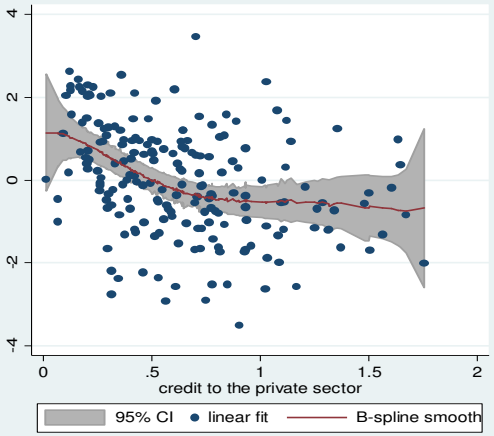


Fig. 1E: EMU1999 (1960-2010)

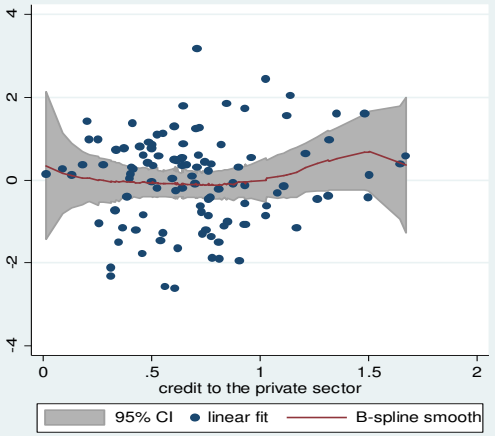


Fig. 1B: All available (1990-2010)

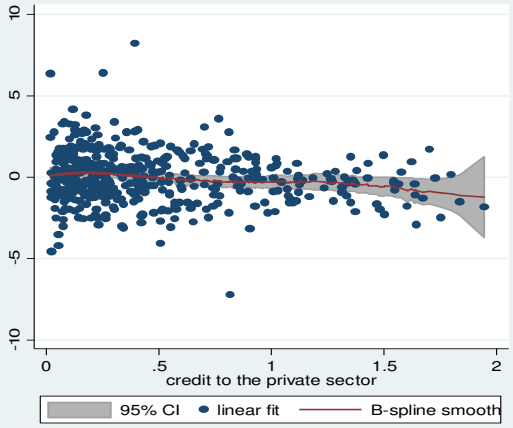


Fig. 1D: EU (1990-2010)

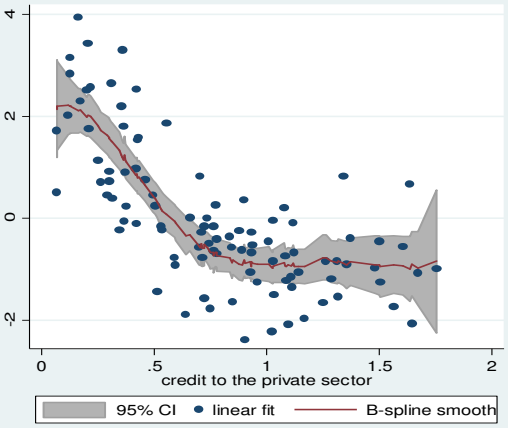
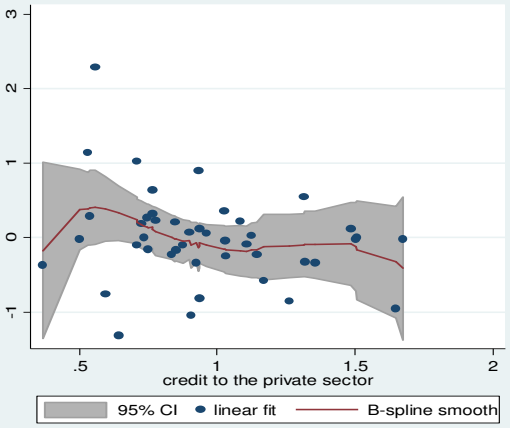


Fig. 1F: EMU1999 (1990-2010)



4.1.2. Financial structure and growth

As a next step to our empirical strategy we proceed with the disaggregation of the financial structure into credit offered by banks (LPC), outstanding private issued debt securities (LPDS), together with the stock market capitalization (LSMC) (see Table 2). As pointed out in the Empirical Strategy and Data section, we use yearly data hereafter. Note that all aforementioned variables are denominated as percentage of GDP and in log terms (that were more significant) and that in this group of empirics three different estimators are used for validity issues, namely the AH, FE and GMM.

The results using the WB data in Table 2 reveal that, while both credit by banks and debt securities have mostly a negative and statistically significant effect on growth, stock market capitalization presents a consistently positive and, as regards EMU MS, even significant influence (see columns 4 and 12 in Table 2). The tendency is rather stable across different estimators and similar whenever either the WB or BIS data are used (see Figures 2 and 3 that plot the respective coefficient estimates of the three financial series under investigation). In fact, with the BIS data (Figure 3), the relative ranking of the impact starting from the most negative for bank credit to less negative for debt securities and more positive for stock market capitalization is even more consistent among different groups of countries.

It should be also pointed out that, although not reported, the Hansen test of over-identifying restrictions in the GMM case cannot reject the adequacy of instruments at the usual significance levels (neither is rejected the absence of serial correlation of second order of errors). Hence, it does not look that the derived estimates would be substantially susceptible to the endogeneity problem e.g. caused by expectations of finance providers about higher growth rates in the future.

In order to further check the robustness of the results that Table 2 offers we perform two additional sets of estimations, namely: (i) to evaluate if results are driven by the financial crisis, interaction terms of respective dummy variable periods are included[13] (Table C1 in Appendix C), and (ii) to assess whether results are robust to potentially different business cycles, the re-estimation of the previous specification is performed using different future horizons of averaging of the dependent variable (Table C2 and Figure C1 in Appendix C). Both sets of estimations provide similar results revealing robustness of the previous findings, as the relative ranking between private credit by banks, outstanding debt securities, and stock market capitalization tends to remain the same.

[13] Please notice that the interacted terms are defined in line two of Table C1.

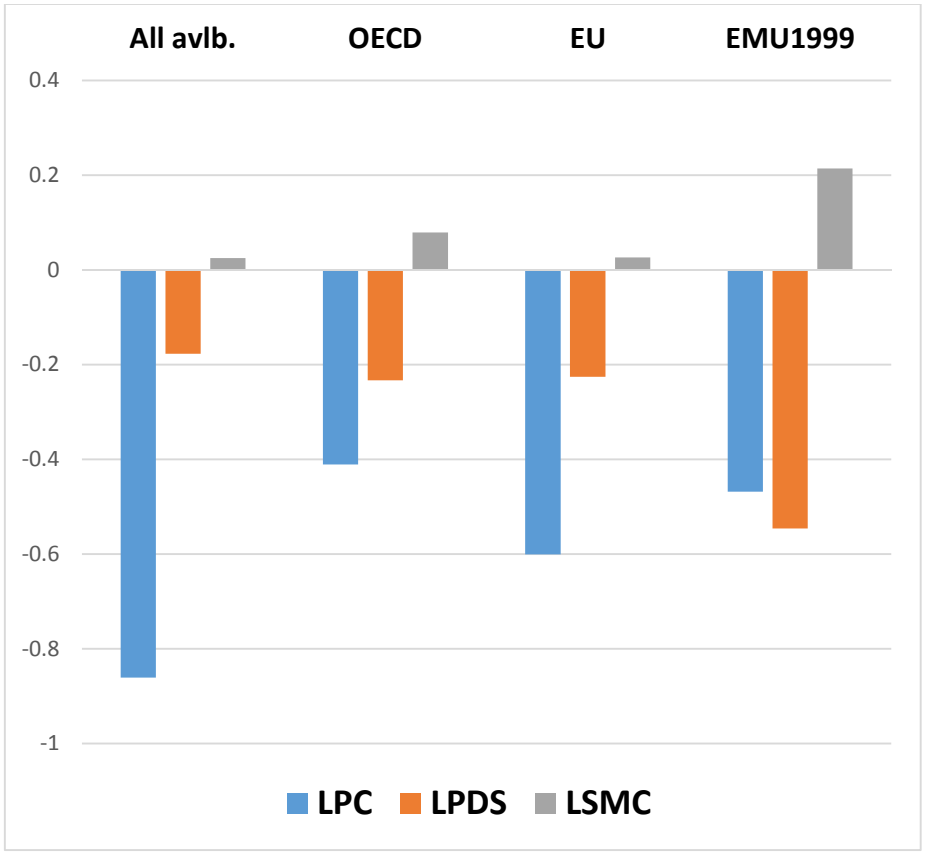
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Estimator:	AH	AH	AH	AH	FE	FE	FE	FE	GMM	GMM	GMM	GMM
VARIABLES \ Countr.:	All avlb.	OECD	EU	EMU1999	All avlb.	OECD	EU	EMU1999	All avlb.	OECD	EU	EMU1999
LGDP	-14.31***	-12.82***	-15.91***	-11.76***	-7.980***	-6.990***	-10.44***	-8.650***	0.0958	0.272**	-0.231**	0.931***
	(3.267)	(2.740)	(3.203)	(1.829)	(2.257)	(1.635)	(2.854)	(2.105)	(0.141)	(0.122)	(0.0920)	(0.330)
LEDU	1.537**	0.557	0.318	0.0200	2.234*	-0.138	-0.294	-0.100	0.282	2.922***	-0.783	-0.535*
	(0.645)	(0.383)	(0.454)	(0.685)	(1.235)	(0.855)	(0.830)	(0.972)	(1.038)	(1.048)	(0.982)	(0.319)
LGC	1.107	2.613**	-0.303	4.019***	0.733	2.004	0.752	3.265	-0.845	-0.867	1.242	0.514
	(1.119)	(1.331)	(1.705)	(1.389)	(1.968)	(1.641)	(2.956)	(3.619)	(1.371)	(1.156)	(1.461)	(0.778)
LOPEN	0.625	1.146*	1.344*	2.797***	1.224	2.710**	2.782*	4.044***	1.661***	1.213***	1.619***	0.642***
	(0.687)	(0.604)	(0.773)	(0.404)	(1.359)	(1.013)	(1.459)	(1.092)	(0.489)	(0.401)	(0.422)	(0.241)
LINF	1.130	0.202	-3.156**	-1.534	-1.822	-7.649**	-20.57***	5.126	-7.620***	-7.863*	-21.36***	-29.50***
	(1.010)	(0.931)	(1.385)	(3.367)	(3.613)	(3.604)	(5.481)	(8.822)	(2.910)	(4.515)	(5.135)	(9.617)
LPC	**-0.861*** **	**-0.411***	**-0.601** **	**-0.468**	**-1.705*** **	**-0.508**	**-0.918** **	**-0.618**	**-1.467*** **	**-0.723***	**-0.754** **	**0.00283**
	(0.310)	(0.237)	(0.296)	(0.525)	(0.479)	(0.315)	(0.366)	(0.654)	(0.371)	(0.387)	(0.319)	(0.347)
LPDS	**-0.177*** **	**-0.233***	**-0.226***	**-0.546*** **	**-0.304**	**-0.502** **	**-0.404** **	**-0.588*** **	**-0.267**	**-0.481*** **	**-0.467*** **	**-1.294*** **
	(0.0598)	(0.139)	(0.129)	(0.124)	(0.213)	(0.194)	(0.194)	(0.157)	(0.171)	(0.155)	(0.134)	(0.192)
LSMC	**0.0249**	**0.0788**	**0.0263**	**0.214** **	**0.246**	**0.417** **	**0.0258**	**0.160**	**0.539***	**0.110**	**0.154**	**0.157** **
	(0.0748)	(0.0692)	(0.0618)	(0.0849)	(0.209)	(0.152)	(0.260)	(0.245)	(0.316)	(0.187)	(0.204)	(0.0730)
Observations	468	360	232	135	533	404	263	152	533	404	263	152
R-squared	0.675	0.737	0.787	0.897	0.585	0.756	0.833	0.927				
Number of cntr_id	43	30	23	11	43	30	23	11	43	30	23	11

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

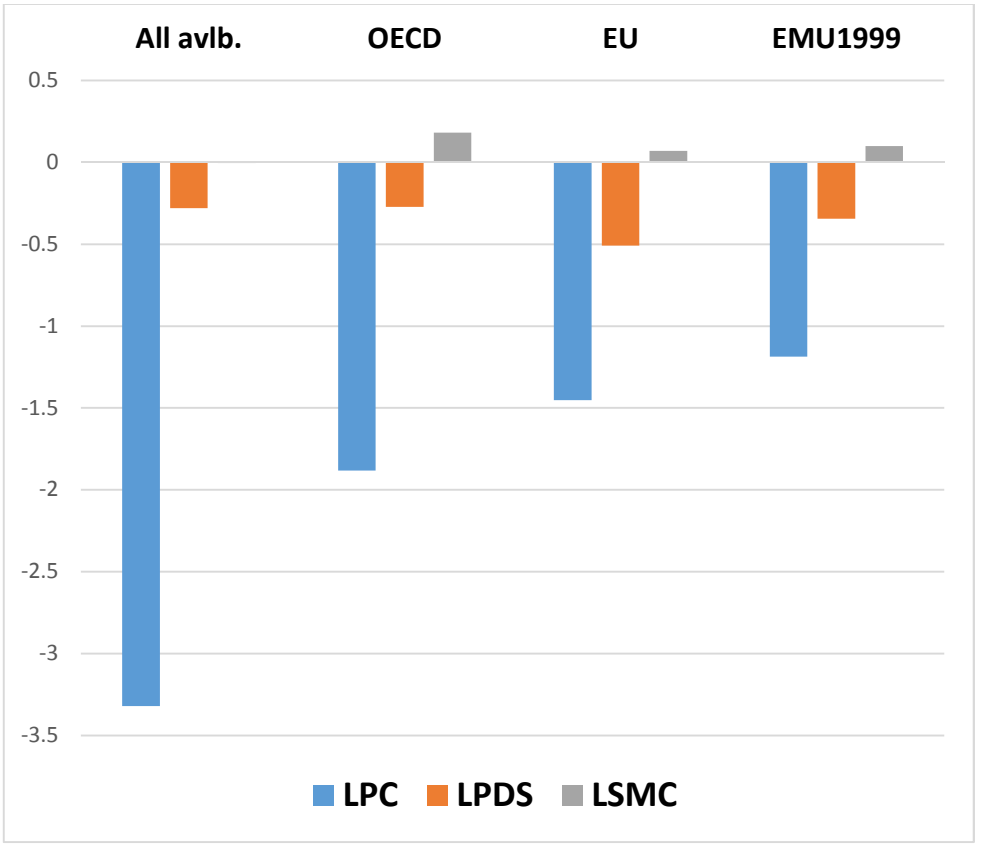
Table 2: Type of finance impact on growth. Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: World Bank. Unbalanced panel with sample initiating mainly from 1990 (LGDP instrumented also with previous data).

Figure 2: Coefficients of financing components in a log-linear model of economic growth as in eq. (1) for different groups of countries (WB data, AH estimator)



Note: LPC - private credit by banks to GDP; LPDS - outstanding private debt securities to GDP; LSMC - stock market capitalization to GDP.

Figure 3: Coefficients of financing components in a log-linear model of economic growth as in eq. (1) for different groups of countries (BIS data, AH estimator).



Note: LPC - private credit by banks to GDP; LPDS - outstanding private debt securities to GDP; LSMC - stock market capitalization to GDP.

To investigate if some non-linearity remains after taking different types of financing into account, we perform the local polynomial smoothing of projection of residuals of previously discussed equation on the three types of financing. Figure 4 (see below) offers the plots of the nonlinear individual effects of bank credit, outstanding private issued debt securities and the stock market capitalization on residuals of growth equations discussed previously for all the countries (Fig. 4A, 4B & 4C, respectively) and the EMU MS (Fig. 4D, 4E & 4F, respectively). Plots explicitly reveal for the EMU group of countries that bank credit has a smoothed inverted U shape close to the left-hand side of the figure (Fig. 4D), private issued debt securities follow a more negative trend (Fig. 4E) while stock market capitalization presents less obvious pattern (Fig. 4F). Similar inferences can be made for the figures that provide the same estimates for the full sample of countries (Fig.4A, 4B & 4C, respectively).

Table 3 provides the findings when we extend our previous analysis by first parameterizing the potential non-linearity and, initially, including the quadratic (non-linear) term of credit offered by bank (LPC2) (columns 1-4). Results confirm the pattern of Figure 4 i.e. both the linear and the quadratic term of bank credit is found to be statically significant, that is positive and negative, respectively. Also, both private issued debt securities (LPDS) and the stock market capitalization (LSMC) variables retain their signs. Furthermore, we did not detect significant non-linearity for them anymore. The negative impact of outstanding private debt securities is slightly puzzling. Hence, we investigate whether their impact depends on specific economic conditions. Given that debt securities are often of longer term, we expect them to contribute to stability when markets are volatile (as suggested in Contesi and Russ, 2013) and/or economic growth is insufficient to pay for current interest rates.

Positive impact of debt securities in connection with volatile or difficult periods when income growth is insufficient to pay out debts can stem from several sources. First, if long term debt securities are used to finance some real projects and not for trading, having a bond issued before a troublesome period and of sufficient duration to overcome it, enables a firm to continue the implementation of investment projects further. On the contrary, banks often have the right and willingness to inquire for more collateral needed to cover their loans whenever e.g. the prices of collateral drop due to uncertainty and/or volatility. This might create substantial liquidity problems both for the direct debtors (as well as their debtors and so on) and divert time and efforts from the implementation of relevant projects to search for additional means to survive. Second, the more debt securities market is developed, the easier and better it serves as an alternative mode of finance on its own. This reduces potential pressures and probability of bank actions that they might be willing to take during uncertain and/or difficult periods.

Figure 4: Nonparametric regressions of residuals of log-linear model on type of financing components to GDP (private credit by banks to GDP, outstanding private debt securities to GDP, and stock market capitalization to GDP). Results for all countries and the EMU1999 countries represented in the rows. Variability bounds account only for nonparametric regression.

Fig. 4A: Private credit by banks, All countries **Fig. 4B:** Private debt securities, All countries **Fig. 4C:** Stock market, All countries

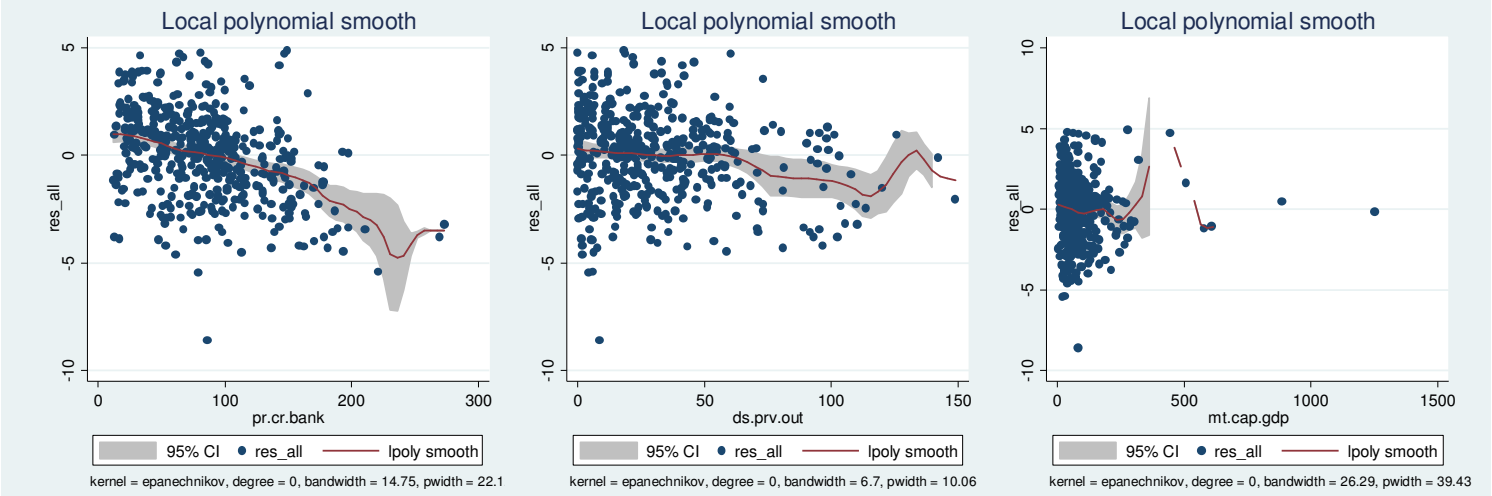
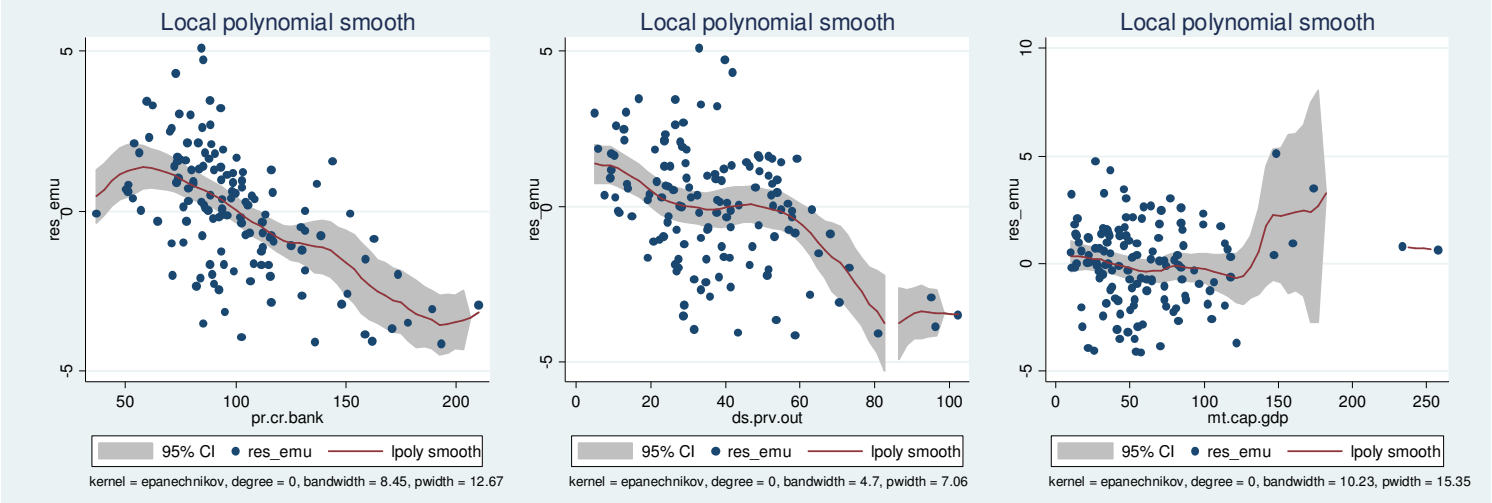


Fig. 4D: Private credit by banks, EMU1999 **Fig. 4E:** Private debt securities, EMU1999 **Fig. 4F:** Stock market, EMU1999



VARIABLES \ Countries:	(1) All avlb.	(2) OECD	(3) EU	(4) EMU1999	(5) All avlb.	(6) OECD	(7) EU	(8) EMU1999	(9) All avlb.	(10) OECD	(11) EU	(12) EMU1999
LGDP	-14.87***	-13.03***	-17.67***	-11.66***	-14.94***	-12.39***	-16.39***	-11.67***	-16.50***	-12.61***	-15.61***	-13.26***
	(2.948)	(2.630)	(2.614)	(1.858)	(2.772)	(2.348)	(2.435)	(2.069)	(2.744)	(2.400)	(2.638)	(1.973)
LEDU	1.643***	0.685*	0.411	0.0751	1.475***	0.607	0.390	0.636	1.720***	0.893*	0.566	0.331
	(0.578)	(0.390)	(0.452)	(0.685)	(0.566)	(0.398)	(0.370)	(0.705)	(0.580)	(0.463)	(0.526)	(0.679)
LGC	0.825	2.332*	0.0157	4.776***	0.494	2.319	0.0544	4.968***	0.0483	2.083	-0.282	2.143***
	(1.011)	(1.289)	(1.764)	(1.291)	(1.032)	(1.449)	(1.719)	(1.262)	(0.920)	(1.290)	(0.911)	(0.780)
LOPEN	0.636	1.053*	1.123	2.839***	0.756	1.179*	1.119	2.980***	0.859	1.296**	1.528**	3.345***
	(0.660)	(0.592)	(0.734)	(0.401)	(0.689)	(0.670)	(0.725)	(0.374)	(0.668)	(0.645)	(0.670)	(0.461)
LINF	0.708	0.291	-2.581**	-1.186	0.529	-0.626	-3.710***	0.170	0.233	-0.710	-4.122***	3.547
	(0.981)	(0.967)	(1.205)	(3.209)	(1.047)	(1.406)	(1.274)	(3.477)	(1.070)	(1.610)	(1.178)	(4.129)
LPC	**4.070****	**3.125*****	**6.506****	**4.419**	**4.441***	**4.151***	**4.138**	**3.445**	**3.758**	**2.705**	**2.539**	**-8.663**
	(1.653)	(1.030)	(2.961)	(4.314)	(2.275)	(2.196)	(2.557)	(4.493)	(2.497)	(2.355)	(2.769)	(6.028)
LPC2	**-0.607*****	**-0.427*****	**-0.878****	**-0.580**	**-0.676****	**-0.554***	**-0.589***	**-0.476**	**-0.579***	**-0.368**	**-0.385**	**0.977**
	(0.213)	(0.133)	(0.382)	(0.536)	(0.307)	(0.286)	(0.327)	(0.523)	(0.337)	(0.298)	(0.349)	(0.650)
LPDS	**-0.180*****	**-0.235***	**-0.232****	**-0.481*****	**-0.214*****	**-0.278****	**-0.293****	**-0.594*****	**-0.527*****	**-0.589****	**-0.842***	**-1.402*****
	(0.0544)	(0.129)	(0.109)	(0.157)	(0.0570)	(0.134)	(0.117)	(0.119)	(0.188)	(0.259)	(0.442)	(0.305)
LPDS*SM_VOL80	**-**	-	-	-	**0.0540*****	**0.0435****	**0.0662*****	**0.0430*****	**0.0435****	**0.0446****	**0.0679*****	**0.0351****
					(0.0175)	(0.0195)	(0.0209)	(0.0167)	(0.0172)	(0.0220)	(0.0210)	(0.0155)
LPDS*exp(RIR-RGDPGR)	**-**	-	-	-	-	-	-	-	**0.340***	**0.356**	**0.676**	**0.801****
									(0.192)	(0.231)	(0.416)	(0.339)
LSMC	**0.0150**	**0.0854**	**0.0191**	**0.220*****	**-0.0198**	**0.0476**	**-0.00734**	**0.180*****	**-0.0209**	**0.0493**	**-0.0404**	**0.100***
	(0.0760)	(0.0691)	(0.0583)	(0.0778)	(0.0782)	(0.0678)	(0.0510)	(0.0580)	(0.0768)	(0.0719)	(0.0519)	(0.0607)
Observations	468	360	232	135	424	323	212	127	371	270	161	84
R-squared	0.690	0.745	0.798	0.899	0.684	0.728	0.808	0.908	0.707	0.756	0.860	0.937
Number of cntr_id	43	30	23	11	39	28	20	10	37	26	19	9

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Sensitivity: non-linear impact (LPC, LPC2). Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: World Bank. Estimator: Anderson-Hsiao. Unbalanced panel with sample initiating mainly from 1990 (LGDP instrumented also with previous data)

Hence, the sensitivity of previous estimations is further examined with the introduction of two additional variables: (i) the interaction between outstanding debt securities and the indicator function, taking value one when volatility of the stock market exceeds its 8th decile (LPDS*SM_VOL80), and (ii) the interaction between outstanding debt securities and the difference between real lending interest rates and the real GDP growth rates (LPDS*exp(RIR-RGDPGR)). The latter variable captures the spread between available lending rates and growth and thus provides insights on the underlying financial conditions.

Empirics robustly reveal that the interaction between debt securities and stock market volatility has a positive coefficient (see columns 5-12 of Table 3) thus reducing the unconditional negative effect of debt securities. This correlates with the insight e.g. by Contessi and Russ (2013) that market-based funding can act as a cushion in times of higher volatility. When the interaction between debt securities, interest rates and growth enters the equation, findings exhibit a clearly positive association with growth, and thus revealing that in periods with relatively high interest rates or low GDP growth rates, long-term based debt security financing helps retain economic activity. It is of interest to note further that the (non-linear) private credit impact becomes insignificant, corroborating that the newly introduced variables are correlated with the developments in the bank credit market as we hypothesized discussing the economic mechanism behind it. On the other hand, the number of explanatory variables becomes fairly large for the given number of observations, hence the small number of degrees of freedom might be truly binding the inference.

In the previous specification we used a simple way (with LPC and LPC2) to parametrize the non-linearity observed in Figure 4. However, in the original Arcand et al. (2015) paper the PC and square of PC (PC2) were used. If we augment the model with these terms and retain the significant ones, we get the results presented in Table 4. They correspond perfectly with Figure 4, as the LPC and PC terms are able to capture the hump-shaped nonlinearity observed around 50% of credit to GDP, whereas the PC and PC2 capture the U-shaped part observed around 200%. The previous results remain similar qualitatively and quantitatively while all the other variables of interest preserve the same signs and significance. It is also of interest to note that the estimations provided already in Table 1 column 7 (that are related to the EMU MS case) had pointed out that PC and PC2 could have been rather driven/capturing the U-shaped part.

Relying on the results presented in Appendix E, Figure 5 plots the marginal effects of bank credit by banks on GDP growth rates in connection with column (3) of Table 3 and Table 4 (i.e. specifications with LPC and LPC2, and PC, PC2, and LPC, respectively). It shows that the positive effect of bank credit on

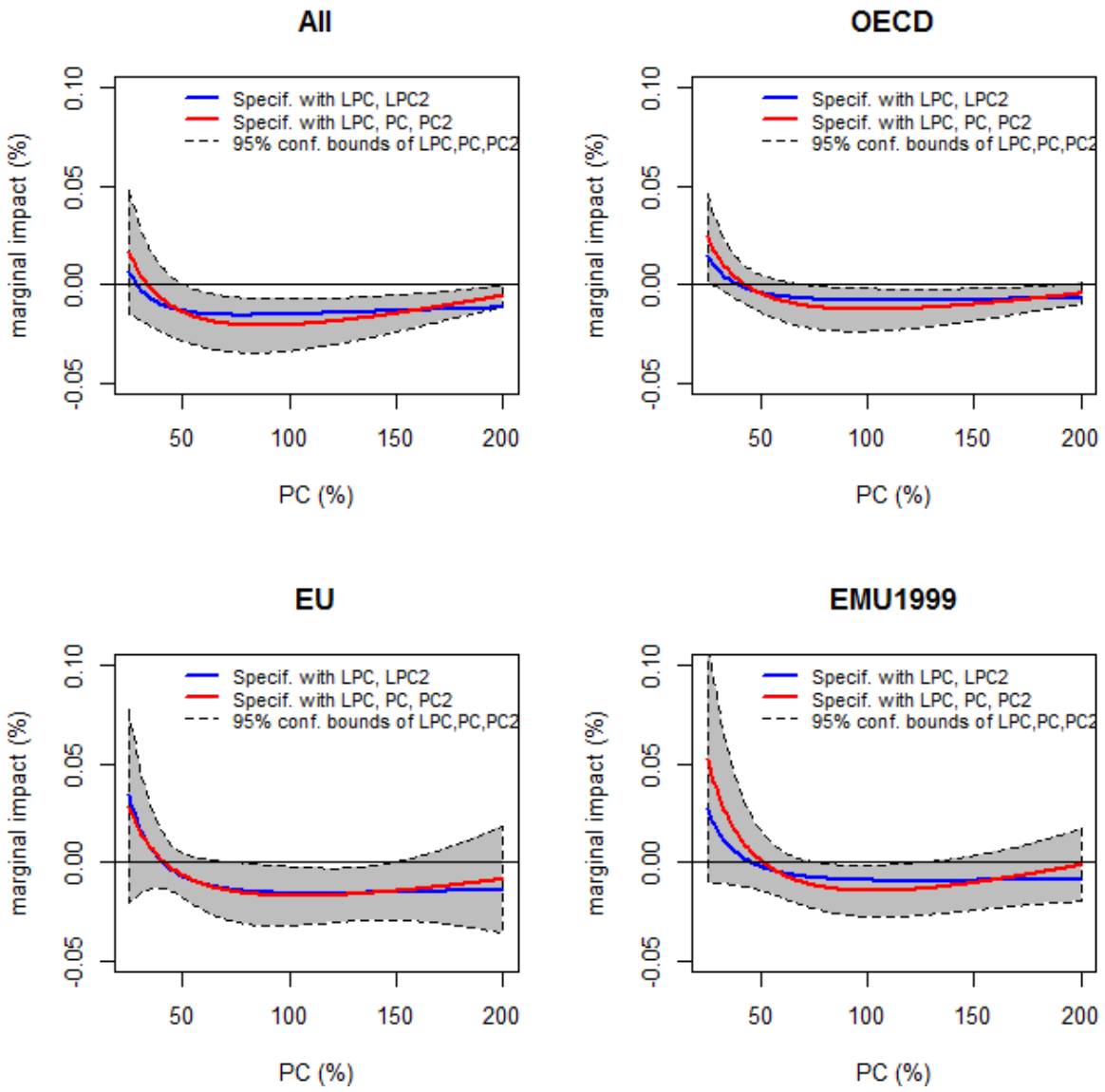
growth disappear much faster than that established in Arcand et al. (2015) who based on panel data found that the optimal point of credit was ranging from 79% to 144% in different specifications.

VARIABLES	(1) All avlb.	(2) OECD	(3) EU	(4) EMU1999	(5) All avlb.	(6) OECD	(7) EU	(8) EMU1999	(9) All avlb.	(10) OECD	(11) EU	(12) EMU1999
LGDP	-14.85***	-13.45***	-17.50***	-11.89***	-14.78***	-12.43***	-16.12***	-11.80***	-16.62***	-12.70***	-14.97***	-13.02***
	(2.823)	(2.651)	(2.609)	(1.869)	(2.688)	(2.215)	(2.261)	(1.782)	(2.696)	(2.257)	(2.504)	(2.013)
LEDU	1.677***	0.706*	0.424	0.127	1.424***	0.616	0.380	0.633	1.614***	0.882*	0.520	0.323
	(0.553)	(0.372)	(0.452)	(0.659)	(0.553)	(0.403)	(0.393)	(0.716)	(0.569)	(0.457)	(0.521)	(0.676)
LGC	0.832	2.187*	-0.0434	4.606***	0.353	2.134	-0.459	4.903***	0.0331	2.093	-0.376	2.151**
	(0.985)	(1.297)	(1.752)	(1.302)	(1.048)	(1.523)	(1.763)	(1.276)	(0.930)	(1.333)	(0.910)	(0.840)
LOPEN	0.634	0.977	1.105	2.698***	0.825	1.206*	0.929	2.931***	0.958	1.364**	1.438**	3.482***
	(0.651)	(0.611)	(0.758)	(0.313)	(0.691)	(0.700)	(0.753)	(0.419)	(0.678)	(0.660)	(0.692)	(0.465)
LINF	0.749	0.486	-2.650**	-0.542	0.433	-0.442	-3.360**	0.326	0.0590	-0.732	-3.966***	3.041
	(0.990)	(0.957)	(1.334)	(3.664)	(1.058)	(1.351)	(1.389)	(4.045)	(1.085)	(1.518)	(1.126)	(4.175)
LPC	**1.840****	**1.653*****	**1.983**	**2.949****	**2.724*****	**3.015*****	**3.082***	**1.114**	**2.672*****	**2.484*****	**2.321**	**-5.668***
	(0.756)	(0.635)	(1.537)	(1.503)	(0.960)	(0.947)	(1.591)	(4.264)	(1.020)	(0.838)	(1.485)	(3.259)
PC	**-0.0630*****	**-0.0459****	**-0.0555**	**-0.0721****	**-0.0998*****	**-0.0869*****	**-0.0916****	**-0.0299**	**-0.101*****	**-0.0772*****	**-0.0761****	**0.101**
	(0.0208)	(0.0181)	(0.0435)	(0.0333)	(0.0306)	(0.0280)	(0.0427)	(0.0763)	(0.0328)	(0.0248)	(0.0378)	(0.0618)
PC2	**0.00012*****	**8.25e-05****	**9.22e-05**	**0.00014***	**0.00024*****	**0.00021*****	**0.00022****	**4.36e-05**	**0.00027*****	**0.00021*****	**0.0002****	**-0.00019**
	(4.09e-05)	(3.53e-05)	(0.000116)	(7.52e-05)	(8.26e-05)	(7.13e-05)	(0.00010)	(0.000154)	(9.34e-05)	(6.60e-05)	(0.000102)	(0.000133)
LPDS	**-0.183*****	**-0.238****	**-0.230****	**-0.415*****	**-0.214*****	**-0.283****	**-0.298*****	**-0.581*****	**-0.502****	**-0.633*****	**-0.943****	**-1.457*****
	(0.0528)	(0.120)	(0.110)	(0.136)	(0.0536)	(0.121)	(0.108)	(0.0863)	(0.196)	(0.243)	(0.451)	(0.297)
LDS*SM_VOL80					**0.0473*****	**0.0349***	**0.0520*****	**0.0423*****	**0.0446*****	**0.0451****	**0.0665*****	**0.0349****
					(0.0159)	(0.0180)	(0.0161)	(0.0163)	(0.0167)	(0.0216)	(0.0213)	(0.0158)
LPDS*exp(RIR-RGDPGR)									**0.311**	**0.386***	**0.754***	**0.819****
									(0.197)	(0.227)	(0.422)	(0.333)
LSMC	**-0.0101**	**0.0640**	**0.0174**	**0.201*****	**-0.0142**	**0.0526**	**-0.00858**	**0.182*****	**-0.0191**	**0.0480**	**-0.0554**	**0.103***
	(0.0735)	(0.0631)	(0.0573)	(0.0685)	(0.0748)	(0.0649)	(0.0523)	(0.0578)	(0.0720)	(0.0686)	(0.0493)	(0.0586)
Observations	468	360	232	135	424	323	212	127	371	270	161	84
R-squared	0.695	0.749	0.798	0.901	0.691	0.735	0.814	0.908	0.715	0.763	0.863	0.938
Number of cntr_id	43	30	23	11	39	28	20	10	37	26	19	9

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 4: Sensitivity: non-linear impact (LPC, PC, PC2). Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: World Bank. Estimator: Anderson-Hsiao. Unbalanced panel with sample initiating mainly from 1990 (LGDP instrumented also with previous data).

Figure 5: Marginal impact of private credit by banks (PC) on the GDP per capita growth rate



In the case of the EMU1999, the point estimate of marginal impact (the solid lines) becomes zero and the peak of credit impact on GDP growth rates is reached at levels when the bank credit makes up about half of GDP. For other groups of countries the turning point is even less than that. These findings would show that the actual bank credit penetration in many economies could be way more harmful for economic growth than estimated previously. However, the established turning point is likely to be conditional on who receives the credit i.e. not only the amount, but also the structure of credit is important. This is the issue that we consider next.

4.1.3. Disaggregation of credit, fund receiver, and further robustness checks

Up to this point of our empirical strategy we looked at the financing structure and potential non-linear impact. Next we turn to the questions if different fund receivers also matter for economic growth and for that purpose we further disaggregate credit to the private sector into more detailed components (see Table 5). We differentiate private credit into the one received by households (LPCHSH) and non-financial corporations (LPCNFC), as well as the outstanding private debt securities into the ones issued by financial (LDSFCO) and non-financial corporations (LDSNFC) (all relative to GDP and in log terms).

Taking into account period effects, the results provide a rather robust association between the variables in question (see columns 1-4). In detail, credit towards households is found to have a detrimental association with growth, while the credit for non-financial corporations has a non-significant effect or even the positive and significant impact in the case of the EMU1999. On the other hand, securities issued by financial corporations have also a negative impact on growth mainly in the EU and EMU MS while no significant effect is estimated for the securities issued by non-financial corporations. However, it should be pointed out that the globalization of financial institutions that recently became especially intense (see REF ???) may be partially responsible for such an effect, because the domestic savings attracted e.g. through debt securities can be outsourced to other markets thus reducing local funding of investments.

The presented results are robust and stronger in terms of statistical significance when no period effects are considered (columns 5-8). In general, the separation of bank private credit into that flowing to households and non-financial firms has much clearer impact difference as compared with that of the split of outstanding debt securities issued by the financial and non-financial corporations (see Figure 6).

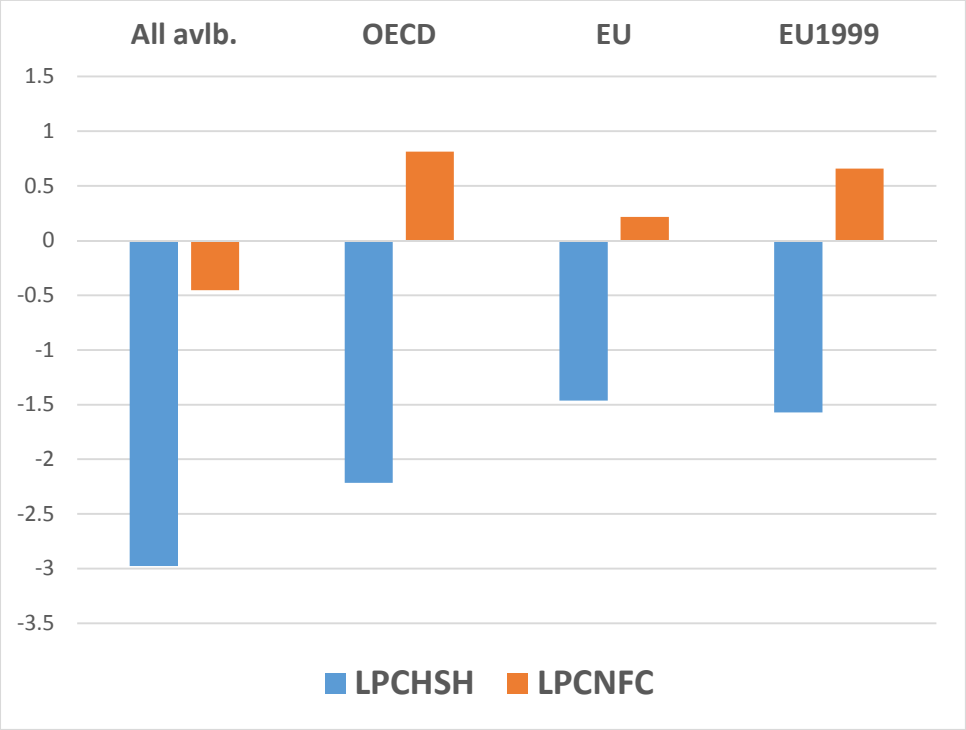
VARIABLES \ Countr.:	(1) period effs. All avlb.	(2) period effs. OECD	(3) period effs. EU	(4) period effs. EU1999	(5) no period effs. All avlb.	(6) no period effs. OECD	(7) no period effs. EU	(8) no period effs. EU1999
LGDP	3.749	-5.097	-11.32**	-8.356*	4.504	0.151	-1.089	-5.979
	(6.203)	(5.517)	(4.436)	(4.502)	(9.163)	(9.290)	(9.098)	(6.670)
LEDU	0.558	0.115	0.118	0.0475	3.670***	3.475***	3.755***	3.366***
	(0.645)	(0.419)	(0.510)	(0.572)	(0.814)	(0.889)	(1.068)	(1.265)
LGC	8.057**	2.189	0.747	3.881***	10.85**	6.878***	7.505***	7.287***
	(4.065)	(1.632)	(2.553)	(1.495)	(4.231)	(2.347)	(2.659)	(1.632)
LOPEN	0.789	-0.472	0.660	2.609***	-0.837	-1.716	-1.574	-0.897
	(1.291)	(1.008)	(1.295)	(0.559)	(1.391)	(1.517)	(1.841)	(1.541)
LINF	1.236	-2.983	-0.363	-6.580***	-3.938	-5.567*	-7.682**	-17.25***
	(4.265)	(2.025)	(2.448)	(2.528)	(4.210)	(2.983)	(3.633)	(3.533)
LPCHSH	**-2.977*** **	**-2.214*** **	**-1.462*** **	**-1.573** **	**-4.237*** **	**-4.084*** **	**-4.108*** **	**-3.785*** **
	(0.938)	(0.701)	(0.520)	(0.779)	(1.010)	(1.001)	(0.970)	(0.524)
LPCNFC	**-0.454**	**0.812**	**0.216**	**0.659***	**-0.444**	**0.395**	**0.523**	**0.381**
	(1.008)	(0.511)	(0.455)	(0.395)	(0.894)	(0.671)	(0.684)	(0.382)
LPDSFCO	**-0.203**	**-0.314**	**-0.332***	**-0.309** **	**-0.517** **	**-0.479** **	**-0.414** **	**-0.394*** **
	(0.207)	(0.218)	(0.170)	(0.121)	(0.255)	(0.221)	(0.206)	(0.151)
LPDSNFC	**-0.0436**	**-0.200**	**-0.228**	**-0.0504**	**-0.0442**	**-0.128**	**-0.159**	**-0.332** **
	(0.234)	(0.198)	(0.198)	(0.0915)	(0.285)	(0.263)	(0.280)	(0.153)
LSMC	**-0.0941**	**0.147**	**0.0375**	**0.0838**	**-0.0853**	**-0.0624**	**-0.0321**	**0.0616**
	(0.180)	(0.149)	(0.149)	(0.0797)	(0.117)	(0.112)	(0.111)	(0.0948)
Observations	259	241	175	132	259	241	175	132
R-squared	0.553	0.733	0.786	0.886	0.268	0.371	0.443	0.540
Number of cntr_id	25	22	16	9	25	22	16	9

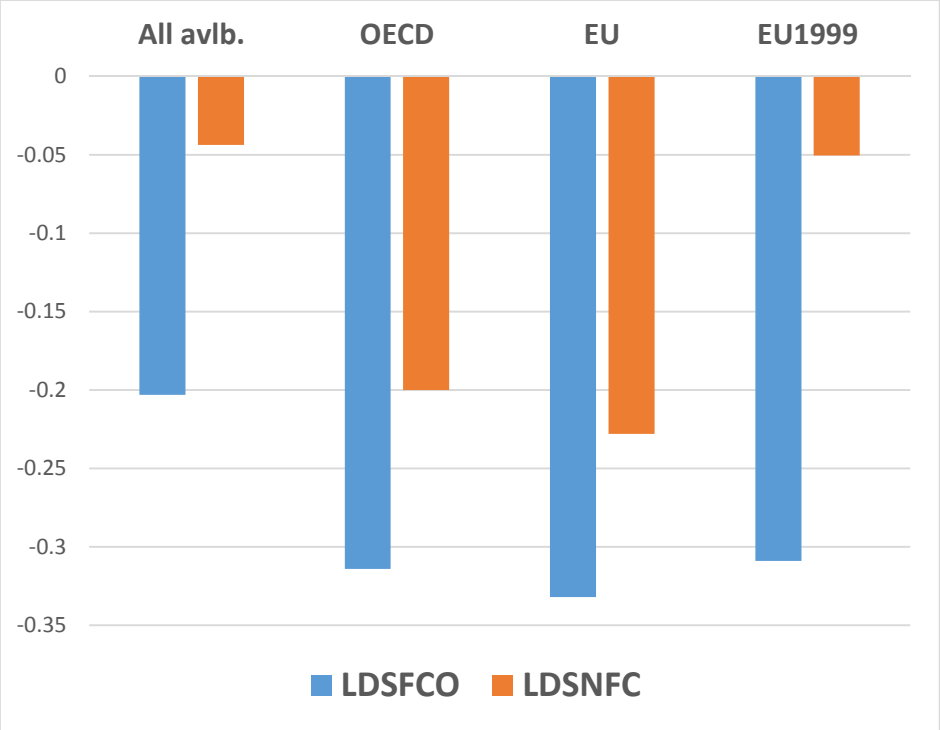
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Detailed split by types of financing and subjects. Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: Bank for International Settlements. Estimator: Anderson-Hsiao. Unbalanced panel with sample initiating mainly from 1989 (LGDP instrumented also with previous data).

We can further infer from the analysis of structural impact that in more developed countries (and especially the EMU1999 MS) bank credit to non-financial corporations contributes and not hinders economic growth. Furthermore, it is more effective in terms of promoting growth relative to the financing using debt securities of non-financial corporations. Hence, the negative average impact of bank credit established previously in Tables 2, C1, and C2 hinges on the large share of credit going to households and financial institutions.

Figure 6: Coefficients in a log-linear model of economic growth as in eq. (1) of different financing components and subjects in different groups of countries (AH estimator)





Note: LPCHSH - private credit to household to GDP; LPCNFC - private credit to non-financial corporations to GDP; LPDSFCO - debt securities issued by financial corporations to GDP; LPDSNFC - debt securities issued by non-financial corporations to GDP.

In addition to our empirical estimations on the finance-growth nexus we provide further robustness checks with emphasis on the overall findings of this section; that is we merge financial structure, non-linearity and fund receiver specifications into a single equation. It should be noted that at this point our effort is to keep number of parameters as low as possible while accounting for any related influences. For that purpose we augment our previous specifications with the ratios of household to firm's private credit and of debt securities issued by financial and non-financial corporations

In particular, Table 6 (see below) offers the empirics of the non-linear impact of financial depth to growth similar to Table 3, with the inclusion of two interaction terms[14]: (i) the interaction between bank issued credit and the ratio of credit to household and non-financial corporations (LPC*PCRAT), and (ii) the interaction between outstanding debt securities and the ratio of debt securities issued by financial and non-financial corporations (LPC*DSRAT). The results are consistent with previous findings from Table 5 that credit to households' affects growth negatively. Furthermore, in the EMU1999 MS both interaction terms have a negative and statistically significant effect on growth (see columns 4 and 8 in Table 6), thus underlying the importance of financial structure in the financial depth-growth relation. As previously, the impact of the allocated debt securities is less clear-cut whenever we look at its impact on growth in different country groups.

Switching to data from the BIS and re-estimating all main previous specifications (see Table 7) confirm the importance of financial structure as results present nearly the same signs and significances (see e.g. columns 9-12 related to the latest specification discussed in this section). The important difference being that non-linearity of bank credit impact in Table 7 becomes (more) significant than that which was observed using the WB data in Table 6 after the introduction of variables representing the structure (ratios) of finance receivers. It should be also pointed out that this appearance of significance of parameter estimates can be attributed to the usage of the BIS data corrected for breaks, since the country coverage in the OECD, EU, and EMU MS cases is the same in both estimations.

[14] It should be pointed out that the signs of estimations remain the same if additional unconditional shifts of composition are also included i.e. PCRAT and/or DSRAT, but significance of non-linear impact of bank credit become less strong due to their high multicollinearity with the introduced series (as well these series are significant only in one case each). Nevertheless, the specification without these shifts seems to be more economically intuitive yielding the total effect of logarithm of private credit by banks as a function of the ratio of credit to households and firms, i.e. the impact is represented by $(\alpha 0 + \alpha 1 \cdot PCRAT) \cdot LPC$, and would say that the total impact of logarithm of private credit (LPC) would decrease with increasing ratio of household to firm credit (PCRAT) whenever $\alpha 1<0$ as is currently in Table 7.

It should be noted further that the interaction term of credit with the household-to-firm in specifications presented in the last two tables affects the shape and peak of the impact of credit on GDP growth rates. Those presented in Figure 5 can be thought as connected with the averages of actual household-to-firm financing ratios. Using the most significant results of Column (12) from Table 7 we derive using results presented in Appendix E that, whenever all bank credit is devoted to firms, the peak of the positive impact of bank credit on growth is reached whenever it makes up about 65% of GDP.

Summarizing all the empirics of financing and growth nexus provided in Section 4.1, we first can confirm that there is a significant non-linearity of bank credit also in the EU and EMU member states, although the peak of non-linear impact seems to be reached at significantly smaller levels of credit-to-GDP in comparison with the previous findings established mostly relying on global country sets and using only credit data without taking other types of financing into account.

Given the historical composition and use of financing, the split of finance by the type of instrument (bank credit, debt securities, and stock market financing) reveals robustly that there was too much of bank credit and its reduction would have benefited economic growth. The analysis by the fund receiver discloses further that the main suspect of problems connected with bank credit is the credit flowing to households.

These findings are quite robust to various perturbations in the performed sensitivity analyses as well as using different datasets, although the results of final specifications, which account for various structure as well as non-linearity, seem to be more significant with the BIS data that are adjusted for structural breaks.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Countries:	All avlb.	OECD	EU	EMU1999	All avlb.	OECD	EU	EMU1999
LGDP	-12.28***	-10.67***	-15.55***	-13.36***	-6.033	-14.00*	-15.84**	-11.93***
	(4.170)	(3.432)	(5.722)	(4.320)	(4.664)	(7.353)	(7.097)	(4.455)
LEDU	0.835	0.667*	0.390	0.613	0.637	0.321	0.332	0.581
	(0.527)	(0.404)	(0.349)	(0.685)	(0.571)	(0.393)	(0.418)	(0.780)
LGC	2.063	2.398	-0.288	3.800***	4.313	0.172	-0.979	3.937***
	(1.557)	(1.500)	(2.626)	(1.370)	(2.774)	(2.317)	(3.154)	(1.227)
LOPEN	1.006	1.103	0.970	2.140***	0.388	-0.783	0.0676	2.107***
	(0.635)	(0.747)	(0.891)	(0.620)	(1.074)	(0.879)	(1.296)	(0.650)
LINF	-0.414	-0.330	-4.329***	-1.482	0.678	-2.550	0.261	-4.814*
	(1.439)	(1.483)	(1.316)	(2.697)	(3.169)	(1.820)	(2.469)	(2.902)
LPC	**5.783****	**4.195***	**4.554***	**4.517**	**0.263**	**4.943**	**6.286**	**5.820**
	(2.816)	(2.303)	(2.602)	(5.131)	(4.120)	(3.769)	(4.712)	(5.548)
LPC2	**-0.765****	**-0.531***	**-0.602***	**-0.557**	**-0.0456**	**-0.551**	**-0.720**	**-0.764**
	(0.373)	(0.294)	(0.327)	(0.563)	(0.460)	(0.442)	(0.576)	(0.611)
LPDS	**-0.315*****	**-0.264****	**-0.289*****	**-0.595*****	**-0.209**	**-0.333***	**-0.586*****	**-0.0720**
	(0.0628)	(0.128)	(0.104)	(0.113)	(0.163)	(0.191)	(0.153)	(0.180)
LPDS*SM_VOL80	**0.0438****	**0.0436****	**0.0688*****	**0.0346****	**0.0173**	**0.0538****	**0.0579****	**0.0343**
	(0.0188)	(0.0199)	(0.0220)	(0.0146)	(0.0257)	(0.0226)	(0.0281)	(0.0222)
LSMC	**-0.00385**	**0.0615**	**-0.0508**	**0.135****	**0.198**	**0.262**	**0.116**	**0.106***
	(0.0915)	(0.0842)	(0.0746)	(0.0530)	(0.129)	(0.170)	(0.175)	(0.0598)
LPC*PCRAT	**-0.163**	**-0.255***	**-0.326****	**-0.393*****	**-0.348**	**-0.407****	**-0.364*****	**-0.316****
	(0.154)	(0.144)	(0.139)	(0.136)	(0.222)	(0.176)	(0.119)	(0.133)
LPDS*DSRAT					**-0.000115**	**-0.000389**	**0.000501***	**-0.00271***
					(0.000731)	(0.000694)	(0.000262)	(0.00143)
Observations	325	296	189	117	229	211	151	111
R-squared	0.666	0.709	0.800	0.915	0.676	0.777	0.806	0.907
Number of cntr_id	31	26	17	10	25	22	16	9

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Sensitivity: Non-linear impact with structure ratios. Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: World Bank and Bank for International Settlements. Estimator: Anderson-Hsiao. Unbalanced panel with sample initiating mainly from 1990 (LGDP instrumented also with previous data).

VARIABLES \ Countries:	(1) All avlb.	(2) OECD	(3) EU	(4) EMU1999	(5) All avlb.	(6) OECD	(7) EU	(8) EMU1999	(9) All avlb.	(10) OECD	(11) EU	(12) EMU1999
LGDP	3.507	-6.063	-12.13**	-8.641*	1.361	-15.71	-25.58**	-13.98***	-1.743	-19.99**	-27.12***	-15.99***
	(5.801)	(6.506)	(4.771)	(4.595)	(6.346)	(12.36)	(11.22)	(4.803)	(6.518)	(9.902)	(10.32)	(5.294)
LEDU	0.684	0.274	0.149	0.157	0.972	0.383	0.287	0.581	0.947	0.289	0.139	0.496
	(0.608)	(0.496)	(0.545)	(0.675)	(0.661)	(0.465)	(0.505)	(0.773)	(0.613)	(0.418)	(0.468)	(0.657)
LGC	7.318**	2.216	0.352	3.770**	6.609*	0.0982	-3.024	2.342*	5.828	-0.755	-3.469	1.589
	(3.589)	(1.949)	(2.737)	(1.701)	(3.540)	(3.287)	(4.333)	(1.320)	(3.660)	(2.744)	(3.786)	(1.535)
LOPEN	0.758	-0.391	0.280	2.662***	0.579	-0.827	-0.873	1.943***	0.256	-1.148	-1.025	1.451*
	(1.290)	(1.058)	(1.256)	(0.647)	(1.197)	(0.971)	(1.323)	(0.692)	(1.200)	(0.865)	(1.172)	(0.777)
LINF	0.305	-3.595*	-1.451	-8.387***	0.311	-3.623*	-1.069	-5.242*	0.316	-3.511	-0.574	-3.520
	(4.013)	(1.970)	(2.406)	(3.250)	(4.002)	(2.034)	(3.646)	(2.891)	(3.772)	(2.372)	(4.406)	(2.562)
LPC	**-3.320*** **	**-1.882*** **	**-1.453*** **	**-1.187***	**1.892**	**10.95**	**18.95**	**11.08*** **	**3.404**	**14.84**	**22.20** **	**12.80*** **
	(1.149)	(0.728)	(0.544)	(0.689)	(5.144)	(9.640)	(11.81)	(3.970)	(5.539)	(9.267)	(11.29)	(4.652)
LPC2					**-0.608**	**-1.481**	**-2.411***	**-1.416*** **	**-0.715**	**-1.847***	**-2.740** **	**-1.526*** **
					(0.615)	(1.124)	(1.424)	(0.449)	(0.628)	(1.087)	(1.369)	(0.532)
LPDS	**-0.280***	**-0.272** **	**-0.509*** **	**-0.343** **	**-0.290** **	**-0.244*** **	**-0.346*** **	**-0.303** **	**-0.210**	**-0.201** **	**-0.309** **	**-0.299**
	(0.151)	(0.135)	(0.147)	(0.143)	(0.143)	(0.0913)	(0.103)	(0.131)	(0.146)	(0.0998)	(0.142)	(0.184)
LPDS*SM_VOL80					**0.0122**	**0.0364***	**0.0497** **	**0.0343** **	**0.0200**	**0.0385** **	**0.0492***	**0.0346** **
					(0.0218)	(0.0196)	(0.0238)	(0.0164)	(0.0204)	(0.0190)	(0.0257)	(0.0160)
LSMC	**-0.00304**	**0.182**	**0.0712**	**0.0990**	**-0.00923**	**0.178**	**0.0769**	**0.0966*** **	**0.00769**	**0.207***	**0.0726**	**0.0873** **
	(0.162)	(0.157)	(0.161)	(0.0840)	(0.165)	(0.133)	(0.140)	(0.0352)	(0.155)	(0.125)	(0.135)	(0.0383)
LPC*PCRAT									**-0.295**	**-0.345** **	**-0.275** **	**-0.437*** **
									(0.238)	(0.156)	(0.118)	(0.111)
LPDS*DSRAT									**0.000134**	**0.000260**	**0.000997**	**-0.000547**
									(0.000483)	(0.000522)	(0.000657)	(0.00136)
Observations	267	248	182	139	257	238	174	131	248	230	167	124
R-squared	0.556	0.733	0.795	0.885	0.599	0.794	0.820	0.907	0.658	0.804	0.819	0.914
Number of cntr_id	25	22	16	9	25	22	16	9	25	22	16	9

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Sensitivity: results with BIS data of credit and debt securities. Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: Bank for International Settlements. Estimator: Anderson-Hsiao. Unbalanced panel with sample initiating mainly from 1990 (LGDP instrumented also with previous data).

4.2. Financial depth, growth and swings of asset prices in housing and stock markets

Financial structure can have different impact on economic growth during different market conditions e.g. the upswings or downswings of asset prices of various intensity. In order to consider such effects and financing structure (namely, the bank-based vs market-based) impact on economic growth rates, we proceed by following a part of the study offered by Langfield and Pagano (2016) with some extensions. Specifically, the hypothesis is tested that bank-based financial structures feature lower economic growth, particularly during times of smaller or larger swings in asset prices of stock and housing markets. According to this hypothesis, banks' credit creation features inefficiencies that could be detrimental to economic growth, both in the upswing and the downswing of asset prices, where also these inefficiencies can be magnified during times of crisis.

As in the previous section, one of our aims is to evaluate whether findings established previously (namely, in Langfield and Pagano, 2016) that were obtained relying on a broader set of countries also hold whenever we consider narrower regions. Although our general interest again is mainly in the EU and EMU MS, we also provide empirics for the OECD as well as the full sample of countries.

To evaluate the impact of structure, we generate an additional bank-market ratio variable defined as the ratio between private credit to outstanding debt securities and stock market capitalization (PC_MK) and estimate the specification *a la* Langfield and Pagano by including dummies of growth and slump periods of the stock market (Table 8 & 10) and the housing market (Table 10 & 11). In detail, Table 8 provides the findings of the estimations referring to stock market growth and slump periods (SM growth and SM slump, respectively), taking the value 1 when a country's stock market increase or decrease at an average annual rate of at least 10%, 5%, 3%, and 2% over 5 years (see columns 1-4, 5-8, 9-12 and 13-16, respectively). The interaction variable between the aforementioned dummies and the bank-market ratio is also used. The considered range of various growth rates represents different intensity/pressure of asset prices: from bums and boosts to more moderate growth and slump periods.

Results reveal that for the whole sample of countries bank-market ratio is negatively correlated with GDP growth, in line with Langfield and Pagano (2016) (see columns 1, 5, 9, 13). So, an increase in the size of a country's banking sector relative to securities and stock market capitalization is associated with lower GDP growth in the subsequent five-year period, when conditioning on the variation of asset prices is taken into account. However, for the more developed group of economies non-significant estimates are found. The interaction term between bank-market ratio and growth periods of the stock market does not

present any statistical significance results, in line with Langfield and Pagano (2016), while the respective slump dummy exhibits a positive association with GDP in the subsequent 5 year period. Interestingly, when we include the standard control variables in our specification results differ substantially, as the statistically significant negative effect of the bank-market ratio is no longer present[15] (see Table 9, columns 5-12). The latter also holds for the interactions between growth and slump periods and the bank-market ratio, as no significant relations are found. On the other hand, it is of interest to note that the credit to deposit ratio (CRED_DEP), which has been introduced as a measure of systemic risk, consistently has a negative sign and often becomes significant. It should be also noted that for the last exercise we used the threshold of 2% which gave stable signs of variables of interest in different groups of countries and can be thought as representing if there is relative gain or loss in the considered markets in real terms.

[15] It should be pointed out that insignificance of financial-market-structure-connected series remains also when credit to deposit ratio (CRED_DEP) is absent from specifications presented in Columns (9) –(12) of Table 11.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Threshold (annual):	10%	10%	10%	10%	5%	5%	5%	5%	3%	3%	3%	3%	2%	2%	2%	2%
VARIABLES \ Countries:	All avlb.	OECD	EU	EU1999	All avlb.	OECD	EU	EU1999	All avlb.	OECD	EU	EU1999	All avlb.	OECD	EU	EU1999
PC_MK	**-1.304*** **	**-0.569**	**-0.136**	**-0.0291**	**-1.202*** **	**-0.403**	**0.0127**	**-0.128**	**-1.150*** **	**-0.392**	**-0.277**	**-0.554**	**-1.109*** **	**-0.525**	**-0.335**	**-0.677**
	(0.399)	(0.369)	(0.424)	(1.028)	(0.408)	(0.339)	(0.452)	(0.871)	(0.399)	(0.332)	(0.532)	(0.680)	(0.396)	(0.333)	(0.570)	(0.619)
PC_MK (SM slump)	**1.215*** **	**0.0863**	**0.0120**	**-55.45**	**1.163*** **	**0.126**	**0.0539**	**-0.408**	**1.059** **	**0.0725**	**0.309**	**-0.136**	**1.016** **	**0.263**	**0.459**	**0.0142**
	(0.397)	(0.657)	(0.707)	(68.30)	(0.391)	(0.490)	(0.382)	(0.337)	(0.393)	(0.363)	(0.281)	(0.493)	(0.385)	(0.365)	(0.360)	(0.716)
PC_MK (SM growth)	**0.621**	**0.525**	**0.293**	**0.0945**	**0.219**	**0.0351**	**-0.115**	**-0.203**	**0.221**	**-0.0197**	**0.180**	**0.00314**	**0.0753**	**0.107**	**0.246**	**0.136**
	(0.409)	(0.339)	(0.355)	(0.581)	(0.374)	(0.320)	(0.327)	(0.483)	(0.377)	(0.295)	(0.413)	(0.638)	(0.366)	(0.265)	(0.411)	(0.793)
SM slump	-0.765	0.321	0.446	58.52	-1.017**	-0.212	0.156	1.010*	-0.839**	-0.0258	-0.112	0.761	-0.872**	-0.223	-0.212	0.752
	(0.537)	(0.751)	(0.956)	(71.10)	(0.467)	(0.457)	(0.632)	(0.457)	(0.384)	(0.330)	(0.469)	(0.765)	(0.352)	(0.349)	(0.571)	(0.876)
SM growth	-0.534	-0.182	0.0860	0.268	-0.0868	0.113	0.292	0.491	-0.0151	0.164	-0.154	0.0759	0.0203	0.00473	-0.116	0.0328
	(0.372)	(0.328)	(0.419)	(0.588)	(0.344)	(0.297)	(0.474)	(0.733)	(0.335)	(0.287)	(0.499)	(0.900)	(0.343)	(0.225)	(0.620)	(1.033)
Constant	2.399***	0.498	-0.679	-0.614	2.211***	0.340	-0.799	-0.460	2.016***	0.323	-0.430	0.128	2.053***	0.468	-0.494	0.0965
	(0.633)	(0.569)	(0.716)	(1.882)	(0.644)	(0.614)	(0.906)	(1.736)	(0.582)	(0.626)	(0.940)	(1.377)	(0.588)	(0.611)	(1.023)	(1.275)
Observations	450	320	195	122	450	320	195	122	450	320	195	122	450	320	195	122
R-squared	0.321	0.611	0.672	0.722	0.313	0.596	0.662	0.727	0.306	0.594	0.663	0.731	0.307	0.594	0.665	0.737
Number of cntr_id	40	27	19	10	40	27	19	10	40	27	19	10	40	27	19	10

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Impact of ratio of private credit to outstanding debt securities and stock market capitalization on economic growth (and its interaction with growth and slump indicators of stock market), various thresholds. Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: World Bank. Estimator: Fixed Effects. Unbalanced panel with sample initiating mainly from 1989.

VARIABLES \ Countr.	(1) All avlb.	(2) OECD	(3) EU	(4) EU1999	(5) All avlb.	(6) OECD	(7) EU	(8) EU1999	(9) All avlb.	(10) OECD	(11) EU	(12) EU1999
CRED_DEP					**-2.327****	**-0.989**	**-0.700**	**-3.880****	**-1.494****	**-0.701***	**-0.217**	**-0.509**
					(1.009)	(0.833)	(1.048)	(1.609)	(0.583)	(0.378)	(0.230)	(0.738)
PC_MK	**-1.109*****	**-0.525**	**-0.335**	**-0.677**	**-0.528**	**-0.327**	**-0.469**	**-0.134**	**-0.115**	**0.185**	**-0.182**	**-0.213**
	(0.396)	(0.333)	(0.570)	(0.619)	(0.404)	(0.435)	(0.694)	(0.668)	(0.313)	(0.290)	(0.201)	(0.280)
PC_MK (SM slump)	**1.016****	**0.263**	**0.459**	**0.0142**	**0.643***	**0.283**	**0.665**	**0.125**	**0.196**	**0.200**	**0.222**	**0.115**
	(0.385)	(0.365)	(0.360)	(0.716)	(0.347)	(0.405)	(0.489)	(0.672)	(0.247)	(0.281)	(0.298)	(0.355)
PC_MK (SM growth)	**0.0753**	**0.107**	**0.246**	**0.136**	**-0.0271**	**0.0939**	**0.460**	**-0.0793**	**-0.275**	**-0.0226**	**0.0509**	**-0.209**
	(0.366)	(0.265)	(0.411)	(0.793)	(0.363)	(0.283)	(0.457)	(0.502)	(0.300)	(0.185)	(0.191)	(0.287)
SM slump	-0.872**	-0.223	-0.212	0.752	-0.437	-0.134	-0.329	0.636	-0.212	-0.0540	-0.00668	0.196
	(0.352)	(0.349)	(0.571)	(0.876)	(0.371)	(0.392)	(0.711)	(0.819)	(0.311)	(0.301)	(0.386)	(0.501)
SM growth	0.0203	0.00473	-0.116	0.0328	0.259	0.121	-0.250	0.408	0.540*	0.326	0.206	0.425
	(0.343)	(0.225)	(0.620)	(1.033)	(0.344)	(0.254)	(0.776)	(0.767)	(0.314)	(0.198)	(0.332)	(0.511)
LGDP									-8.496***	-7.436***	-14.24***	-14.21***
									(2.711)	(2.303)	(3.195)	(2.123)
LEDU									5.720***	-1.511	-1.169	-0.100
									(1.588)	(1.462)	(1.769)	(1.178)
LGC									0.118	-0.405	-6.253	-2.314
									(2.185)	(2.394)	(4.735)	(3.340)
LOPEN									1.413	3.199**	4.011**	4.417**
									(1.582)	(1.195)	(1.780)	(1.576)
LINF									-5.209	-10.08*	-11.61	6.591
									(4.454)	(5.551)	(6.966)	(5.606)
Observations	450	320	195	122	426	296	171	122	386	282	168	121
R-squared	0.307	0.594	0.665	0.737	0.396	0.596	0.661	0.825	0.588	0.742	0.855	0.941
Number of cntr_id	40	27	19	10	39	26	18	10	37	26	18	10

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Impact of ratio of private credit to outstanding debt securities and stock market capitalization on economic growth (and its interaction with growth and slump indicators of stock market), 2% annual threshold. Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: World Bank. Estimator: Fixed Effects. Unbalanced panel with sample initiating mainly from 1989

In the next two groups of estimations we re-estimate the specification taking into account housing prices instead of stock market ones (see Tables 10 & 11 below). We can once more infer that negative effect of the bank-market ratio vanishes when the standard set of control variables is included in our estimations. This also holds for the interaction referring to the slump period of the housing market and the bank-market ratio. The interesting insight is that relative increase of credit financing during periods of high growth in the housing market reduces economic growth rates: it has consistently negative sign of impact and also significant for the cases of all countries and EU member states (columns (9) and (11)). This is again fully consistent with the previously results established in Tables 5 and 7.

We next summarize the empirical findings about the bank-to-market based financing impact on economic growth under different conditions in stock and housing markets as represented by their asset prices. For larger sample of countries there is evidence that, evaluating unconditionally, expansion of relative bank-based financing hurts economic growth, whereas the negative effect disappears during the slumps of stock market (the positive coefficient of interaction term PC_MK (SM slump) is insignificantly different in absolute terms from the negative coefficient of unconditional credit-to-market impact revealed by PC_MK indicator). For the EU and EMU both the unconditional impact and the cushion effect does not seem to be significant and all the effects become insignificant after including the 'standard controls'.

For larger sample of countries, the boom in housing prices coupled with relative expansion of credit reduces the growth rates and survives the conditioning on the control variables. It also remains significant in the EU case when the controls are included. In fact, the credit-to-market interaction with housing booms (PC_MK (HS growth)) term is among the two variables that consistently retain the (negative) sign across various groups of countries and specifications. The other one being the credit-to-deposit variable. It seems therefore that there is a general tendency for future growth rates to decrease when the credit is not financed out of savings and when there are booms of housing prices coupled with expansion of bank credit relative to market-based financing.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Threshold (annual):	5%	5%	5%	5%	3%	3%	3%	3%	2%	2%	2%	2%	1%	1%	1%	1%
VARIABLES \ Countries:	All avlb.	OECD	EU	EU1999	All avlb.	OECD	EU	EU1999	All avlb.	OECD	EU	EU1999	All avlb.	OECD	EU	EU1999
PC_MK	**-0.335*** **	**-0.970*** **	**0.312**	**-0.300**	**-0.328*** **	**-0.837** **	**0.439**	**0.436**	**-0.161**	**-0.668***	**0.476**	**0.777**	**-0.100**	**-0.850** **	**0.194**	**1.060**
	(0.111)	(0.310)	(0.493)	(0.693)	(0.0759)	(0.364)	(0.520)	(1.101)	(0.128)	(0.371)	(0.539)	(1.142)	(0.148)	(0.382)	(0.387)	(1.135)
PC_MK (HS slump)	**-0.742**	**2.044*** **	**0.629**	**0.456**	**-0.638**	**0.923**	**0.404**	**-0.435**	**-0.295**	**-0.204**	**0.241**	**-0.998**	**-0.216**	**0.0680**	**0.504**	**-0.450**
	(0.866)	(0.692)	(0.774)	(0.414)	(0.668)	(0.561)	(0.857)	(0.968)	(0.444)	(0.506)	(0.330)	(0.962)	(0.484)	(0.490)	(0.328)	(0.831)
PC_MK (HS growth)	**-0.344**	**-0.0630**	**-0.524**	**-0.175**	**-0.530***	**-0.109**	**-0.568**	**-1.095**	**-0.317*** **	**-0.419**	**-0.654**	**-1.468**	**-0.336*** **	**-0.239**	**-0.353**	**-1.577**
	(0.338)	(0.389)	(0.394)	(0.442)	(0.271)	(0.404)	(0.494)	(0.924)	(0.109)	(0.415)	(0.535)	(0.999)	(0.0744)	(0.371)	(0.506)	(1.008)
HS slump	1.371	-1.135	0.223	0.587	1.131	-0.0758	0.202	1.595	0.601	0.488	0.368	2.020	0.588	0.145	0.655	2.136
	(0.980)	(0.780)	(0.892)	(0.469)	(0.756)	(0.760)	(0.925)	(1.217)	(0.517)	(0.662)	(0.272)	(1.158)	(0.550)	(0.594)	(0.433)	(1.238)
HS growth	-0.342	-0.183	0.255	0.174	-0.461	-0.160	-0.0632	1.049	-0.576**	0.0946	-0.00175	1.215	-0.314	-0.0185	0.322	2.141
	(0.430)	(0.281)	(0.373)	(0.404)	(0.291)	(0.285)	(0.534)	(1.124)	(0.267)	(0.306)	(0.533)	(1.199)	(0.208)	(0.316)	(0.688)	(1.463)
Constant	1.106***	1.239**	-1.122	-0.192	1.598***	1.166**	-0.836	-0.975	1.455***	1.161**	-0.727	-1.070	1.226***	1.325**	-0.899	-2.117
	(0.262)	(0.461)	(0.972)	(1.379)	(0.337)	(0.510)	(0.863)	(1.778)	(0.322)	(0.497)	(0.811)	(1.744)	(0.297)	(0.544)	(0.783)	(1.998)
Observations	408	302	181	120	408	302	181	120	408	302	181	120	408	302	181	120
R-squared	0.458	0.650	0.723	0.708	0.510	0.655	0.734	0.715	0.483	0.642	0.743	0.720	0.456	0.638	0.743	0.722
Number of cntr_id	33	20	15	9	33	20	15	9	33	20	15	9	33	20	15	9

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10: Impact of ratio of private credit to outstanding debt securities and stock market capitalization (PC_MK) on economic growth (and its interaction with growth and slump indicators of housing market), various thresholds. Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: World Bank. Estimator: Fixed Effects. Unbalanced panel with sample initiating mainly from 1989.

VARIABLES \ Countr.:	(1) All avlb.	(2) OECD	(3) EU	(4) EU1999	(5) All avlb.	(6) OECD	(7) EU	(8) EU1999	(9) All avlb.	(10) OECD	(11) EU	(12) EU1999
CRED_DEP					**-1.513***	**-0.709**	**-0.796**	**-4.089*****	**-1.180****	**-0.685***	**-0.399**	**-1.272**
					(0.836)	(0.782)	(0.912)	(1.203)	(0.522)	(0.342)	(0.247)	(0.967)
PC_MK	**-0.161**	**-0.668***	**0.476**	**0.777**	**0.0118**	**-0.565**	**0.581**	**0.613**	**0.127**	**-0.0139**	**0.0753**	**-0.0692**
	(0.128)	(0.371)	(0.539)	(1.142)	(0.102)	(0.420)	(0.638)	(0.643)	(0.114)	(0.312)	(0.242)	(0.335)
PC_MK (HS slump)	**-0.295**	**-0.204**	**0.241**	**-0.998**	**-0.168**	**-0.0801**	**0.0230**	**1.106***	**0.485**	**0.821***	**0.159**	**-0.0121**
	(0.444)	(0.506)	(0.330)	(0.962)	(0.448)	(0.563)	(0.380)	(0.538)	(0.295)	(0.410)	(0.324)	(0.554)
PC_MK (HS growth)	**-0.317*****	**-0.419**	**-0.654**	**-1.468**	**-0.312*****	**-0.537**	**-0.715**	**-0.679**	**-0.322*****	**-0.263**	**-0.359***	**-0.247**
	(0.109)	(0.415)	(0.535)	(0.999)	(0.107)	(0.402)	(0.536)	(0.426)	(0.0887)	(0.337)	(0.189)	(0.377)
HS slump	0.601	0.488	0.368	2.020	0.338	0.254	0.753	-0.245	-0.643	-0.999*	-0.466	-0.522
	(0.517)	(0.662)	(0.272)	(1.158)	(0.587)	(0.790)	(0.463)	(0.500)	(0.384)	(0.512)	(0.580)	(0.621)
HS growth	-0.576**	0.0946	-0.00175	1.215	-0.431	0.215	0.112	0.619	0.175	0.435	0.0868	0.205
	(0.267)	(0.306)	(0.533)	(1.199)	(0.266)	(0.304)	(0.724)	(0.672)	(0.241)	(0.277)	(0.271)	(0.471)
LGDP									-7.174***	-7.414***	-14.13***	-12.60**
									(1.543)	(2.193)	(2.973)	(3.815)
LEDU									2.902*	-0.569	-0.427	-0.735
									(1.501)	(1.053)	(0.718)	(1.018)
LGC									-0.121	0.568	-0.625	-0.265
									(1.986)	(2.113)	(3.812)	(4.111)
LOPEN									2.719*	3.786***	4.967***	4.146**
									(1.341)	(1.303)	(1.487)	(1.604)
LINF									-18.32***	-7.995	10.03	10.37
									(5.225)	(6.681)	(11.76)	(11.86)
Observations	408	302	181	120	379	273	152	120	339	260	149	119
R-squared	0.483	0.642	0.743	0.720	0.519	0.647	0.751	0.845	0.726	0.792	0.918	0.919
Number of cntr_id	33	20	15	9	32	19	14	9	30	19	14	9

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Impact of ratio of private credit to outstanding debt securities and stock market capitalization (PC_MK) on economic growth (and its interaction with growth and slump indicators of housing market), 2% annual threshold. Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: World Bank. Estimator: Fixed Effects. Unbalanced panel with sample initiating mainly from 1990.

4.3. Shifts of financial structure and growth empirics

To illustrate economic significance of the established results, we provide in the final part of this report some estimates on the possible impact of a change of financial composition in terms of the amount of credit provided in the economy among different sources (i.e. bank credit, debt securities or the stock market). In order to avoid too many assumptions we restrict ourselves to a very simple scenario of an increase of stock market capitalization in the EU MS by 10 percentage points, with the respective reduction of private credit originating from banks deriving the impact for various countries depending on their actual structure of financing (see Figure D1 in Appendix D). Note that the solid horizontal line signifies the overall median of impact (derived from all years), whereas the thinner one represents that of the particular year, and the relative coefficients are derived from Table 2, column 3 (see above).

Looking at the median impact of the described shift by 10 percentage points, we can infer that in 1995 it would have led to a median raise in 5-year GDP growth rates by more than 0.11 percentage point thereafter (see top-left chart). If the same shift of financial structure would have been implemented later on, the median impact becomes smaller. For instance, its implementation in 2013 would yield already only about 0.06 percentage point faster median 5-year growth rates (see bottom-right chart). Overall there is a path dependency of economic significance of structural policy on growth, implied by that the higher is the financial penetration, the lower will be a particular effect of this policy.

The above conclusions are based on the log-linear model estimated using credit series from the WB GFDD database. It should be pointed out that these data series on credit seem to have structural breaks for e.g. France, Denmark, Sweden. Hence, in Figure D2 of Appendix D we also present the calculated impact using the BIS credit data and the respective estimated model with log-linear financial series (see column 3 of Table 7). The ranking of the impact in the countries remains similar as well as the fading out impact for the later years of intervention, but the median impact on economic growth rates is higher and now reaches 0.21 percentage points (from 0.27 in 1995, to 0.14 in 2013).

The fading out effect of the impact established previously using the log-linear specification is connected with higher penetration of financing; to achieve the same impact on growth with higher levels of financial penetration requires larger adjustments in terms of structure. It is not the case anymore with the non-linear model. We therefore repeat the exercise using non-linear estimated model (see columns 7 and 11 of Table 7) and present the results in Figures D3 and D4 (see Appendix D), respectively. Since the later specification with the ratio of households to firm credit is available only for the data from BIS and the specifications in Table 7 for the EU and EMU are more significant than that with the WB presented in

Table 3, we rely in these simulations on the BIS data-linked estimates. Results connected with both specifications produce similar qualitative pattern with slightly higher median impact (ranging from 0.21 in 1995 to 0.32 in 2008) when derived using column 7 of Table 7 and somewhat smaller (ranging from 0.14 in 1995 to 0.29 in 2008) when derived using column 11 of Table 7.

As it is revealed by Figures 8 and 9, a simple and uniform reduction of the share of credit is no more beneficial for certain countries, because it could even worsen economic growth situation in some of them, provided that credit would have deviated even further from the peak of impact (turning point) due to this implemented policy.

5. Conclusions

This report offers insights on the financial development and economic growth debate, while emphasizing on relevant empirics for the European Union and the Euro area. The empirical findings can be grouped in several categories. First, results highlight that financial structure and growth are inextricably linked. Specifically, credit provided by banks presents an inverted U-like effect on growth (although having more general non-linearity than a simple inverted U-shape). For the EMU MS the threshold (peak of positive impact) is found to be close to 50%. This is conditional on the actual financing structure with substantial share of bank credit going to households. If all credit were directed towards financing of non-financial corporations, the estimated turning point would shift to around 65%. Estimates using the whole EU sample give similar but somewhat smaller thresholds. Consequently, large bank credit penetration relative to GDP, especially with heavy financing of households, can be more harmful to economic growth than estimated/thought previously.

Second, the structure of financing matters for economic growth: both the type of instrument of financing (bank loans, debt securities, and stock market) and the type of fund receivers (households, firms or financial corporations). Starting from the type of financing, bank credit appears to have the most negative impact and stock market a more positive one on economic growth during the analyzed period. Interestingly, the unconditional impact of outstanding debt securities tends to be negative, but when GDP growth rates are low relative to lending interest rates and/or stock market volatility is high, larger share of debt securities can facilitate economic growth.

Third, further disaggregation by beneficiaries of financial means reveals that the established negative impact of bank credit is connected with substantial financing of households. On the contrary,

bank credit to non-financial corporations tends to contribute to economic growth instead of hindering it. Furthermore, it seems to be more effective in terms of promoting economic growth relative to the financing using debt securities of non-financial corporations on average. In a similar manner, debt securities issued by the financial corporations seem to induce negative influence on future economic growth rates. Partially, this can be connected with that the domestic savings are outsourced to other markets thus reducing local funding of investments rather than due to poor performance of the financial institutions per se.

Fourth, and consistent with the third, expansion of bank credit relative to market-based financing during housing market booms affects economic growth negatively. Housing market booms facilitate expansion of credit to households both due to the increased needs for those acquiring housing and because of larger value of collateral acceptable to banks. This, together with larger return rates in this market, can divert and even reduce the means devoted to financing of productive firm investments. There also seem to be a general tendency for future growth rates to decrease whenever credit amounts are larger relative to (financed not out of) savings.

Finally, from the policy perspective, several alternatives connected with the financial deepness and its structure would seem to promote economic growth. Regarding the banking sector, it can be achieved both by reducing the bank credit to GDP levels in a number of European countries (as Europe's financial structure has become strongly bank-based with substantial bank credit penetration), and also by directing more credit towards non-financial corporations. The later has smaller economic impact on average, but the former depends nontrivially on the initial conditions of a particular economy (namely, the actual distance from the peak of credit impact, level of financial penetration of all modes of finance, etc.). Further development of debt securities market seem to be beneficial mostly with facilitation of growth during difficult periods, whereas further development of stock market seems to be favorable in general.

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List of abbreviations and definitions

GDP: GDP per capita (constant LCU).

PC: The financial resources provided to the private sector by domestic money banks as a share of GDP.

PC: (BIS) Total credit received by non-financial sector (adjusted for breaks).

PDS: Total amount of domestic private debt securities (amount outstanding) issued in domestic markets as a share of GDP.

SMC: Market capitalization of listed domestic companies as a percentage of GDP.

PCHSH: Private credit received by households.

PCNFC: Private credit received by non-financial corporations.

DSFCO: Debt securities issued by financial corporations.

DSNFC: Debt securities issued by non-financial corporations.

SM_VOL: Stock price volatility which is the average of the 360-day volatility of the national stock market index.

RGDPGR: Annual percentage growth rate of GDP at market prices based on constant local currency.

RIR: Real interest rate: the lending interest rate adjusted for inflation as measured by the GDP deflator.

CRED_DEPOS: Bank credit to bank deposits (%).

EDU: Gross enrolment ratio, secondary, both sexes (%).

GC: General government final consumption expenditure as a percentage of GDP.

OPEN: Trade openness (calculated as exports plus imports divided by GDP).

INF: Inflation, measured by the consumer price index (annual %).

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Appendix

Appendix A: Definitions and County Groups

Table 1A: Definitions and Sources of Original Data

Variable	Definition	Source
GDP	GDP per capita (constant LCU).	World Bank; World Development Indicators (WDI); 2015
PC	The financial resources provided to the private sector by domestic money banks as a share of GDP. Domestic money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits.	Global Financial Development Database (WB); 2015
PC (BIS)	Total credit received by non-financial sector (adjusted for breaks).	Bank for International Settlements (BIS), Credit to the Non-financial Sector; 2016
PDS	Total amount of domestic private debt securities (amount outstanding) issued in domestic markets as a share of GDP. It covers long-term bonds and notes, treasury bills, commercial paper and other short-term notes.	Global Financial development Database (WB); Original source: Bank for International Settlements (BIS); 2016
SMC	Market capitalization of listed domestic companies as a percentage of GDP.	World Bank; World Development Indicators (WDI).
PCHSH	Private credit received by households.	Bank for International Settlements (BIS), Credit to the Non-financial Sector; 2016.
PCNFC	Private credit received by non-financial corporations.	Bank for International Settlements (BIS), Credit to the Non-financial Sector; 2016
DSFCO	Debt securities issued by financial corporations.	Bank for International Settlements (BIS) Debt Securities Statistics; 2016.
DSNFC	Debt securities issued by non-financial corporations.	Bank for International Settlements (BIS) Debt Securities Statistics; 2016.
SM_VOL	Stock price volatility which is the average of the 360-day volatility of the national stock market index.	Global Financial Development Database (WB); 2015
RGDPGR	Annual percentage growth rate of GDP at market prices based on constant local currency.	World Bank; World Development Indicators (WDI); 2015
RIR	Real interest rate: the lending interest rate adjusted for inflation as measured by the GDP deflator.	World Bank; World Development Indicators (WDI); 2015
CRED_DEPOS	Bank credit to bank deposits (%).	Global Financial Development Database (WB); 2015. Original source: International Financial Statistics (IFS), International Monetary Fund (IMF).
EDU	Gross enrolment ratio, secondary, both sexes (%).	World Bank; World Development Indicators (WDI).

GC	General government final consumption expenditure as a percentage of GDP.	World Bank; World Development Indicators (WDI); 2015
OPEN	Trade openness (calculated as exports plus imports divided by GDP).	World Bank; World Development Indicators (WDI); 2015
INF	Inflation, measured by the consumer price index (annual %).	World Bank; World Development Indicators (WDI); 2015

Table 2A: Groups of Countries

Groups	Countries	No.
Full Sample	AUS,AUT,BEL,CAN,CHL,CHE,COL,CYP,CZE,DEU,DNK,ESP,FIN,FRA,GBR, GRC,HKG,HRV,HUN,IDN,IND,ISL,IRL,ITA,JPN,KOR,LBN,LUX,MEX,MLT, MYS,NLD,NOR,PER,PHL,POL,PRT,SVN,SVK,SWE,THA,TUR,USA,ZAF.	44
OECD	AUS,AUT,BEL,CAN,CHL,CHE,CZE,DEU,DNK,EST,FIN,FRA,GBR,GRC,HUN, ISL,IRL,ITA,JPN,KOR,LUX,MEX,NLD,NZL,NOR,POL,PRT,SVN,SVK,ESP, SWE,TUR,USA.	33
EU	AUT,BEL,BGR,CZE,CYP,DEU,DNK,EST,FIN,FRA,GBR,GRC,HRV,HUN,IRL, ITA,ESP,LTU,LVA,LUX,MLT,NLD, POL,PRT,ROU,SVN,SVK,SWE.	27
EMU1999	AUT,BEL,FIN,FRA,DEU,IRL,ITA,LUX,NLD,PRT,ESP.	11

* These countries constitute the corresponding groups of countries starting from Table 2. The number of observations available in the specific estimations can be smaller due to data limitation.

Appendix B: Economic variables and specifications

From the economic perspective, the vector of explanatory variables $\boldsymbol{x_{i,t}}$ in eq. (1) covers a couple of different types of variables. First, some standard control variables are included almost in all cases covering:

LGDP – logarithm of income per capita,

LEDU – logarithm of gross enrolment ratio[16], secondary, both sexes (%),

LGC – logarithm of general government final consumption expenditure (% of GDP),

LOPEN – logarithm of trade (% of GDP),

LINF – the inverse hyperbolic sigh transform (IHST) of consumer price inflation rate in % (CPI), i.e. log(CPI/100+sqrt(1+(CPI/100)^2)), where the IHST allows avoiding problems related to zero and negative values appearing when the usual log transformation is applied.

Second, $\boldsymbol{x_{i,t}}$ also covers several financial series under consideration used in different specifications:

a) in Table 1, following Arcand et al. (2015), we include:
   i. PC - private credit by deposit money banks to GDP (%),
   ii. PC2 – square of PC;
b) in Tables 2–4, in order to account for different financial structure we include:
   i. LPC – logarithm of PC,
   ii. LPDS – logarithm of outstanding domestic private debt securities to GDP (%),
   iii. LSMC – logarithm of market capitalization of listed domestic companies (% of GDP);
c) in Tables 5–6, we look at nonlinear impact by augmenting the specification indicated in b) with LPC2 (square of LPC) and additional interaction terms of LPDS with
   i. SM_VOL80 – an indicator if stock market volatility is higher than the 8th decile,
   ii. exp(RIR-RGDPGR) – exponent of the difference between real interest rates (RIR) and the growth rate of real GDP (RGDPGR);

[16] In this we follow Gambacorta et al. (2014), however main results remain unchanged if e.g. Barro and Lee logarithm of total average years of total schooling, age 25+ were used. We prefer the former one, because it has positive impact in most of considered equations, whereas the latter one becomes negative more often.

d) in Table 7, we look at the impact of structural composition of credit and outstanding private debt securities by including (in addition to LSMC):
    i. LPCHSH – logarithm of market value of credit to households & NPISHs (% to GDP),
    ii. LPCNFC – logarithm of market value of credit to Non-financial corporation (% to GDP),
    iii. LPDSFCO – IHST of outstanding debt securities by financial corporations (% to GDP)
    iv. LPDSNFC – IHST of outstanding debt securities by non-financial corporations (% to GDP).

e) in Tables 8–9, we augment the Table 5 specification with interaction terms of LPC with ratio of private credit to households (PCHSH) to credit to non-financial corporations (PCNFC) and LPDS with ratio of outstanding private debt securities by financial corporations (PDSFCO) to that of non-financial corporations (PDSNFC), i.e.:
    i. LPC*PCRAT = LPC*(PCHSH/ PCNFC),
    ii. LPDS*DSRAT = LPDS*(PDSFCO / PDSNFC),

f) in Tables 10–12, similar to Langfield and Pagano (2016) the impact of financial structure is investigated by including:
    i. PC_MK – ratio of PC to sum of outstanding private debt securities and stock market capitalization,
    ii. PC_MK (SM slump) – PC_MK interaction with stock market slump intensity indicator,
    iii. PC_MK (SM growth) – PC_MK interaction with stock market growth intensity indicator,
    iv. SM slump – stock market slump intensity indicator,
    v. SM growth – stock market growth intensity indicator,
    vi. CRED_DEP – credit to deposits ratio.

Appendix C: Sensitivity analysis of type of financing instrument impact on economic growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Interaction term:	**LPC**	**LPC**	**LPC**	**LPC**	**LPDS**	**LPDS**	**LPDS**	**LPDS**	**LSMC**	**LSMC**	**LSMC**	**LSMC**
VARIABLES \ Countries:	All avlb.	OECD	EU	EMU1999	All avlb.	OECD	EU	EMU1999	All avlb.	OECD	EU	EMU1999
LGDP	-17.25***	-13.78***	-20.82***	-11.30***	-15.45***	-12.86***	-16.76***	-11.21***	-14.39***	-12.84***	-16.96***	-11.75***
	(3.330)	(2.877)	(4.357)	(1.450)	(3.170)	(2.700)	(3.156)	(1.875)	(3.190)	(2.843)	(3.640)	(2.193)
LEDU	1.213**	0.526	0.379	-0.490	1.447**	0.684	0.470	-0.100	1.559**	0.580	0.336	-0.0478
	(0.558)	(0.402)	(0.507)	(0.499)	(0.633)	(0.423)	(0.573)	(0.582)	(0.675)	(0.395)	(0.484)	(0.622)
LGC	0.743	2.458*	-0.846	4.795***	1.258	2.756**	-0.398	3.611**	1.106	2.530*	-0.364	3.716***
	(1.141)	(1.371)	(2.078)	(1.210)	(1.066)	(1.292)	(1.600)	(1.631)	(1.107)	(1.343)	(1.918)	(1.232)
LOPEN	0.485	0.978*	0.677	2.818***	0.549	1.132*	0.883	2.855***	0.608	1.137*	1.125	2.695***
	(0.552)	(0.588)	(0.741)	(0.340)	(0.615)	(0.588)	(0.803)	(0.286)	(0.680)	(0.589)	(0.732)	(0.361)
LINF	0.533	0.178	-2.532	0.216	0.994	0.129	-3.477*	-1.558	1.125	0.331	-2.468	-1.995
	(0.980)	(0.921)	(1.922)	(3.776)	(0.974)	(0.992)	(1.852)	(3.855)	(1.002)	(0.924)	(1.793)	(3.890)
LPC	**-0.536****	**-0.310**	**-0.527****	**-0.374**	**-0.842*****	**-0.418***	**-0.611****	**-0.430**	**-0.851*****	**-0.387***	**-0.623****	**-0.410**
	(0.231)	(0.209)	(0.263)	(0.473)	(0.309)	(0.236)	(0.290)	(0.489)	(0.305)	(0.219)	(0.299)	(0.471)
LPDS	**-0.176*****	**-0.247***	**-0.205**	**-0.591*****	**-0.159****	**-0.251***	**-0.238**	**-0.568*****	**-0.175*****	**-0.228**	**-0.212***	**-0.531*****
	(0.0537)	(0.138)	(0.132)	(0.133)	(0.0650)	(0.151)	(0.154)	(0.129)	(0.0616)	(0.143)	(0.125)	(0.128)
LSMC	**-0.0193**	**0.0725**	**0.0414**	**0.267*****	**0.0106**	**0.0887**	**0.0294**	**0.219*****	**0.0345**	**0.101**	**0.0896**	**0.265*****
	(0.0709)	(0.0698)	(0.0638)	(0.0702)	(0.0727)	(0.0698)	(0.0647)	(0.0814)	(0.0947)	(0.0860)	(0.0859)	(0.0875)
Interact.term * I(year>=2003)	-0.322**	-0.166	-0.462***	0.0729	-0.0673*	-0.0878***	-0.111**	0.0485	-0.0543	-0.0685	-0.103	0.00887
	(0.137)	(0.114)	(0.149)	(0.137)	(0.0375)	(0.0277)	(0.0476)	(0.124)	(0.0581)	(0.0798)	(0.0953)	(0.116)
Interact.term * I(year>=2004)	-0.335*	-0.00622	-0.241	0.840*	-0.171***	-0.0677	-0.165	0.217	-0.000170	0.0994	-0.0385	-0.167
	(0.184)	(0.183)	(0.327)	(0.468)	(0.0618)	(0.105)	(0.115)	(0.503)	(0.109)	(0.142)	(0.246)	(0.305)
Interact.term * I(year>=2005)	-0.286***	-0.242***	-0.160	-0.223	-0.0755	0.0127	-0.00693	-0.384***	-0.0193	-0.174*	-0.0843	-0.240*
	(0.0707)	(0.0866)	(0.100)	(0.160)	(0.0565)	(0.0799)	(0.0652)	(0.0895)	(0.0966)	(0.104)	(0.0696)	(0.125)
Interact.term * I(year>=2006)	-0.231**	-0.0585	-0.378*	-0.389	-0.0379	0.0884	-0.0294	0.255	0.0393	0.00753	-0.139	-0.0383
	(0.0956)	(0.0817)	(0.208)	(0.294)	(0.0529)	(0.107)	(0.0983)	(0.193)	(0.0487)	(0.0606)	(0.109)	(0.214)
Interact.term * I(year>=2007)	-0.361***	-0.220**	-0.201	-0.574***	-0.0791	-0.0349	0.0220	-0.0185	0.000738	0.00526	-0.0229	-0.00393
	(0.0742)	(0.0896)	(0.169)	(0.213)	(0.0566)	(0.0728)	(0.0914)	(0.172)	(0.0613)	(0.0745)	(0.0933)	(0.215)
Interact.term * I(year>=2008)	-0.343**	-0.0741	-0.313	0.0834	-0.0704**	-0.0358	0.00799	0.296	0.0340	0.0350	-0.0857	0.0190
	(0.134)	(0.109)	(0.223)	(0.247)	(0.0346)	(0.0472)	(0.0659)	(0.223)	(0.0520)	(0.0692)	(0.138)	(0.177)
Observations	468	360	232	135	468	360	232	135	468	360	232	135
R-squared	0.718	0.748	0.801	0.908	0.693	0.743	0.799	0.901	0.676	0.740	0.791	0.900
Number of cntr_id	43	30	23	11	43	30	23	11	43	30	23	11

Table C1: Sensitivity: crisis period dummy interaction terms (an interaction term used in each case is specified in the second line, which is bolded). Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: World Bank. Estimator: Anderson-Hsiao. Unbalanced panel with sample initiating mainly from 1990 (LGDP instrumented also with previous data).

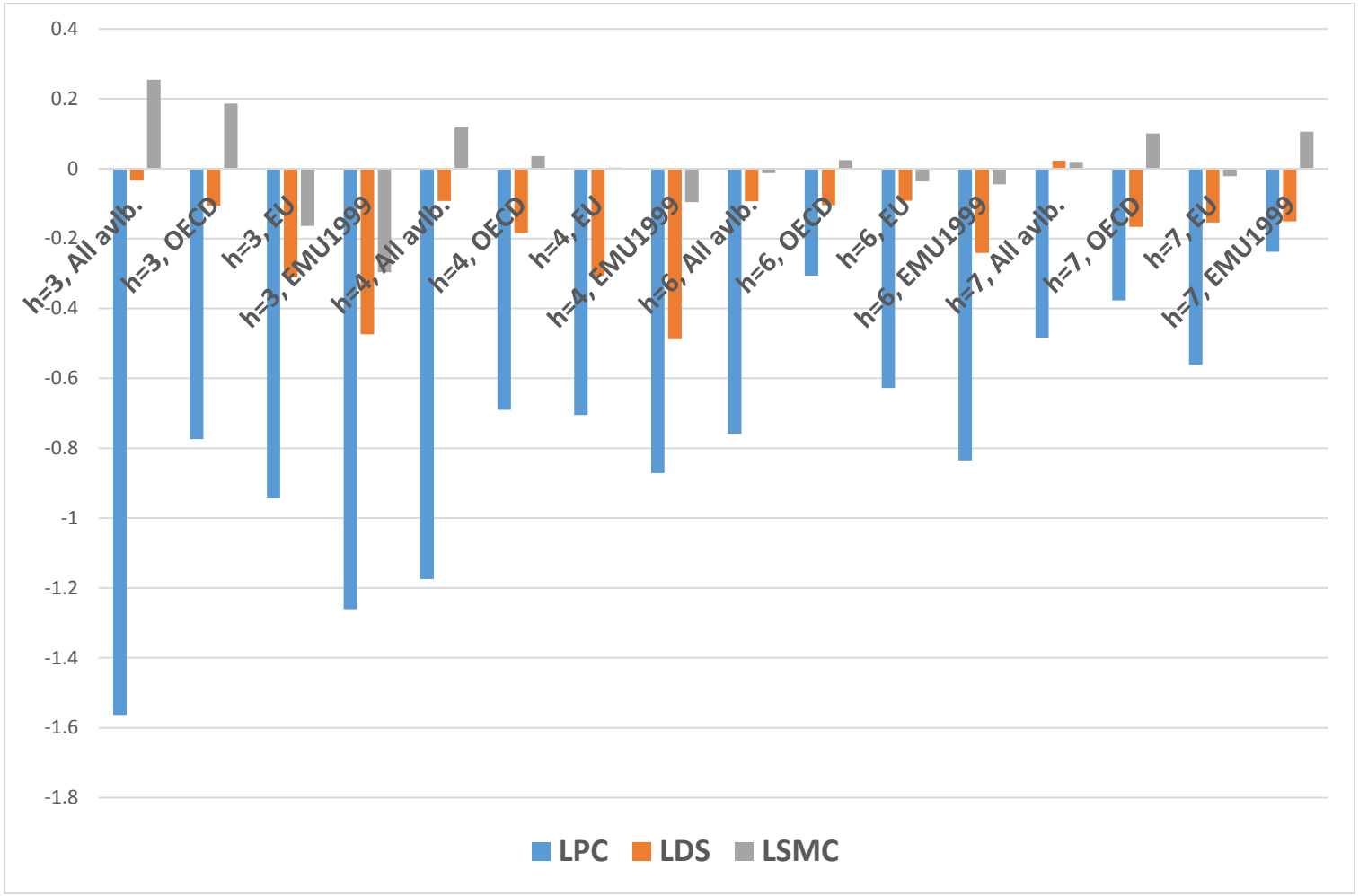
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Future periods:	**h=3**	**h=3**	**h=3**	**h=3**	**h=4**	**h=4**	**h=4**	**h=4**	**h=6**	**h=6**	**h=6**	**h=6**	**h=7**	**h=7**	**h=7**	**h=7**
VARIABLES	All avlb.	OECD	EU	EMU1999	All avlb.	OECD	EU	EMU1999	All avlb.	OECD	EU	EMU1999	All avlb.	OECD	EU	EMU1999
LGDP	-16.68***	-15.36***	-17.62***	-17.91***	-11.69***	-9.293**	-12.52***	-9.661**	-12.67***	-11.41***	-15.58***	-13.59***	-12.37***	-9.203**	-13.40***	-14.66***
	(4.326)	(4.246)	(4.778)	(5.426)	(3.887)	(3.712)	(4.202)	(4.308)	(2.889)	(3.224)	(3.586)	(2.306)	(2.897)	(4.137)	(3.668)	(2.518)
LEDU	-0.332	-0.908	-0.552	0.667	1.069	0.418	0.468	0.886**	0.519	-0.214	-0.488	0.241	0.585*	-0.0157	-0.0839	0.390**
	(0.859)	(0.856)	(0.761)	(0.542)	(0.832)	(0.478)	(0.473)	(0.433)	(0.506)	(0.421)	(0.487)	(0.289)	(0.322)	(0.322)	(0.360)	(0.186)
LGC	2.733**	4.623**	0.780	1.357	2.160	4.797***	3.098**	4.399**	0.756	1.077	-1.105	1.259	0.434	0.978	-1.014	-1.004
	(1.342)	(1.895)	(1.932)	(2.318)	(1.369)	(1.601)	(1.515)	(1.919)	(0.792)	(1.264)	(2.031)	(0.952)	(0.769)	(1.482)	(1.537)	(1.263)
LOPEN	0.428	0.938	1.676**	3.165***	0.712	1.479*	1.860**	4.050***	0.666	1.426***	1.307**	1.421**	0.320	0.944	0.974***	0.717
	(0.674)	(0.682)	(0.750)	(1.070)	(0.664)	(0.791)	(0.918)	(0.421)	(0.510)	(0.537)	(0.646)	(0.629)	(0.481)	(0.594)	(0.361)	(0.479)
LINF	3.326**	3.178	-6.262***	-3.770	2.554**	1.416	-1.463	-2.648	-0.0485	-1.607*	-3.812**	-0.121	0.265	-0.542	-2.203	3.342
	(1.644)	(2.677)	(1.893)	(3.820)	(1.172)	(1.757)	(2.010)	(1.886)	(1.048)	(0.899)	(1.819)	(3.190)	(0.772)	(0.721)	(1.829)	(2.994)
LPC	**-1.563*** **	**-0.774** **	**-0.943** **	**-1.261***	**-1.174*** **	**-0.690** **	**-0.705***	**-0.871**	**-0.758*** **	**-0.306***	**-0.628*** **	**-0.835** **	**-0.484*** **	**-0.377*** **	**-0.561*** **	**-0.238**
	(0.446)	(0.304)	(0.422)	(0.749)	(0.335)	(0.283)	(0.389)	(0.568)	(0.293)	(0.167)	(0.208)	(0.372)	(0.188)	(0.144)	(0.138)	(0.194)
LPDS	**-0.0343**	**-0.106**	**-0.311** **	**-0.474***	**-0.0922**	**-0.184**	**-0.307** **	**-0.488*** **	**-0.0934***	**-0.105**	**-0.0916**	**-0.241*** **	**0.0225**	**-0.166**	**-0.154**	**-0.151**
	(0.0863)	(0.203)	(0.157)	(0.255)	(0.0863)	(0.190)	(0.126)	(0.142)	(0.0498)	(0.129)	(0.114)	(0.0780)	(0.0850)	(0.208)	(0.180)	(0.142)
LSMC	**0.255** **	**0.186***	**-0.164**	**-0.296** **	**0.121**	**0.0356**	**0.00288**	**-0.0954**	**-0.0122**	**0.0242**	**-0.0363**	**-0.0445**	**0.0198**	**0.101**	**-0.0219**	**0.106**
	(0.112)	(0.113)	(0.168)	(0.149)	(0.0887)	(0.0645)	(0.0567)	(0.124)	(0.0943)	(0.0494)	(0.0608)	(0.139)	(0.0700)	(0.0659)	(0.0590)	(0.0856)
Observations	528	397	256	151	499	379	245	143	432	337	215	126	394	312	196	117
R-squared	0.673	0.717	0.820	0.863	0.639	0.690	0.772	0.882	0.662	0.693	0.785	0.867	0.656	0.677	0.771	0.874
Number of cntr_id	44	30	23	11	43	30	23	11	43	30	23	11	42	29	23	11

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table C2: Sensitivity: different future periods. Dependent variable: yearly GDP per capita average growth rates over 5 year periods ahead. Credit data source: World Bank. Estimator: Anderson-Hsiao. Unbalanced panel with sample initiating mainly from 1990 (LGDP instrumented also with previous data).

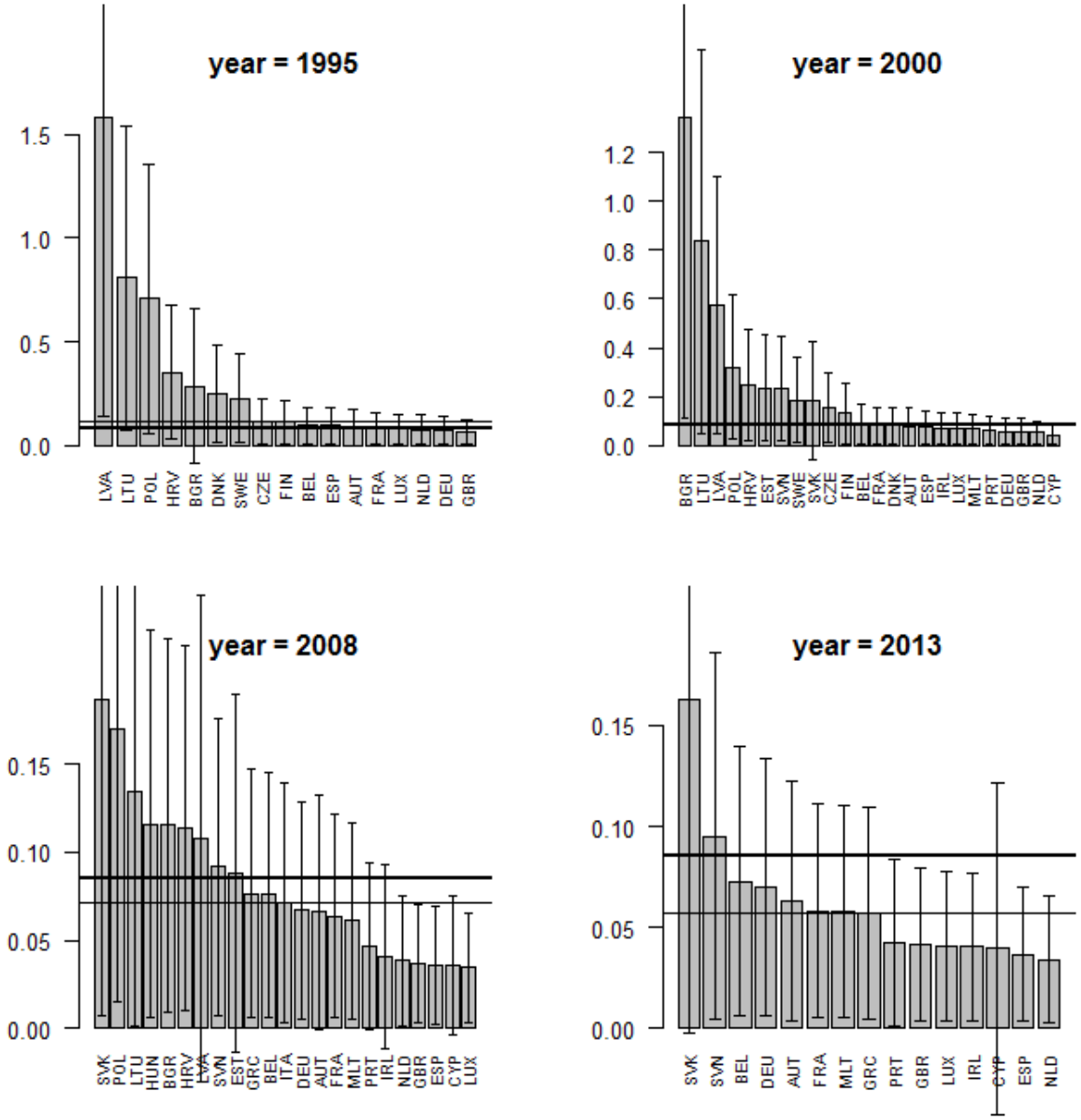
Figure C1: Coefficients of financing components in a log-linear model of economic growth as in eq. (1) for different future growth periods h∈{3,4,6,7} and groups of countries (AH estimator).



Note: LPC - private credit by banks to GDP; LDC - outstanding private debt securities to GDP; LSMC - stock market capitalization to GDP.

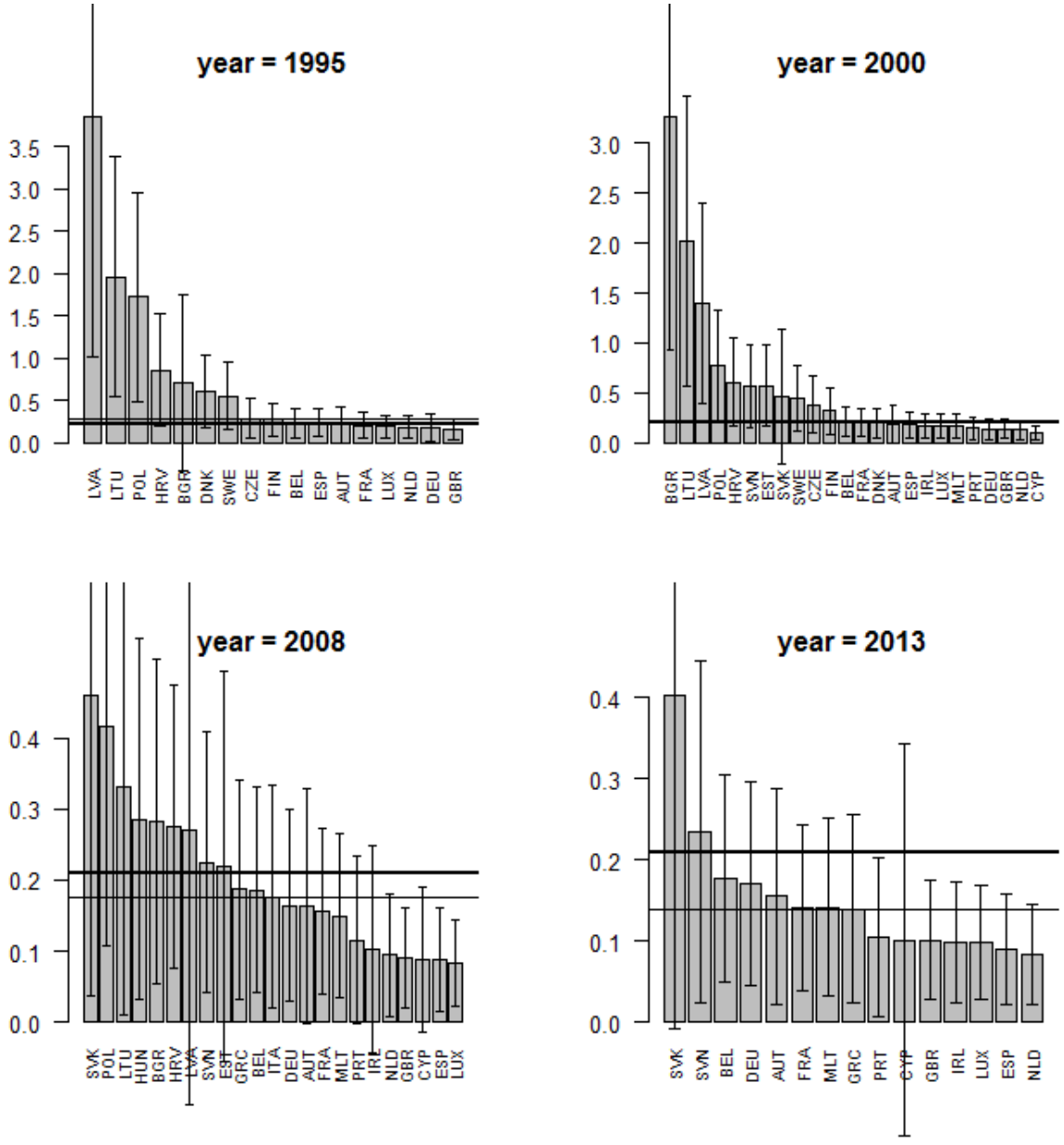
Appendix D: Simulated impact of changing financials composition

Figure D1: Impact with 95% confidence bounds on growth (in p.p.) from reducing private credit while increasing stock market capitalization to GDP by 10 p.p. (EU AH estimation), WB data, log-linear model (column 3 of Table 2).



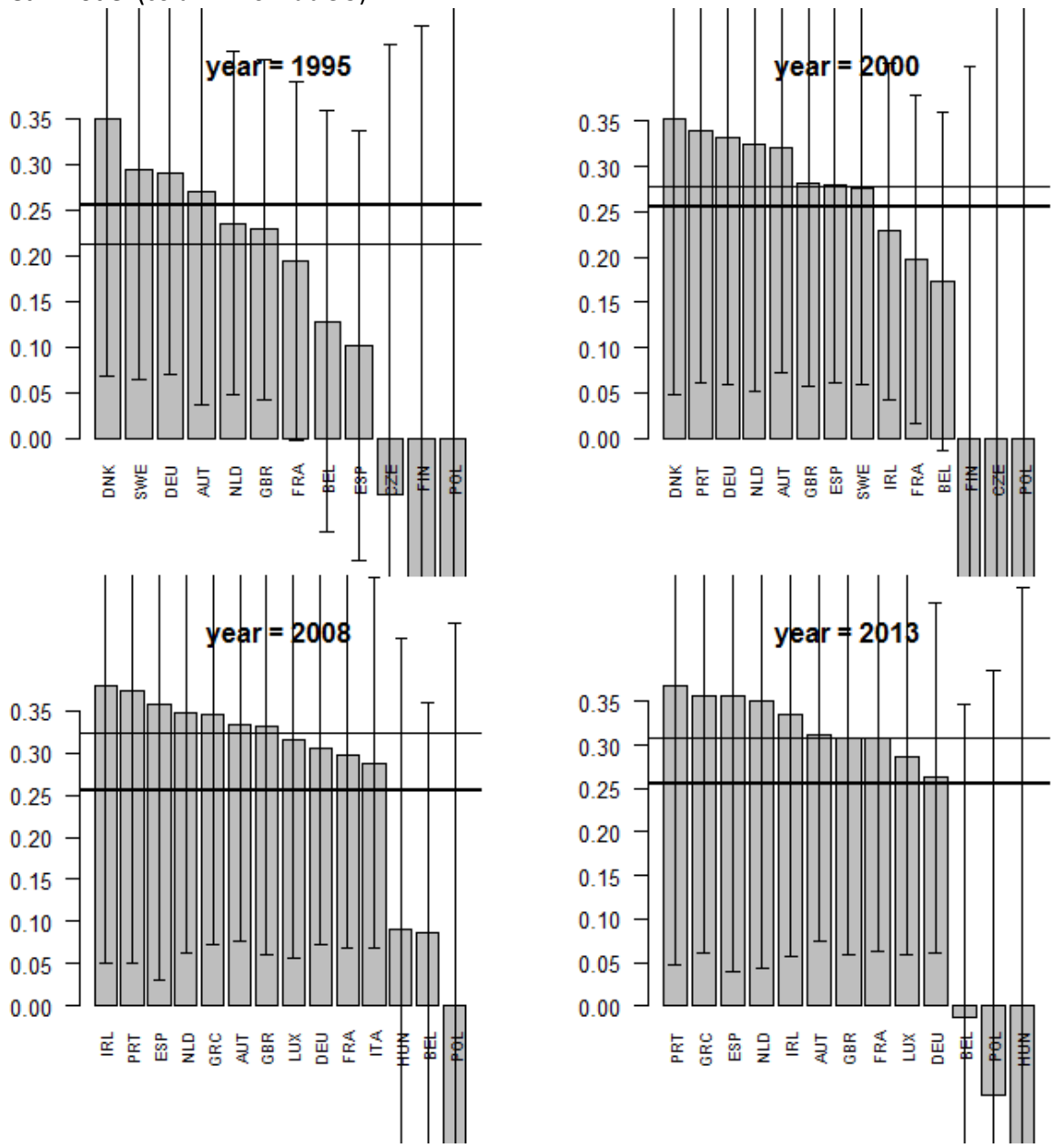
Note: solid horizontal line signifies the overall median of impact (derived from all years), whereas the thinner one represents that of the particular year.

Figure D2: Impact with 95% confidence bounds on growth (in p.p.) from reducing private credit while increasing stock market capitalization to GDP by 10 p.p. (EU AH estimation), BIS data, log-linear model (column 3 of Table 9).



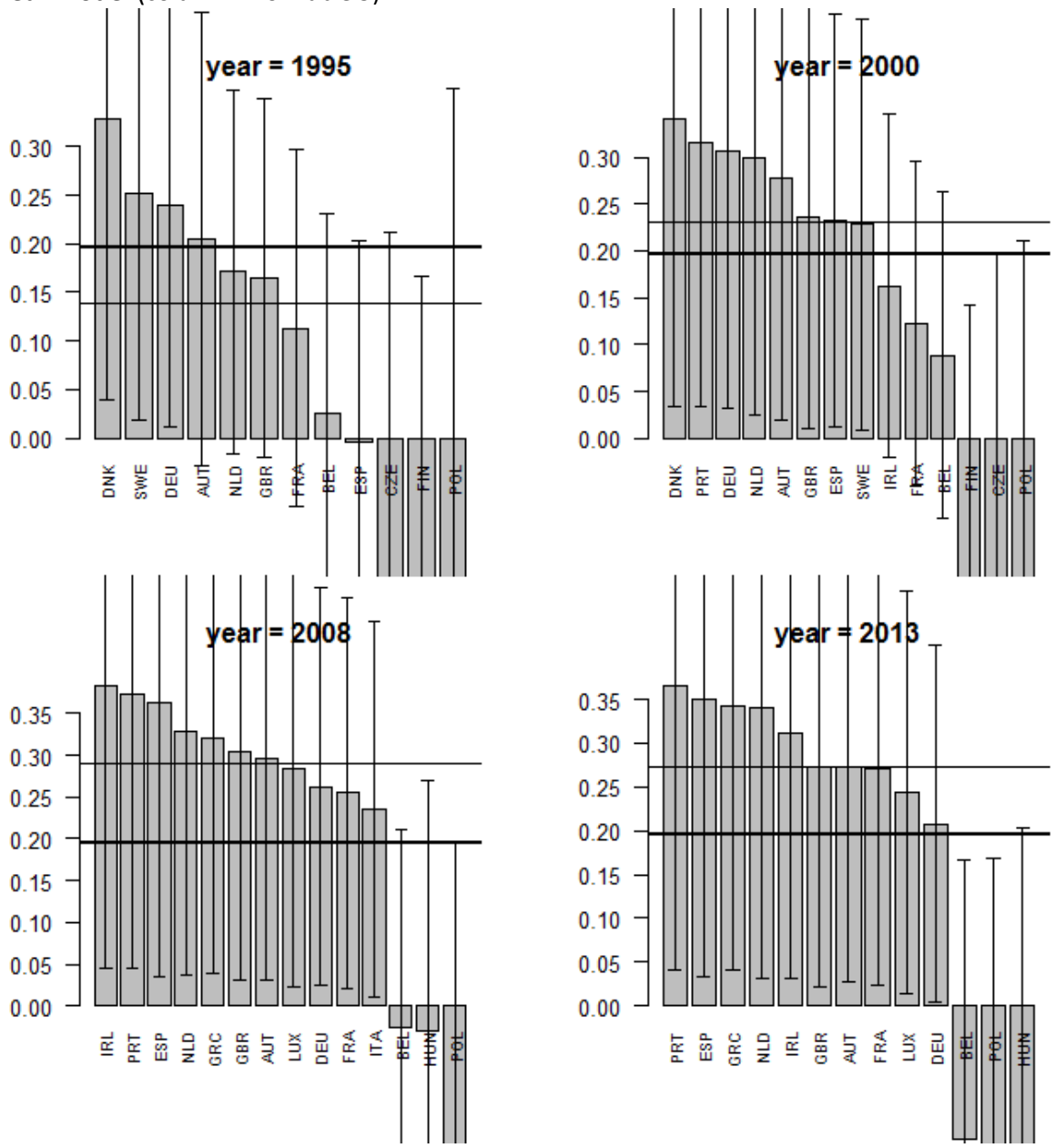
Note: solid horizontal line signifies the overall median of impact (derived from all years), whereas the thinner one represents that of the particular year.

Figure D3: Impact with 95% confidence bounds on growth (in p.p.) from reducing private credit while increasing stock market capitalization to GDP by 10 p.p. (EU AH estimation) BIS data, non-linear model (column 7 of Table 9).



Note: solid horizontal line signifies the overall median of impact (derived from all years), whereas the thinner one represents that of the particular year.

Figure D4: Impact with 95% confidence bounds on growth (in p.p.) from reducing private credit while increasing stock market capitalization to GDP by 10 p.p. (EU AH estimation) BIS data, non-linear model (column 11 of Table 9).



Note: solid horizontal line signifies the overall median of impact (derived from all years), whereas the thinner one represents that of the particular year.

Appendix E: Calculation of marginal impact and turning point

Denote by x the argument of interest (some financial series in our case) and let z be the part explaining the dependent variable which does not depend on x. Then $y = f(x,z) + z$ defines the value of the dependent variable y (growth rate in our case) at given values of x and z, where f: $A \times B \to \Re$, $A,B \subset \Re$. Namely, we consider the parameterization of (financial) impact of x by

$$f(x,z) = \alpha x + \beta \ln(x) + \delta \ln(x)^{\wedge 2} + \phi z \cdot \ln(x)$$

with the marginal impact

$$\partial y/\partial x = \partial f(x,z)/\partial x = \alpha + (\beta + \phi z)/x + 2\delta \ln(x)/x.$$

In simpler specifications $\alpha = 0$ and/or $\phi = 0$ are pre-imposed. Under proper values of parameters that ensure the negative second order derivative at the extreme, the peak of impact $x^*(z)$ satisfies

$$\alpha x^*(z) + 2\delta \ln(x^*(z)) = -(\beta + \phi z),$$

which, for $\alpha = 0$, simply yields

$$x^*(z) = \exp\{-(\beta + \phi z)/2\delta\}.$$

For instance, when z stands for the ratio of bank credit to households and non-financial corporations (correspondingly, with parameters satisfying $\beta > 0$, $\phi < 0$, $\delta < 0$), the turning point of f (in terms of x) corresponding to total amount of credit going only to firms is given by $x^* := x^*(0)$.

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