

The mechanisms linking the finance-growth relationship in view of the financial crisis: An empirical investigation of the EU countries

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Abstract

Purpose - The paper aims to explore the mechanisms linking the impact of financial development on economic growth and focuses on the long-term post-global financial crisis.

Design/Methodology/Approach - The study employs panel data for twenty-five European Union countries over the period 1995-2017. Principal Component Analysis is employed to produce two aggregate indices, namely financial banking sector development and stock market sector development. The empirical analysis is based on estimates through the autoregressive distributed lag (ARDL) method.

Findings - The results suggest that the outbreak of the crisis has led to a disruption of the positive finance-growth relationship, and the banking sector dominates in this adverse effect. The foreknowledge of the current study is that the linking mechanisms of the negative impact of financial development on economic growth, ten years after the global financial crisis, are household debt, private debt, and non-performing loans for the banking sector, while for the equity market this is the case through savings. Interestingly, the results reveal that unemployment increase excessively the borrowers' debt level and then the non-performing loans.

Research Implications - An implication is that the increase of credit supply and any monetary expansion along with lack of regulatory control and monitoring can lead banks to a higher risk exposure through household and private debt as well as non-performing loans. Besides, the higher levels of unemployment rates call attention for the trade-off between prudential regulation on the supply of loans and economic activity, since higher unemployment affect the non-performing loans and, as a consequence discourage the demand, increase precautionary savings, and cancel or postpone investment decisions, thus, affecting the equity market.

Originality/Value – The paper provides useful insights to economists and policymakers who are interested in understanding the weakness of banking and stock market sectors to promote economic growth for a long time after the global financial crisis.

Keywords: Economic growth; Financial development; Dynamic heterogeneous panel model; Household debt; Private debt; Non-performing loans.

1 Introduction

A large amount of literature has examined the relationship between financial development and economic growth and have demonstrated a positive association (King and Levine, 1993; Levine, 1997; Rajan and Zingales, 1998; Beck, 2000). Also, a considerable number of studies focused on exploring the dynamic relationship between financial development and economic growth and their findings support the existence of a significantly positive long-run relationship between financial deepening, economic activity and a set of macroeconomic variables (Benhabib and Spiegel, 2000; Rioja and Valev, 2004; Anwar and Cooray, 2012; Kar et al., 2011; Cojocaru et al., 2015; Muhammad et al., 2016). In general, all these studies used cross-sectional or time-series data suggesting that a well-developed financial system enhances economic activity, and therefore is consistent with the proposition of “finance-led growth”.

On the other hand, many recent studies that used panel data methods do not provide substantial evidence supporting the view that financial development is a significant factor in economic growth (Menyah et al., 2014; Ductor and Grechyna, 2014; Caporale et al., 2015; Ayadi et al., 2015; Swamy and Dharani, 2018). The results of these studies are mostly obtained using GMM dynamic panel estimates and ignore the integration and cointegration properties of the data. At the same time, another approach undertaken by many researchers in order to examine the dynamic impact of financial development on economic growth was the panel ARDL model that implements the pooled mean group (PMG) and mean group (MG) estimators. Results from those studies demonstrate that financial development has a positive and homogenous effect on growth in the long-run, whereas in the short-run the impact is negative (Loayza and Ranciere, 2006; Samargandi et al., 2015; Sohag et al., 2015).

Focusing on the financial structure, there is considerable literature investigating the effect of bank and stock market sectors on economic growth. In an early theoretical study for the architecture of the financial system, Boot and Thakor (1997) argue that a financial system in its infancy will be bank-dominated and increased capital markets’ performance and efficiency diminishes bank lending and banks’ market share. In later studies, it is found that the well-functioning stock markets are better at raising funds for firms, thus fostering economic activity (Allen and Gale, 1999; Narayan and Narayan, 2013). Furthermore, Shen and Lee (2006) found that only stock market development has positive effects on economic growth, while the effect of banking development is negative. However, Levine (1997), Allen and Gale (2000) and Song and Thakor (2010), emphasize that the focus should be on creating well-functioning banks and markets rather than on choosing between the two as they are complementary sources of finance.

However, the financial crisis has revealed weaknesses of the bank industry and equity market, resulting in drastic fall of economic activity. The empirical literature on the

finance-growth relationship, through both sectors; the bank and the stock market is scarce, but gaining importance. In a recent study, Asteriou and Spanos (2019) explored the role of financial development in economic growth using indicators from both sectors. They also investigated the relationship between the two in both short (2008-2009) and long horizons (2008-2016), within and outside the global financial crisis. Employing a static panel model, their results suggest that in years 2008 and 2009, the capital adequacy of banks promoted the stability of the financial system and kept the economy from falling out, as a result of the deposit guarantee scheme. Also, during the same period (2008-2009), the major indicator of size relative to economy liquid liabilities, hindered economic growth, showing that any expansion of broad money as a share of GDP, did not contribute to economic growth. Nevertheless, from the results there is no clear picture of which sector prevails in the positive or negative effect on economic growth before and after the crisis.

To this end, important questions have been raised in the context of the weakness of the financial development to promote economic growth in the post-crisis period: how does the financial bank and stock market development affect the economy at regular periods and stress times? What are the transmission channels that render the financial system highly sensitive to shocks and cannot stimulate the economic growth?

In this sense, the current study aims to shed light on the performances of two types of financial system using dynamic panel data models and investigate the transmission channels. It extends the research of Asteriou and Spanos (2019) by concentrating on the behavior of two sectors of the economy, namely the banking sector and the stock market sector, and find out the effect they had on economic growth (positive or negative), in the short and long run including the recent financial crisis. The advanced knowledge of the current study, is that the long-run finance-growth relationship is, on average, of a positive sign at normal periods, motivated, by and large, by the stock market sector, rather than the banking sector. It is also revealed that the outbreak of the crisis has led to a disruption of said relationship, whereas the banking sector dominates in this adverse effect.

On the above discussion, the main contribution stems from the analysis concerning all the transmission channels in the pre-crisis and post-crisis periods. The importance of the unemployment- household and private debts as mechanisms that transmit the effect of the bank sector on economic growth is found to be unequivocal, both periods being considered. Also, the influence of non-performing loans, for the post-crisis period, plays a very important role as a prudential regulation transmission channel of the credit supply for the economy. The results of the transmission mechanism for the equity market during the post-crisis period, highlight the relevance of savings as an importance tool on investment decisions.

Our analysis differs from the work of Samargandi et al. (2015), Sohag et al. (2015) as well as Hausken and Welburn (2020) since it considers the influence of financial development proxied by two indices – one for the banking sector and one for the stock market

sector – on economic activity, for different periods. For this reason, as a first step, the principal component analysis (PCA) technique is employed on various widely used financial indicators in order to produce two aggregate indices, namely financial banking sector development (fdbanks) and financial stock market development (fdstock). Also, the whole sample period is examined, which in turn is split into the pre-crisis and post-crisis periods. Additionally, robustness checks are conducted through (i) a sample heterogeneity along the cross-sectional dimension; and (ii) controlling for other potentially relevant variables.

Besides the introduction, the paper is structured as follows. Section 2 presents the data, and the model specification for the finance-growth relationship; the analysis uses the panel autoregressive distributed lag (ARDL) model to explore the dynamic relationship in the short and long-run. Section 3 provides the empirical results, followed by robustness checks in section 4. Section 5 presents an empirical investigation of the channels through which financial development may affect growth. Section 6 discusses the results, while the final section concludes.

2 Data and model specification

2.1 Data

The data consists of 25 EU countries over the period 1995-2017. Table 1 provides a complete list of the countries included in the sample, and Table 2 presents the description of all variables used in the study. Summary statistics and correlation analysis results are reported in Appendix A in Tables A.1 and A.2 respectively. The empirical analysis considers the effect of financial development on economic growth proxied by two sectors; the bank and stock market. For this reason PCA is employed based on widely used financial indicators to produce two aggregate indices, namely financial banking sector development (fdbanks) and financial stock market development (fdstock). Three indicators are used as proxies for the banking sector (bank deposits, liquid liabilities and credit supply to private sector) and two for the market sector (market capitalisation and total value traded). The results of the PCA are presented in Tables B.1 and B.2 of Appendix B.

[Insert Tables 1 and 2 here]

2.2 Model specification

The standard panel models, such as pooled OLS, fixed effects and random effects models have some shortcomings. For instance, pooled OLS is a highly restrictive model since it imposes a common intercept and slope coefficient for all cross-sections and thus disregards individual heterogeneity. The fixed effect model, on the other hand, assumes that the estimator has common slopes and variance but country-specific intercepts. Particularly

for two-way fixed effects estimation, both cross-sectional and time effects can be observed through the introduction of dummy variables, and this estimator faces a problem because of the loss of the degree of freedom (Baltagi, 2008).

Another disadvantage of the static panel approaches is that they are unable to capture the dynamic nature of data, which is a fundamental issue in empirical research. Additionally, as Loyaza and Ranciere (2006) argue, static panel estimators do not take the advantage by distinguishing between the short-and the long-run relationships. However, many economic relationships are dynamic in nature, and one of the advantages of the panel data is that they allow understanding the dynamics adjustments or the long-run tendencies. These dynamic relationships are characterised by the presence of a lagged dependent variable among the regressors and dynamic panel models are employed to study the short and long-run economic relationships encountered in the data.

Based on Pesaran et al. (1999), the dynamic heterogenous panel regression can be incorporated into the error correction model using the autoregressive distributed lag ARDL(p,q) technique as below:

$$\Delta ggd p_{i,t} = \sum_{j=1}^{p-1} \gamma_j^i \Delta ggd p_{i,t-j} + \sum_{j=0}^{q-1} \delta_j^i \Delta \mathbf{X}_{i,t-j} + \phi^i [ggd p_{i,t-1} - (\beta_0^i + \beta_1^i \mathbf{X}_{i,t-1})] + \epsilon_{i,t} \quad (1)$$

where Δ denotes the first difference operator, $ggd p$ denotes the growth rate of GDP and is the dependent variable, \mathbf{X} is a matrix of independent variables including the two financial development indices $fdbanks$ and $fdstock$ as well as the rate of inflation (inflation), trade openness (openness) and gross fixed capital formation (gfcf), γ and δ represent the short-run coefficients of lagged dependent and independent variables respectively, β_s are the vectors of the long-run coefficients and ϕ is the speed of adjustment to the long-run equilibrium. The subscripts i and t represent country and time indexes respectively, while p is the number of lags of the dependent variable and q is the number of lags of the independent variables. The term in the brackets of Eqn.(1) contains the long-run growth regression, which is derived from the following equation:

$$ggd p_{i,t} = \beta_0^i + \beta_1^i \mathbf{X}_{i,t} + u_{i,t} \quad (2)$$

Eqn.(1) can be estimated by three different estimators: The first is the mean group (MG) model of Pesaran and Smith (1995), where the main characteristic is that it does not impose any restriction and allows for all coefficients to vary and be heterogeneous in the long-run and short-run. The second is the pooled mean group (PMG) estimator developed by Pesaran et al. (1999), where the main characteristic is that the short-run coefficients, the intercepts, the speed of adjustment to the long-run equilibrium values and the error variances are allowed to be heterogeneous country by country, while the long-run slope coefficients are restricted to be homogeneous across countries. The third, is the dynamic

fixed effect (DFE) estimator, which is very similar to the PMG estimator and imposes restrictions on the slope coefficient and error variances to be equal across all countries in the long run. The DFE model further restricts the speed of adjustment coefficient and the short-run coefficient to be equal too. Also, Pesaran and Smith (1995) and Pesaran et al. (1999) present the ARDL model in error correction form as a cointegration test and showed that can be used with different orders of integration $I(0)$ or $I(1)$.

3 Estimation results

3.1 Whole sample period

Table 3 presents the results of the pooled mean group (PMG)-model (I), mean group (MG)-model (II) and dynamic fixed effects (DFE)-model (III)-estimations, for the full sample of countries during the whole sample period. The Hausman test examines the validity of the long-run homogeneity restriction across countries. Specifically, it tests the null hypothesis of no systematic differences between the coefficients of PMG and MG firstly and secondly between PMG and DFE, to measure the efficiency and consistency among them. According to the corresponding p-values in the last rows of the table, the test fails to reject the null hypothesis that there is long and short-run homogeneity restriction across models, thus DFE is the efficient and consistent model.

In the long-run, according to the PMG estimator (model I), the estimated coefficients on the bank sector and inflation suggest a negative association with economic growth, while the coefficients for the stock market and capital formation associated with the economic activity are positive, all with significance level at 1%. The results of the MG estimator (model II) show that the estimated coefficients are insignificant, while the negative effect of inflation rate on economic growth seems to be weak, with 10% level of significance. The findings of the DFE estimator, reveal that the estimated coefficients on the financial stock market development, trade openness and capital formation are positive, while the coefficient on inflation is negative, all with significance level at the 1%. Regarding the results in the short-run, there is substantial evidence that trade openness is the driving force on economic activity. Also, the negative sign of error correction coefficients and their significance levels, satisfy the main requirement of validity, consistency, and efficiency of a long-run relationship among the variables of interest and confirms that there is a long-run equilibrium. Furthermore, it is worth noticing that in DFE-model III-the speed of adjustment is 73%, indicating how quickly the model comes to equilibrium. However, the speed of adjustment estimates from each model implies significantly different short-run dynamics.

Our results do not support the findings in many studies, and undermine the notion that financial development has a positive and significant long-run effect on economic growth as

argued by Beck (2000), Benhabib and Spiegel (2000), Rioja and Valev (2004), Muhammad et al. (2016), Loayza and Ranciere (2006), Samargandi et al. (2015), Sohag et al. (2015), Caporale et al. (2015), Ayadi et al. (2015), Swamy and Dharani (2018), among others. Therefore, in the following section, the finance-growth relationship is further investigated with particular emphasis on the crisis period.

[Insert Table 3 here]

3.2 *Pre-crisis and post crisis periods*

Table 4 reports the results of the dynamic relationship between financial development and economic growth for the full sample of countries during the pre-crisis and post-crisis periods. Across all models, the Hausman tests fail to reject the long and short-run homogeneity restrictions; thus, emphasis will be based on the DFE model for interpreting the results.¹The finance-growth relationship is tested for a different range of periods before and after the crisis. For the period before the crisis (pre-crisis), the following three varied range of periods are defined: 1995-2006, 1995-2007 and 1995-2008. For the post-crisis period, the following three different range of periods are set: 2007-2017, 2008-2017 and 2009-2017. Through this varied range of periods, it is easier to explore further how the behaviour of financial development has shifted before and after 2008.

In the long-run, the results show that the positive and insignificant effect of the bank sector on economic growth during the pre-crisis period (1995-2007) starts to have a negative but insignificant effect when 2008 is included in the sample period and becomes significantly negative after 2008. The findings also reveal that the adverse effect of the banking sector becomes stronger after 2009, since the size of the coefficient changes from -0.373 at 5% significance level to -0.552 at 1% significance level. On the other hand, the significantly positive effect of the stock market on growth during the pre-crisis period remains positive but becomes insignificant after 2008. For the last sub-period it tends to recover to the pre-crisis levels but it is still statistically insignificant.

[Insert Table 4 here]

From the macroeconomic variables, there is substantial evidence that trade openness and gross fixed capital formation have a significantly positive impact on economic growth, whereas the inflation rate has an adverse effect on economic activity, both periods being considered. It is also worth noticing that openness started to have a lower impact after 2006 and appears to recover after 2009, but not returning to the pre-crisis levels, ten years after the financial crisis, while the significantly positive effect of gross fixed capital formation becomes even stronger during the post-crisis period. Considering the inflation rate, the significantly negative effect during the pre-crisis period remains unchanged in the aftermath of the crisis and appears to be stronger as evidenced from the size of the coefficients.

Turning now to the results in the short-run, there is substantial evidence that the sector development of the banking sector and gross capital formation have an adverse effect on growth during the post-crisis period, while the impact of the stock market sector is insignificant both before and after the crisis. Also, trade openness hinders economic activity before crisis, while after the crisis becomes significantly positive. Interestingly, during the post crisis period, the inflation rate appears to have a significantly positive effect on economic activity. Finally, the negative sign of error correction coefficients and their significance levels, confirm that there is a long-run equilibrium.

4 Robustness check

4.1 *Sample heterogeneity along the cross-sectional dimension*

Given the data availability for the EU countries¹ that allows for a full balanced panel and the importance of including both low and high index bank and/or stock market values, restricting the sample is of additional importance. Thus, as an extra econometric robustness check, we eliminated from the sample, two at a time, first the bank index outliers, i.e., the country with the lowest financial bank index² and the country with the highest bank index,³ followed by all the other countries (starting with those that reported the higher and lower indices for the bank index). As evidenced in Table 5, the estimated short and long-run coefficients of the bank and stock market indices remain unchanged at their significance level with the same sign, thus confirming the robustness of the initial results. Also, following the same process for the stock market index (results are reported in Table 6), the results again remain robust across all models.

4.2 *Controlling for other potentially relevant variables*

An important additional variable to keep in mind when investigating the relationship between financial development and economic growth is household debt. Household debt is defined as the combined debt of all people in a household including consumer debt and mortgage loans. Intuitively, household debt is essential to fill the shortage of income for a household in financing their daily expenses for consumption such as personal use, car and property. From an economic perspective, household debt is assumed as a wheel for consumption and through active lending practices by the financial institutions the consumption is growing, thus stimulating economic growth. Consistent with some previous

¹See Beck et al. (2010) for the Global Financial Development Database.

²This country was Romania with a score -2.01 from the principal component analysis, as the average of liquid liabilities is 31%, credit to private sector 23% and bank deposits 24% all shared to GDP.

³This country was Cyprus with a score 4.75 from the principal component analysis, as the average of liquid liabilities is 186%, credit to private sector 171% and bank deposits 173% all shared to GDP.

studies, it positively influences economic growth at a certain point and acts negatively subsequently (Cecchetti et al., 2011; Lombardi et al., 2017).

On the other hand, consumption heavily depends on the level of income. Therefore, poor households are likely to face a maximum coverage ratio — a limit on the amount of debt-service payments that low-income borrowers can afford at a given interest rate (Justiniano et al., 2016) — restricting the amount of debt that they can take. After 1993, a European Union’s Directive⁴ took effect and many financial institutions were engaged in lax lending regulations for subprime mortgage borrowers. This significantly increased the lenders’ ability to finance mortgage credit, and therefore led to an increase in credit supply. The outward shift of the credit supply lowered the interest rates and directly reduced mortgage payments for subprime households. Such effect led them to expand their borrowing and house purchases triggering the rise in housing prices and the value of the collateral led to more debt accumulation by subprime borrowers (Agarwal et al., 2012; Justiniano et al., 2016).

At the end of the 1990s, the volume of the mortgage loans amounted to just over 50% of EU GDP (Whitehead et al., n.d.). That is, most of the rise in household indebtedness reflects strong mortgage financing growth in an environment of dynamic housing markets and coincides with the U.S. and subsequent European economic crises of 2007–2012 (Mian and Sufi, 2009). To this end, private debt is of utmost importance, since it extends any debt held by companies, representing 147% of EU GDP.⁵ In the context of shocks, the higher level of debt implies a greater risk that households and companies will face in servicing their debt and that the number of non-performing loans (NPLs) will increase.

Another relevant variable that affects consumption is the gross national saving. As income grows, the consumption and the aggregate savings of households tend to rise, and financial development can induce more savings via two channels. First, the incentives to save may increase with the proliferation of financial instruments, which can satisfy the diverse needs and portfolio preference of various savers. Therefore, the willingness to save may depend on the degree of sophistication of the financial system (Goldsmith, 1969; Park and Srinivasan, 1994). The second argument postulates that the existence of a sophisticated financial system facilitates the intermediation between savers and investors (Shaw, 1973). More intermediation from savers and investors enhances the incentives to save since an efficient financial system effectively reduces risk and information costs, which can increase net real returns of savers and positively affect saving. Additionally, financial development may affect both saving and investment decisions. An understanding of the saving-investment correlation is crucial, given that higher capital accumulation necessitates more saving, which can be mobilized domestically or obtained from foreign

⁴Directives 89/647/EEC and 91/633/EEC introduced a preferential weighting for residential loans.

⁵The total private debt in 2009 was 214%, attributed 67% to households debt and 147% held by companies.

countries.

Based on the above, the response of financial growth indicators to changes in household and private debt is examined first. Table 7 presents the results of the DFE estimator. In the first column, the whole sample period is examined, and the findings in the long-run confirm the robustness of those observed in Table 3-model III. In the next three columns (2 to 4), the pre-crisis period is reviewed, and the findings suggest that household debt is statistically insignificant in determining economic growth across all models. Also, its inclusion does not modify the results significantly for financial development indices and macroeconomic variables-compared to the initial results-(Table 4). Moreover, it is worth noticing that the positive and significant effect of the stock market sector development seems to be stronger with household debt-compared to those observed in Table 4. In the next three columns (5 to 7), the post-crisis period is also reviewed, and the statistically significant negative impact of the bank sector development on economic growth that was detected in the initial results (see Table 4-post-crisis period), is now modified since it becomes insignificant. The findings also suggest that after 2008 the household debt negatively affects economic growth. Regarding the influence of private debt on economic activity, the results are reported in the last seven columns (8 to 14). It is worth noticing that private debt does not modify the initial findings (Table 4), thus confirming their robustness. Also, the findings suggest, with statistical significance, that economic growth is stimulated when private debt expanded before the outbreak of the financial crisis. Broadly, the results confirm the robustness of those observed in the initial estimations, while the presence of sensitivity of the banking sector after the crisis is attributed to household debt.

Turning now to the next step, the response of financial development in NPLs and gross domestic savings is examined. Table 8 reports the results of the DFE estimator. In the first three columns the impact of NPLs on economic growth, only for the post-crisis period is considered. The estimated coefficients do not suggest significant changes of financial development to changes in NPLs, and confirm the robustness of the initial results. In turn, in columns 4 to 10, the findings suggest a high sensitivity of financial development to changes in savings after 2007 (columns 7 to 10). Its inclusion modifies the results significantly for both financial development indices (compared to the initial results of Table 4), while for the macroeconomic variables this is true only for trade openness. Additionally, the estimated coefficients reveal that an increase in NPLs causes a reduction in economic activity, while savings have a consistently positive impact on the economy for all period under examination. Nevertheless, the results confirm the robustness of those observed in the initial estimations, while the presence of sensitivity of financial development is attributed to savings.

[Insert Tables 5, 6, 7 and 8 here]

5 Channels

Considering the weakness of the financial development in stimulating EUs economic growth after the global financial crisis, the question that arises concerns the mechanism linking these two variables. Although an analysis for the channels of the finance-growth context is considered relevant (Montes, 2013), the importance of the prudential regulation and supervision for the banking sector is unequivocal. Since the 2007-2009 financial crisis, accounting bodies and prudential regulators are increasingly focused on early recognition of credit losses and enhanced disclosure (Bholat et al., 2018). Thus, the financial stability by over-indebtedness of households and under-provisioning of non-performing loans as well as their role as a transmission channel for the economy, is crucial, mainly when the economic environment is relatively uncertain.

To this end, the transmission mechanism for the impact of financial bank sector development on economic growth, through household debt as well as private debt, is examined first. Second, the role of NPLs⁶ as a transmission mechanism for the financial bank sector development on the economy is also examined. Finally, the impact of financial stock market development on economic growth through savings and investment decisions is investigated as a third possible channel. While these relationships are estimated individually, the impact of financial development may work through several channels simultaneously.

5.1 Mechanisms for the financial bank sector development

This section examines the possible channels using household and private debt in the ARDL(p,q) model as below:

$$\Delta hhd_{i,t} = \sum_{j=1}^{p-1} \gamma_{1j}^i \Delta hhd_{i,t-j} + \sum_{j=0}^{q-1} \delta_{1j}^i \Delta \mathbf{X}_{1i,t-j} + \phi_1^i [hhd_{i,t-1} - (\beta_2^i + \beta_3^i \mathbf{X}_{1i,t-1})] + \epsilon_{1i,t} \quad (3)$$

where the dependent variable hhd is the household debt, and

$$\Delta pvd_{i,t} = \sum_{j=1}^{p-1} \gamma_{2j}^i \Delta pvd_{i,t-j} + \sum_{j=0}^{q-1} \delta_{2j}^i \Delta \mathbf{X}_{1i,t-j} + \phi_2^i [pvd_{i,t-1} - (\beta_4^i + \beta_5^i \mathbf{X}_{1i,t-1})] + \epsilon_{2i,t} \quad (4)$$

where the dependent variable pvd is the private debt. In both equations, \mathbf{X}_1 is a matrix of independent variables including the two financial development indices $fdbank$ and $fdstock$ as well as the inflation rate, trade openness and unemployment rate. Coefficients γ , δ and β_s are defined similarly to the methodology section (see section 2.2). The dynamic fixed effects-error correction model is used, since it is more efficient than the PMG and MG estimators⁷. In addition to the lagged financial development indices, the other macroe-

⁶NPLs are examined only for the post-crisis period due to the lack of the data availability.

⁷The Hausman test was executed for all equations and the results are available upon request.

conomic variables are main determinants of household or private debt in the literature (Moore and Stockhammer, 2018). Hence, the level of household or private debt is assumed to depend on: (i) the depth of the financial system as proxied by the financial development indices, which contain as components, credit to private sector, bank deposits and stock market prices; (ii) the inflation rate, which is a proxy for financial stability/instability; (iii) an indicator of openness of the economy to capture the possibility of foreign saving inflows or outflows; and (iv) the unemployment rate, since the worst employment slumps often follow expansions of household debt (Donaldson et al., 2019).

Table 9 presents the estimation results. In columns 1 to 7 the results of Eq.(3), are reported, where dependent variable is the household debt, while in columns 8 to 14 are reported the results of Eq.(4), where dependent variable is the private debt. Similarly to the robustness check in the previous section, the same three ranges of pre-crisis and post-crisis periods are used. In both equations; when the whole period is examined (columns 1 and 8), the long-run positive effect of the bank sector on household and private debt can easily be observed that is mainly attributed to the post-crisis periods. However, the impact of the bank sector on private debt appears to start when 2007 is included in the pre-crisis period (see column 10) and increased in 2008, while after 2009 appears to be insignificant. In general, the findings suggest the presence of household and private debt channels as mechanisms that transmit the adverse effect of the financial bank sector development on the economy ten years after the global financial crisis. It is also worth noting that unemployment led to higher household debt starting from 2008 (see column 6), and after 2009 the statistical significance and the size of the estimated coefficients increased. Regarding the effect of unemployment on private debt, the estimates show that the higher private debt is caused by unemployment after 2009 (see column 14).

The regression results for the short-run equations show similar results for the effect of bank sector on household debt, while for private debt this is not the case. Broadly, the estimated short-run coefficients for the unemployment rate appear to be insignificant. The estimated coefficients of ect_{t-1} , which measures the speed of adjustment back to the long-run equilibrium value, are statistically significant at the 1% level and correctly signed, implying that an error-correction mechanism exists in all models. In all cases, the speed of adjustment suggests the economy takes less than 2 years to achieve long-run equilibrium whenever there is a deviation from the long-run steady state.

This analysis unveiled that the rise in the debt ratio has put both households and companies in a riskier financial position. The banking sector development plays a significant attenuating impact on such risk, and if an increase in unemployment is accompanied by a rise in the debt ratio, this can increase borrower's debt levels excessively and increase problematic loans. To examine this issue further, the ARDL(p,q) model is used for the

impact of household's ratio and unemployment on NPLs:

$$\Delta npl_{i,t} = \sum_{j=1}^{p-1} \gamma_{3j}^i \Delta npl_{i,t-j} + \sum_{j=0}^{q-1} \delta_{3j}^i \Delta X_{2i,t-j} + \phi_3^i [npl_{i,t-1} - (\beta_6^i + \beta_7^i X_{2i,t-1})] + \epsilon_{3i,t} \quad (5)$$

where the dependent variable npl denotes the NPLs, and all the rest variables and coefficients are defined similar as before. The results reported in Table 10, show that both variables; household debt and unemployment cause an increase in NPLs across all models. However, in columns 1 to 6, there is no evidence for NPLs to be a transmission mechanism of financial development (*fdbanks and fdstock*) for the economy. In addition, the findings reveal that inflation rate has a positive impact on non-performing loans with statistical significance indicating the importance of price instability at stress times.

Nevertheless, one of the three components of the financial bank sector development (*fdbanks*) in principal component analysis is the credit supply to the private sector (*privy*), which in turn is main determinant of the household debts (Prinsloo, 2002; Jacobsen and Naug, 2004) among others. For this reason the bank sector index (*fdbanks*) is decomposed in two main components: the first, is the size of financial bank sector development (*fbsize*)-consisted of liquid liabilities and bank deposits-while the second is the credit to private sector (*privy*). In this sense, a contribution to the empirical literature is provided regarding the non-performing loans as mechanism that transmits the long-run negative effect of financial bank sector development through credit supply on economic growth, after the global financial crisis, for a group of countries with high degree of financial integration like EU.

In turn, it is considered the influence of prudential regulation and supervision of banks, since the timely recognition of problem loans and credit loss by banks, is critical in assessing how to mitigate crises (Bholat et al., 2018). Transparency of asset-positions are well-understood by market regulators and monetary policy as well as prudential regulation develop an important role in terms of constraining credit supply (Montes and do Vale Monteiro, 2014).

Employing the ARDL(p,q) model, and using two different components as proxies for the bank sector (*fsize* and *privy*), the results are reported in columns 7 to 12 only for the post-crisis period. The long-run estimated coefficients reveal with statistical significance that an increase of the bank lending, proxied by the credit to private sector, causes an increase of non-performing loans, which is relevance of the prudential regulation and monetary policy channel. Thus, it can be inferred that the main mechanisms linking the deterioration of the assets quality (NPLs) of EU banks, during the post-crisis period is the household debt through the higher unemployment as well as the price instability.

The overall results suggest that apart from household and private debt channels, NPLs (non-performing loans) channel is a mechanism that transmits the adverse effect of the financial bank sector development on the economy after the global financial crisis. It

is also worth noticing that the main component of the bank sector development that transmits the negative effect on economic growth is credit to the private sector. However, the results seems to be in contrast with the findings of a recent study by Welburn and Hausken (2017), who argued that contagion through credit or trade channels, or common macroeconomic conditions without contagion, can cause crises, and this is the case only for EU countries that may default due to high levels of government debt. Nevertheless, in the current study, credit is examined from another aspect, as a main component of the financial bank sector development, having a significant impact on NPLs, and the European Union has put significant efforts into dealing with high stock of NPLs, through recapitalization of banks.

[Insert Tables 9 and 10 here]

5.2 Mechanisms for the financial stock market sector development

In this section the channel through which financial stock market development is likely to have an impact on economic growth is investigated. To this end, the empirical analysis focuses on the impact of stock market on: (i) gross savings to GDP; and (ii) capital formation. The fact that accumulated savings is one of the main factors to economic growth is unquestionable and can be considered as the sources of capital stock, which plays a crucial role in creating investment, production, and employment and eventually enhance economic growth (Levine and Zervos, 1998; Rillo and Miyamoto, 2016). In addition, studies that indicate domestic savings as a basic source of investment provide substantial evidence on a positive correlation between stock market activity and investment (Feldstein et al., 1983; Wood, 1995; Morek et al., 1990; Barro, 1990). A well-functioning stock market may induce a high level of investment because it can identify fundable projects that otherwise may not be undertaken. The stock market also affects the quality of investment or the allocation of capital by channeling funds to the most profitable investment activities (Ndikumana, 2005). According to this strand of literature, the main transmission channel through which financial stock market development affects economic growth is the increased savings and hence capital accumulation. The next two equations provide useful insight into testing the validity of the gross savings channel and accumulation of capital stock and the findings reveal that there is a substantial evidence for the channel of saving in the post-crisis period as well as the importance of savings on investment:

$$\Delta sav_{i,t} = \sum_{j=1}^{p-1} \gamma_{4j}^i \Delta sav_{i,t-j} + \sum_{j=0}^{q-1} \delta_{4j}^i \Delta Z_{1i,t-j} + \phi_4^i [sav_{i,t-1} - (\beta_8^i + \beta_9^i Z_{1i,t-1})] + \epsilon_{4i,t} \quad (6)$$

$$\Delta gfcf_{i,t} = \sum_{j=1}^{p-1} \gamma_{5j}^i \Delta gfcf_{i,t-j} + \sum_{j=0}^{q-1} \delta_{5j}^i \Delta Z_{2i,t-j} + \phi_5^i [gfcf_{i,t-1} - (\beta_{10}^i + \beta_{11}^i Z_{2i,t-1})] + \epsilon_{5i,t} \quad (7)$$

where the dependent variables in Eq.(6,7) are gross domestic savings (*sav*) and gross fixed capital formation (*gfcf*), as a share of GDP, respectively. Z_1 is a matrix of independent variables including financial development indices as well as inflation rate and trade openness, while Z_2 includes all indicators of Z_1 and savings as well. In Table 11, the findings indicate that during the post-crisis period, gross domestic saving depends positively on financial stock market development. Similarly, the results from the capital formation equation suggest that investments are stimulated by an increase in savings. The findings support the results of Ang (2008), that saving behaviour and investment decision are influenced by the level of financial development. However, the novelty in our study, is that the effects caused by stock market development on gross savings are important only on the aftermath of financial crisis.

[Insert Table 11 here]

6 Discussion of the results

The first part of the estimation results analyses the influence of financial development proxied by two indices-one for the banking sector and one for the stock market sector-on economic activity, for different periods. Initially, the whole sample period is examined, which in turn is splitted in the pre-crisis and post-crisis periods. The findings suggest that 2008 serves as a starting point for the crisis in the bank industry across EU countries and there is overwhelming evidence of a negative relationship between the development of the banking sector and economic growth. A possible explanation of the negative effect in the aftermath of the crisis might be the EU's Directive that took effect after 1993, which led to financial institutions being involved in lax lending regulations for subprime mortgage borrowers; thus leading to an increase in credit supply. The higher financial intermediation may have adverse effects if the financial system is liberalized and allowed to operate under a weak regulatory environment. Also, the results of this study are in line with Sundararajan et al. (1991), Easterly and Kraay (2000), Deidda and Fattouh (2002) and Ang (2007), who find that any monetary and credit expansion along with a lack of regulatory control and monitoring from the banks, may result in ineffective mobilization of savings and allocation of funds to inappropriate selection of projects, which in turn, has an adverse effect of financial development on economic growth. Figure 1, indicates that big and fast- growing financial bank sector creates a financial boom, which is not in general growth enhancing.

[Insert Figure 1 here]

On the other hand, there is substantial evidence of a positive relationship between financial development of the stock market sector and economic growth, but this is reported only in the pre-crisis period. It is worth noticing that after 2009, the positive and

significant relationship becomes insignificant. Figure 2 suggests that over the period 2002 to 2008, the size of the stock market is increasing, and the reason might be the newly created currency area of the twelve participating European Union member states. The new currency has a considerable weight, not only in the European economy but also in the global economy. Specifically, there is a rapid growth achieved by European securities markets from 2002 until 2008, and the euro strengthened the integration of the financial markets across the EU countries. This process of integration coincided with the trends towards globalization and securitization as well as the expanded privatization and the entry of foreign investors. However, from 2008, the size of the stock market fell and until 2017 had not recovered to the pre-crisis levels. This results may have been caused by the drop in the stock prices when the crisis erupted and shows that the stock market performance is highly volatile and easily affected by global economic conditions.

[Insert Figure 2 here]

The second part of the estimation results conducts a robustness check through (i) a sample heterogeneity along the cross-sectional dimension; and (ii) controlling for other potentially relevant variables. In general, the results confirm the robustness of these observed in the initial estimations (Tables 3 and 4). However, during the post-crisis period, a sensitivity of the bank sector is presented and is attributed to the household debt (Table 7) and savings (Table 8), while for private debt and non-performing loans this is not true. A possible explanation, might be that household credit and enterprise credit have a different impact on economic growth. There is empirical evidence that the loans to enterprises enhance economic growth by easing the liquidity constraint on firms; this leads to the formation of new companies and the expansion of existing ones (Levine, 2005). Conversely, the evidence for the loans provided to households, suggests that it either has no effect on medium and long-term economic growth (Beck, 2000) or that it even reduces growth. Jappelli and Pagano (1994) argue that higher availability of household credit reduces private savings and economic growth. The over-lending to the households created a credit boom that led to a banking crisis. Demirguc and Detragiache (1998) and Kaminsky and Schmukler (2002) argue that the banking crises are associated with the rapid growth of credit to the private sector. Finally, these relevant variables are used in analysing the channel through which financial development has an impact on growth, and a relevant discussion is provided below.

The last part of the estimation results investigates the channels of the finance-growth context. The findings suggest the presence of household and private debts as mechanisms that transmit the weakness of the bank industry to contribute to the economic activity, for a long period after the crisis. The finding that in the aftermath of crisis NPLs provide a mechanism that transmits the effect of the credit supply on the economy is of great importance. The analysis, therefore confirms that one of the principal effects that led

to financial crisis might be the credit expansion and the over-lending at normal times without tight lending conditions. However, looking specifically at terms of bank loans before the crisis, less collateral were provided as a proportion of loans.

In contrast, in a recent study, Hausken and Welburn (2020) found that there are different reasons behind the turmoil in EU countries that received aid packages and led to a crisis based on banks, originated from a huge budget deficit (eg Greece), real estate bubble (one of the key factors in the Irish banking crisis after 2008). Interestingly, the same authors suggest that financial support through international loans (ILs) should have looked at the crisis holistically over its time duration and consider alternative utility functions that could affect market stability in other ways or accounts for altruism directly, i.e donate funds without expecting anything in return except that the crisis gets alleviated or ends. From the results of the current study, it can be easily observed in Table 10, that there is a trade-off between credit supply and unemployment, with the former to have lower effect on NPLs. Thus, we can infer that international loans (ILs) or aid packages might be an important factor to reduce unemployment and NPLs, which in turn is closely related to real estate bubble.

Finally, another important factor that is found to have a robust impact on household and private debt is the sharp rise on the unemployment rate. From Figure 3, it can be easily observed that there is a co-movement of bank sector components (bdep, lly and privy) with household debt and private debt (left graph), which is also the case for unemployment and non-performing loans (right graph).

[Insert Figure 3 here]

Considering the channel through which the equity market affects the economic activity, the findings suggest the presence of savings and hence investments. Figure 4 (left-side), illustrates the saving-investment condition, and it is worth noticing that their co-movement diverges over the period 2009-2014. The divergence provides further evidence for saving-investment imbalances and seems that the negative shock is linked with worsening future income prospects. A possible explanation might be that firms tended to cancel their investment decisions and retain their earnings, thus increasing savings, while household reduced their expenditures, contributing to the weakness in demand. Moreover, the average stock market development index (right graph of figure 4) appears to have a gradually upward trend after crisis, but never to fully recover to the pre-crisis levels. Furthermore, the combination of these two graphs in figure 4, shows clearly that savings is the main channel that contributes to capital formation, and thus to stock market performance.

[Insert Figure 4 here]

7 Conclusions

The article focuses on the finance-growth relationship in the European Union after the 2007-2009 financial crisis. We adopt an in-depth approach to address the key issues in the literature. The research is motivated by the concern of the financial system weakness to promote economic growth for a long period after the crisis. From an econometric perspective, we used the autoregressive distributed lag autoregressive distributed lag (ARDL) model, and assume as “normal times” the pre-crisis period, and as “stress times” the post-crisis period.

The initial results suggest that the long-run finance-growth relationship is, on average, of a positive sign at regular periods, motivated, by and large, by the stock market sector, rather than the banking sector. It is also revealed that the outbreak of the crisis has led to a disruption of said relationship, whereas the banking sector dominates in this adverse effect. This means that financial development is associated with lower long-run growth rates ten years after the outbreak of financial crisis in European Union.

Interestingly, in a robustness check, the long-run perspective of the finance-growth relationship is reinforced by the evidence of similar results when the sample heterogeneity along the cross-sectional dimension is examined. Adversely, when the robustness check is applied using other potential variables such as household and private debt, saving and non-performing loans, a presence of sensitivity is observed during the post-crisis period, in both sectors; the bank and stock market, mainly attributed to household debt and saving for the former, and only saving for the later.

The advanced knowledge of the current study is that the mechanisms that transmit the negative/insignificant impact of the bank/stock market sectors on the economy ten years after the global financial crisis are household and private debt for the bank sector, while saving is for the stock market sector. Also, a contribution to the empirical literature is provided regarding the non-performing loans which are found to be as the mechanism that transmits the long-run negative effect of financial bank sector development through credit supply on economic growth, after the global financial crisis for a group of countries with high degree of financial integration. However, the results indicate that an increase of unemployment increases the borrowers’ debt level excessively, which in turn increases non-performing loans.

A key policy implication that emerges from the results is the evidence concerning the increase of credit supply and monetary expansion along with lax-lending regulations, lack of regulatory control and monitoring from the banks. Besides, it is important to note that the analysis for the influence of unemployment rate calls attention for the trade-off between prudential regulation and economic activity, since higher unemployment affects the household debt as well as non-performing loans and, as a consequence discourage the demand, increase the precautionary savings, and cancel or postpone investment decisions.

As a result, an important tool, such as restrictions on loan-to-value and debt-to-income ratios, help to constrain the growth in household and private debt and acts on balance between economic growth and low risk exposure of the financial system. In this sense, the findings call for a further investigation of possible threshold effects of household debt-to-GDP-ratios subject to increased pressure when the credit supply-to-GDP-ratio is above to a turning point.

[Insert Appendices A and B here]

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