PANOECONOMICUS, 2022, Vol. 69, Issue 4, pp. 527-554
Received: 27 September 2018; Accepted: 16 December 2021.

UDC 330.34:303.446.3(4-672EU)"1990/216"
https://dx.doi.org/10.2298/PAN180927014B
Original scientific paper

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The Finance-Growth Nexus in the Age of Financialisation: An Empirical Reassessment for the European Union Countries

Summary: This paper draws an empirical reassessment of the finance-growth nexus by performing a panel data econometric analysis for all 28 European Union countries over 27 years from 1990 to 2016. Since the mid-1980s, the financial system has experienced a strong liberalisation and deregulation by preventing its beneficial effects on the real economy. This phenomenon, typically called financialisation, points to a negative view of finance and contradicts the well-entrenched hypothesis on the finance-growth nexus. We estimate both linear and non-linear growth models by incorporating seven proxies of finance (money supply, domestic credit, financial value added, short-term interest rate, long-term interest rate, stock market volume traded and stock market capitalisation) and five control variables (the lagged growth rate of the real per capita gross domestic product, the inflation rate, the general government consumption, the degree of trade openness and the education level of the population). Our results show that finance has impaired economic growth in the EU countries, both in the pre-crisis period and in the crisis and post-crisis periods. The enormous growth of domestic credit and of the financial value added have been restraining the economic growth of the EU countries since 1990 and particularly up until the Great Re-cession. This implies the need to reduce the prominence of finance, i.e. so-called de-financialisation, in the coming years in order to avoid the potential new "secular stagnation" in the current age of financiali-sation.

Keywords: Finance, Economic growth, European Union, Panel data, Least-squares dummy variable bias-corrected estimator.

JEL: C33, E44, O16, O47.

The author thanks the helpful comments and suggestions of two anonymous referees, Sérgio Lagoa, Sofia Vale, the participants in Dinâmia'CET - Iscte Workshop on Dinâmicas Socioeconómicas e Territoriais Contemporâneas (Iscte - Instituto Universitário de Lisboa, December 2018) and the participants in 3º Encontro Anual de Economia Política (Católica Porto Business School from Universidade Católica Portuguesa and Faculdade de Economia from Universidade do Porto, February 2019). The usual disclaimer applies.

During recent years and particularly until the Great Recession, the financial system suffered a process of strong liberalisation and deregulation as a means to restrain financial repression, to support financial development and to achieve a higher level of economic growth (Ricardo Barradas 2016). As a consequence, the realm of finance has gained a huge preponderance since the mid-1980s giving rise to an excessive financial deepening with deleterious effects on the real economy (Peter L. Rousseau and Paul Wachtel 2011; Adolfo Barajas, Ralph Chami, and Seyed Reza Yousefi 2013; Era Dabla-Norris and Narapong Srivisal 2013). This phenomenon, typically called financialisation, points to a negative view of finance, which seems to contradict the well-entrenched hypothesis on the finance-growth nexus (James B. Ang 2008; Petra Valickova, Thomas Havranek, and Roman Horvath 2014; Phillip Arestis, Georgios

Chortareas, and Georgios Magkonis 2015) and have resurrected beliefs around a new "secular stagnation" in the era of financialisation (Paul Krugman 2013; Lawrence W. Summers 2014; Riccardo Pariboni, Walter Paternesi Meloni, and Pasquale Tridico 2020).

This paper aims to make an empirical reassessment of the finance-growth nexus in the age of financialisation by performing a panel data econometric analysis for the European Union (EU) countries from 1990 to 2016. This paper introduces at least seven novelties to the literature, namely by analysing the EU countries; performing a panel data econometric analysis; incorporating the period before, during and after the crisis; assessing both the linear and non-linear effects of finance on economic growth; taking into account the potential endogeneity between finance and economic growth and/or the omission of other relevant variables to explain the economic growth in the EU countries; examining the robustness of our results using different proxies for finance; and incorporating other control variables that are recognised as important drivers of economic growth.

The paper concludes that finance has been prejudicial for economic growth in the EU countries, both in the pre-crisis period and in the crisis and post-crisis periods. The huge growth of the domestic credit and of the financial value added has constrained a higher level of economic growth in the EU countries since 1990 and particularly until the Great Recession.

The rest of the paper is organised as follows. In Section 1, the literature review on the finance-growth nexus is presented, namely by describing the theoretical and empirical evidence around that. Section 2 describes the growth models that will be estimated, as well as the expected impacts of each variable included in these models. Data and econometric methodology are explained in Sections 3 and 4, respectively. Section 5 presents the empirical findings and a discussion of results. In Section 6, the main conclusions are addressed.

1. Literature Review on the Finance-Growth Nexus: Theoretical and Empirical Evidence

It is widely acknowledged that the realm of finance has suffered a strong transformation in the last decades all over the world. Barradas (2016) makes a good description of this transformation by identifying three different stages in the evolution of the financial system, which reflect the different impacts of finance on the real economy.

The first stage – financial repression – was characterised by high levels of regulation and restrictions on the functioning of the financial system. During this period, administrative control was exercised by the central bank and/or by the government on the level of interest rates that can be paid on deposits or charged on loans, on the products and/or services that can be supplied by banks, and on the volume, direction and allocation of credit; along with legal requirements for high reserves and a strong control of international capital flows (Ang 2008). In some countries, the majority of financial institutions were State-owned banks or State-directed banks in order to support a wide range of economic and social purposes and to channel credit to specific sectors (Gerald A. Epstein 2005). This financial repression restrained the quantity and the

quality of investments, representing by itself a strong constraint on economic growth (Edward S. Shaw 1973).

Against this backdrop, the financial system was subject to strong liberalisation and deregulation in the 1970s and 1980s giving rise to the second stage – financial development. Two different aspects were determinants to support this new liberalising and deregulatory paradigm. On the one hand, this was fostered by theoretical arguments on the potential advantages provided by the financial system. The majority of these advantages are related to the beneficial effects of the financial system on the reallocation of savings to finance entrepreneurs' investments, which spurs economic growth (Malcolm Sawyer 2014). This is the "intermediation or financial facilitator view" in the words of Thorsten Beck, Hans Degryse, and Christiane Kneer (2014), according to which the financial system facilitates the proper functioning of modern market economies by serving the development of the non-financial sectors. Ross Levine (2005), Ang (2008) and Arestis, Chortareas, and Magkonis (2015) synthesise this belief by maintaining that the financial system is crucial to support a higher level of economic growth, because it produces information *ex ante* about investments, allocates capital, screens and monitors investments, exerts a certain control after the provision of funding, facilitates the trading of both financial and non-financial assets, diversifies risk, offers risk management services, promotes the exchange of goods and services, reduces the informational asymmetries and minimises transaction costs. Moreover, Shaw (1973) underline that liberalisation and deregulation are crucial to ensure that emerging and developing economies can access international capital markets, a necessary condition to boost their levels of economic growth. On the other hand, this was also supported by the emergence of several empirical studies that find a positive relationship between finance and economic growth. Ang (2008), Valickova, Havranek, and Horvath (2014), Arestis, Chortareas, and Magkonis (2015) provide a survey on the empirical literature on this matter, claiming that the finance-growth nexus is a well-recognised empirical fact for a huge variety of countries and/or time periods.

Financial liberalisation and deregulation implied the adoption of internal and external measures at a country-level, namely the elimination of interest rates ceilings, the reduction of legal reserve requirements, the abolition of State-directed credit programmes, the creation of more financial institutions and the privatisation of existing ones, the provision of a greater variety of financial products and/or services and the loosening of control on international capital flows (Ang 2008; Sawyer 2014, 2015; Kizito Uyi Ehigiamusoe and Hooi Hooi Lean 2017). As a consequence, the financial system acquired a great prominence since the mid-1980s by giving rise to an excessive financial deepening with negative repercussions on the economic and social spheres. The higher incidence of financial crises, the emergence of inflation episodes, the higher fragility of banking systems and the greater volatility of aggregate demand are some manifestations of the unsustainable nature of this new liberalising and deregulatory environment (Rousseau and Wachtel 2011; Barajas, Chami, and Yousefi 2013; Dabla-Norris and Srivisal 2013). This paved the way to the third stage – financialisation – transferring the deleterious effects of financial deepening onto the real economy.

From an empirical point of view, this negative view of finance is also corroborated by the emergence of several empirical studies finding a weakening in the positive

relationship between finance and economic growth or even a negative relationship between them (Felix Rioja and Neven Valev 2004a, b; Philippe Aghion, Peter Howitt, and David Mayer-Foulkes 2005; M. Ayhan Kose et al. 2006; Eswar S. Prasad, Raghuram G. Rajan, and Arvind Subramanian 2007; Rousseau and Wachtel 2011; Stephen G. Cecchetti and Enisse Kharroubi 2012; Barajas, Chami, and Yousefi 2013; Dabla-Norris and Srivisal 2013; Beck, Degryse, and Kneer 2014; Max Breitenlechner, Martin Gächter, and Friedrich Sindermann 2015; Ehigiamusoe and Lean 2017; Constantinos Alexiou, Sofoklis Vogiazas, and Joseph Nellis 2018; Barradas 2020; Pariboni, Meloni, and Tridico 2020). Lukas Menkhoff and Norbert Tolksdorf (2001) stress that there has been a "disruptive relationship" between finance and economic growth in the last ten or twenty years, because the financial sphere started to follow its own logic and the real economy began to adapt to the consequences of this. These authors call this the "decoupling hypothesis" between the financial system and the real economy. In the same vein, Cecchetti and Kharroubi (2012), Barajas, Chami, and Yousefi (2013), Dabla-Norris and Srivisal (2013), Beck, Degryse, and Kneer (2014), Barradas (2020) and Pariboni, Meloni, and Tridico (2020) conclude that there has been a non-linear relationship between finance and economic growth as a concave quadratic function, in a context where finance has an inverted U-shaped effect on economic growth. This means that from a certain threshold a further enlargement of the financial system can even reduce economic growth.

Several reasons are identified in the literature to explain this weakening or the reversal in the relationship between finance and economic growth in the age of financialisation. Firstly, the growth of the financial system has occurred essentially at the level of non-intermediation financial activities (proprietary trading, market making, provision of advisory services, insurance and other non-interest income generating activities), which have a less noticeable effect on economic growth (Beck, Degryse, and Kneer 2014). Sawyer (2014, 2015) emphasises that the expansion of the financial system has been visible in the proliferation of derivatives, securitisation, shadow banking and the scale of financial asset transactions and not in activities directly connected with the linkage between savings and investment. This is also visible in the appearance of other financial institutions that do not directly favour financial intermediation, like investment funds, money market funds, hedge funds, private equity funds, special purpose vehicles, among others (Engelbert Stockhammer 2010; Bill Lucarelli 2012). Secondly, the relationship between savings and investments has also narrowed due to the liquidity function of the financial system, according to which savers are increasing the transactions of financial assets by rearranging their portfolios that do not generate a substantial amount of further funds for investors (Sawyer 2014). Thirdly, the financial system has amplified the volatility of the aggregate demand and particularly the volatility of both consumption and investment (Dabla-Norris and Srivisal 2013). Effectively, the unstable and speculative nature of stock markets does not favour the stability of economies (Ang 2008). This is linked with the "financial instability hypothesis" of Hyman P. Minsky (1991) and represents in itself a critique to Milton Friedman's (1953) argument that financial speculation is stabilising because it drives prices back to their fundamental levels (Thomas I. Palley 2007). Fourthly, the strong growth of credit in the age of financialisation has increased the vulnerability of banks and the

likelihood of a systemic banking crisis (Rousseau and Wachtel 2011). As claimed by these authors, this is particularly relevant due to the absence of legal and regulatory infrastructures to deal with this. The strong growth in credit has increased debt levels, which makes economies more vulnerable to any negative shocks (Stockhammer 2010; Natascha van der Zwan 2014). Additionally, the majority of credit has been channelled to households for mortgage purposes (Costas Lapavitsas 2011), which prevents higher rates of physical capital accumulation that are crucial to sustain more investment, economic growth and employment creation (Özgür Orhangazi 2008). Fifthly, banks tend to encourage risk-aversion behaviour on the part of investors in order to ensure that they pay their debts. Investors respond to these pressures by investing excessively in tangible assets that can be used as collateral instead of in knowledge-based assets, which constrains the corporations' opportunity to expand the potential growth of economies (Ang 2008). Sixthly, the financial system competes with the remaining sectors for scarce resources, which suggests that financial booms are not growth-enhancing (Cecchetti and Kharroubi 2012). The financial system also absorbs resources that are often highly paid, which decreases the available resources to real and productive sectors (Sawyer 2014). Seventhly, imperfect competition, rent extraction, implicit insurance due to bailouts and negative externalities from auxiliary services which benefit some clients and not society as a whole are other problems arising from an oversized financial system (Beck, Degryse, and Kneer 2014). Eighthly, the financial system only boosts economic growth by encouraging innovative investments in the early stages of economic development in line with the "supply leading hypothesis" (Alexiou, Vogiazas, and Nellis 2018). Effectively, these authors state that economic growth itself increases the demand for more financial services boosting the financial system, which makes the "demand-following hypothesis" more relevant than the aforementioned "supply leading hypothesis".

This weakening or the reversal in the relationship between finance and economic growth have resurrected beliefs around a new "secular stagnation" in the era of financialisation, particularly through a dampening of the aggregate demand linked to an unprecedented degree of openness (in terms of international trade and capital mobility), a sustained retrenchment of the welfare state, a massive de-unionization and the corresponding weakening of labour market institutions, an increasing trend of inequalities and the dominance of supply-side policies (Krugman 2013; Summers 2014; Pariboni, Meloni, and Tridico 2020).

This paper examines the impact of finance on economic growth in the EU countries between 1990 and 2016 through a panel data econometric analysis, which extends the existing literature in at least seven different directions. Firstly, this paper is centered on the EU countries, for which the empirical evidence is relatively scarce and exhibits mixed results (Alexiou, Vogiazas, and Nellis 2018). The EU countries represent an interesting case study, namely because they have witnessed a strong growth of the financial system in recent years (Figures A6 to A12 in the Appendix) that have not led to a comparable a path of economic growth (Figure A1 in the Appendix). Secondly, the paper conducts a panel data econometric analysis, in a context where the empirical literature has been dominated by cross-country works probably due to the lack of available time series data (Ang 2008). Panel data econometric analysis tends to be more

advantageous than pure time series and/or pure cross-country analyses by offering the opportunity to work simultaneously with several countries over several years. This improves the accuracy and the reliability of the produced results due to the possibility of working with larger samples (Badi H. Baltagi 2005; Chris Brooks 2009). Thirdly, this paper assesses the impact of finance on economic growth both in the pre-crisis period and in the crisis and post-crisis periods, respectively. This is important taking into account the general recognition that the relationship between finance and economic growth is extremely complex and not stable over time (Anna Grochowska et al. 2014). Nonetheless, the majority of empirical studies on the finance-growth nexus only focus on the period until the Great Recession. Breitenlechner, Gächter, and Sindermann (2015), Dilek M. Durusu-Ciftci, Serdar Ispir, and Hakan Yetkiner (2017), Ehigiamusoe and Lean (2017), Alexiou, Vogiazas, and Nellis (2018), Barradas (2020) and Pariboni, Meloni, and Tridico (2020) are the only exceptions, but they do not analyse this issue for the EU countries. Fourthly, the paper examines the relationship between finance and economic growth by estimating both linear and non-linear growth models, in a context where the latter have been quite neglected in the empirical literature. Cecchetti and Kharroubi (2012), Barajas, Chami, and Yousefi (2013), Dabla-Norris and Srivisal (2013), Beck, Degryse, and Kneer (2014), Barradas (2020) and Pariboni, Meloni, and Tridico (2020) are some exceptions and confirm that finance exerts an inverted U-shaped impact on economic growth. Fifthly, this paper uses an estimator that takes into account the potential endogeneity between finance and economic growth and/or the omission of other relevant variables to explain the economic growth in the EU countries. This is quite relevant given the potential bi-directionality between finance and economic growth (Ang 2008; Alexiou, Vogiazas, and Nellis 2018). Sixthly, the paper uses different proxies for finance, which allows to offer a complete picture on the role of finance on economic growth and to capture different dimensions of finance (Beck, Degryse, and Kneer 2014; Breitenlechner, Gächter, and Sindermann 2015). Seventhly, our growth models incorporate other important control variables in order to prevent the problem of omitted relevant variables that would imply the production of inconsistent and biased estimates (Jeffrey M. Wooldridge 2003; Michael Kutner et al. 2005; Brooks 2009).

2. Growth Models and Hypotheses

In order to assess the finance-growth nexus, we estimate a linear growth model based on Robert G. King and Levine's (1993) version of the Robert J. Barro's (1991) growth regression by including a measurement of finance, which has the following form:

$$Y_{i,t} = \beta_0 + \beta_1 X_{i,t} + \beta_2 F_{i,t} + u_{i,t}, \quad (1)$$

where i is the country, t is the time period (years), Y is the growth rate of the real *per capita* gross domestic product, X is a set of control variables that have been shown both theoretically and empirically to be robust determinants of economic growth, F is a measure of the importance of finance, and u is the two-way error term component accounting for unobservable country-specific effects and time-specific effects.

Note that we use the growth rate of the real *per capita* gross domestic product instead of the growth rate of the real gross domestic product as a proxy of economic

growth in order to consider not only the investors' prospects but also the people's prosperity (Alexiou, Vogiazas, and Nellis 2018). This is a common strategy in the majority of empirical studies around the finance-growth nexus (Rioja and Valev 2004a, b; M. Kabir Hassan, Benito Sanchez, and Jung-Suk Yu 2011; Rousseau and Wachtel 2011; Beck, Degryse, and Kneer 2014; Khoutem Ben Jedidia, Thouraya Boujelbène, and Kamel Helali 2014; Breitenlechner, Gächter, and Sindermann 2015; Durusu-Ciftci, Ispir, and Yetkiner 2017; Ehigiamusoe and Lean 2017; Alexiou, Vogiazas, and Nellis 2018; Barradas 2020).

Considering also the aforementioned potentially non-linear relationship between finance and economic growth (Cecchetti and Kharroubi 2012; Barajas, Chami, and Yousefi 2013; Dabla-Norris and Srivisal 2013; Beck, Degryse, and Kneer 2014; Barradas 2020; Pariboni, Meloni, and Tridico 2020), our growth model is also estimated taking into account the following form:

$$Y_{i,t} = \beta_0 + \beta_1 X_{i,t} + \beta_2 F_{i,t} + \beta_3 F_{i,t}^2 + u_{i,t}. \quad (2)$$

This approach allows us to identify the peak of the inverted U-shape (i.e. the turning point) through which the positive effect of finance starts to diminish by exerting a negative influence on growth. The turning point of finance – F^* – can be obtained directly by the estimated coefficients, namely by determining the maximum of this concave quadratic function on the relationship between finance and growth, namely:

$$\left(\beta_2 F_{i,t} + \beta_3 F_{i,t}^2\right)' = 0 \Leftrightarrow \beta_2 + 2\beta_3 F_{i,t}^* = 0 \Leftrightarrow F_{i,t}^* = \frac{-\beta_2}{2\beta_3}. \quad (3)$$

In both growth models (linear and non-linear one), our set of control variables encompasses the lagged growth rate of the real *per capita* gross domestic product, the inflation rate, the general government consumption, the degree of trade openness and the education level of the population. A similar set with these control variables was also used by Rioja and Valev (2004a, b), Hassan, Sanchez, and Yu (2011), Rousseau and Wachtel (2011), Cecchetti and Kharroubi (2012), Beck, Degryse, and Kneer (2014), Breitenlechner, Gächter, and Sindermann (2015), Ehigiamusoe and Lean (2017) and Barradas (2020).

The lagged value of the dependent variable was included in our growth models in order to take into account the steady-state convergence predicted by the neoclassical growth model (Hassan, Sanchez, and Yu 2011; Alexiou, Vogiazas, and Nellis 2018). As such, a positive effect of the lagged dependent variable on economic growth is expected.

The inflation rate is expected to exert a negative impact on economic growth, reflecting the level of uncertainty represented by price variability (Barro 2003). This disruptive relationship between inflation and economic growth can also be explained through the decrease in investment, savings and capital accumulation in periods of high inflation (Stanley Fischer 1993). The inclusion of the inflation rate also proxies the institutional development (Gunther Schnabl 2009; Alexiou, Vogiazas, and Nellis 2018).

The general government consumption is expected to impact positively following the Keynesian argument that higher government spending stimulates aggregate

demand, representing therefore an important motor for economic growth (Alexiou and Nellis 2013; Ehigiamusoe and Lean 2017; Alexiou, Vogiazas, and Nellis 2018).

The degree of trade openness has a positive effect on economic growth through the greater competition and technological progress that a higher level of trade openness tends to generate (L. Alan Winters 2004; Ehigiamusoe and Lean 2017; Alexiou, Vogiazas, and Nellis 2018).

Economic growth also depends positively on the education level of the population, reflecting the beneficial role that human capital can have on growth (Rousseau and Wachtel 2011; Ehigiamusoe and Lean 2017).

3. Data

We collected annual data from 1990 to 2016 for all countries of the EU, obtaining a panel data composed of a total of 28 cross-sectional units ($N = 28$) observed over time ($T = 27$). This is the span and the periodicity for which all data exists, which covers the years where the age of financialisation achieved more preponderance in the case of the EU countries (Van der Zwan 2014).

In order to obtain a holistic picture of the finance-growth nexus, we chose to use a large set of proxies to capture the role of finance and verify if our results are robust to the proxy chosen. This is particularly relevant, considering that "defining appropriate proxies for the degree of financial development is, indeed, one of the challenges faced by empirical researchers" (Sebastian Edwards 1996). The traditional measures referred to in the theoretical and empirical literature around this subject are the money supply (Rioja and Valev 2004a, b; Hassan, Sanchez, and Yu 2011; Rousseau and Wachtel 2011; Breitenlechner, Gächterm, and Sindermann 2015; Ehigiamusoe and Lean 2017; Alexiou, Vogiazas, and Nellis 2018; Barradas 2020), the domestic credit (Rioja and Valev 2004a, b; Hassan, Sanchez, and Yu 2011; Rousseau and Wachtel 2011; Cecchetti and Kharroubi 2012; Beck, Degryse, and Kneer 2014; Jedidia, Boujelbène, and Helali 2014; Breitenlechner, Gächter, and Sindermann 2015; Durusu-Ciftci, Ispir, and Yetkiner 2017; Ehigiamusoe and Lean 2017; Alexiou, Vogiazas, and Nellis 2018; Barradas 2020; Pariboni, Meloni, and Tridico 2020), the financial value added (Beck, Degryse, and Kneer 2014; Barradas 2020), the real interest rates (Alexiou, Vogiazas, and Nellis 2018), the stock market total volume traded (Jedidia, Boujelbène, and Helali 2014; Durusu-Ciftci, Ispir, and Yetkiner 2017; Alexiou, Vogiazas, and Nellis 2018) and the stock market capitalisation (Alexiou, Vogiazas, and Nellis 2018; Barradas 2020; Pariboni, Meloni, and Tridico 2020). These measures tend to capture different dimensions of finance, namely the financial depth, the overall size of financial intermediation activity and their corresponding efficiency (Beck, Degryse, and Kneer 2014; Breitenlechner, Gächter, and Sindermann 2015). In order to avoid multicollinearity problems, these measures will be used separately from each other.

It is worth noting that the available data for these different proxies of finance differ slightly according to the respective variable, but in all cases it was impossible to collect data for all the years for each country. Against this backdrop, seven unbalanced panels were constructed. The structure and composition of our seven unbalanced panels are illustrated in Table 1.

Table 1 Sample Composition of Each Unbalanced Panel

Country	Money supply	Domestic credit	Financial value added	Short-term interest rate	Long-term interest rate	Stock market volume traded	Stock market capit.
Austria	1990-2015	2001-2016	1995-2016	1990-2016	1990-2016	1990-2015	1990-2015
Belgium	1990-2015	2001-2015	1995-2015	1990-2015	1990-2015	1990-2014	1990-2015
Bulgaria	1991-2015	2001-2016	1999-2016	1998-2016	2002-2016	1997-2013	1993-2012
Cyprus	1990-2015	2005-2015	1995-2015	1999-2015	1997-2015	1992-2015	1992-2015
Czech Rep.	1994-2015	2001-2015	1995-2015	1994-2015	2001-2015	1994-2014	1994-2012
Denmark	1990-2015	2001-2016	1990-2016	1990-2016	1990-2016	1990-2012	1990-2012
Estonia	2004-2015	2004-2015	1996-2015	1996-2015	1998-2010	1998-2012	1998-2012
Finland	1990-2015	2001-2016	1990-2016	1990-2016	1990-2016	1990-2012	1990-2012
France	1990-2015	2001-2015	1990-2015	1990-2015	1990-2015	1990-2014	1990-2015
Germany	1992-2015	2001-2015	1995-2015	1992-2015	1992-2015	1992-2015	1992-2015
Greece	1990-2015	2001-2015	1995-2015	1990-2015	1992-2015	1990-2015	1990-2015
Hungary	1992-2015	2001-2016	1995-2016	1994-2016	1999-2016	1992-2015	1992-2015
Ireland	1990-2015	2001-2016	1995-2016	1990-2016	1990-2016	1995-2015	1996-2014
Italy	1990-2015	2001-2015	1995-2015	1990-2015	1990-2015	1990-2014	1990-2014
Latvia	1996-2015	2010-2015	1996-2015	1996-2015	2001-2015	1996-2012	1996-2012
Lithuania	1996-2015	2010-2016	1996-2016	1999-2016	2001-2016	1996-2012	1996-2012
Luxembourg	1992-2011	2001-2015	1995-2015	1999-2015	1992-2015	1992-2015	1992-2015
Malta	1990-2015	2005-2016	1995-2016	1995-2016	2000-2016	1996-2015	1995-2015
Netherlands	1990-2015	2001-2016	1995-2016	1990-2016	1990-2016	1990-2014	1990-2015
Norway	1990-2015	1990-2016	1990-2015	1990-2012	1990-2010	1990-2015	1990-2015
Poland	1991-2015	2001-2016	1995-2016	1995-2016	1999-2016	1991-2015	1992-2015
Portugal	1990-2015	2001-2016	1995-2016	1990-2016	1990-2016	1990-2014	1990-2015
Romania	1991-2013	1991-2016	1995-2016	1995-2016	2006-2016	1995-2012	1995-2012
Slovakia	2002-2015	2006-2015	1995-2015	1995-2015	2000-2015	1994-2013	1994-2013
Slovenia	1996-2015	2005-2015	1996-2015	1998-2015	2002-2015	1996-2015	1996-2015
Spain	1990-2015	2001-2016	1995-2016	1990-2016	1990-2016	1990-2015	1990-2015
Sweden	1990-2015	2001-2015	1993-2015	1990-2015	1990-2015	1990-2012	1990-2012
UK	1990-2015	1990-2015	1995-2015	1990-2015	1990-2015	1990-2014	1990-2012
Observations	665	428	615	653	599	630	631
Missing	91	328	141	103	157	126	125

Source: Author's compilation.

Table 2 contains the proxies used for each variable and the respective sources and Table 3 contains the descriptive statistics for each one. Figures A1 to A12 in the Appendix represent the respective plots.

Table 2 The Proxies and Sources of Each Variable

Variable	Proxy	Source
Growth	GDP per capita growth (annual %)	World Bank
Inflation	Inflation, consumer prices (annual %)	World Bank
Government consumption	General government final consumption expenditure (% of GDP)	World Bank
Trade openness	Exports and imports of goods and services (% of GDP)	World Bank
Education	School enrolment, secondary (% gross)	World Bank
Money supply	Liquid liabilities (% of GDP)	Fred St. Louis
Domestic credit	Domestic credit provided by financial sector (% of GDP)	World Bank
Financial value added	Gross value added of financial, insurance and real estate activities (%)	Eurostat

Short-term interest rate	Real short-term interest rates, deflator GDP (%)	AMECO
Long-term interest rate	Real long-term interest rates, deflator GDP (%)	AMECO
Stock market volume traded	The stock market total volume traded (% of GDP)	Fred St. Louis
Stock market capitalization	Stock market capitalization (% of GDP)	Fred St. Louis

Source: Author's compilation.

Table 3 The Descriptive Statistics of Each Variable

Variable	Mean	Median	Maximum	Minimum	Standard deviation
Growth	0.022	0.022	0.244	-0.146	0.036
Inflation	0.081	0.025	10.584	-0.045	0.459
Government consumption	0.197	0.194	0.279	0.116	0.029
Trade openness	1.034	0.863	4.102	0.340	0.588
Education	1.045	1.010	1.639	0.597	0.163
Money supply	0.819	0.657	3.991	0.158	0.559
Domestic credit	1.198	1.159	3.166	0.128	0.604
Financial value added	0.147	0.139	0.385	0.081	0.048
Short-term interest rate	0.016	0.012	0.252	-0.232	0.038
Long-term interest rate	0.028	0.025	0.244	-0.124	0.033
Stock market volume traded	0.321	0.132	2.500	0.000	0.426
Stock market capitalization	0.342	0.342	2.500	0.000	0.402

Source: Author's calculation.

4. Econometric Methodology

Our growth models are estimated using the LSDVBC estimator follow the "xtlsdvc" command in the Stata software. The LSDVBC estimator was introduced by Stephen Nickel (1981), Jan F. Kiviet (1995) and Maurice J. G. Bun and Kiviet (2003) and it was extended by Giovanni S. F. Bruno (2005a, b) for the case of unbalanced panels. This is the only existing estimator that can produce reliable estimates taking into account that we have a dynamic panel data model due to the inclusion of the lagged growth rate among the control variables, an unbalanced panel due to the presence of some missing values in our sample, a macro panel due to the relatively small cross-sectional dimension *N* of our sample and the possible existence of endogeneity due to the aforementioned potential reverse causation between finance and growth in the wake of the "demand-following hypothesis" and due to the omission of relevant variables.

We can appoint two specific sets of reasons to validate the adequacy of the LSDVBC estimator to produce our estimates. Firstly, the standard panel data estimators (e.g. pooled ordinary least squares, least-squares dummy variables, fixed effects and random effects) produce biased and/or inconsistent estimates because the lagged dependent variable is correlated with fixed effects in the error term (Nickel 1981; Baltagi 2005; A. Colin Cameron and Pravin K. Trivedi 2009; among others) and the standard panel data estimators for dynamic panel data models (e.g. T. W. Anderson and Cheng Hsiao 1982; Manuel Arrelano and Stephen Bond 1991; Arrelano and Olympia Bover 1995; Richard Blundell and Bond 1998) produce severely biased and imprecise estimates in the presence of macro panels with a moderate cross-sectional dimension *N* (Bruno 2005a, b). Secondly, Monte Carlo evidence has concluded the

superiority of the LSDVBC estimator *vis-à-vis* the former estimators in terms of bias and efficiency in the cases of macro panels (Kiviet 1995; Ruth A. Judson and Ann L. Owen 1999; Bruno 2005a, b) and the good performance of the LSDVBC estimator also in the cases where endogeneity can exist (Andreas Behr 2003).

The implementation of the LSDVBC estimator involves two different stages (Bruno 2005a, b). Firstly, the LSDVBC estimator produces consistent estimates. This forces the definition of an initial matrix of starting values, which can be achieved through three different consistent estimators (Anderson and Hsiao 1982; Arrelano and Bond 1991; Blundell and Bond 1998). However, the results are quite robust to the choice of one of these three different estimators (Bun and Kiviet 2001; Bruno 2005a, b). Secondly, the LSDVBC estimator corrects the bias by producing a set of multiple replications to bootstrap the standard errors. In what follows, the estimates are presented, which are produced by using the Arrelano and Bond estimator to initialise the LSDVBC estimator and a number of replications equal to 250. We also include time dummies in our estimates and the respective WALD test to evaluate their statistical significance. It should be noted that we do not perform panel unit root tests by assuming the stationarity of our twelve variables due to the following three reasons. Firstly, our variables are measured in growth rates (in the case of growth and inflation), ratios (in the case of government consumption, trade openness, education, money supply, domestic credit, financial value added, stock market volume traded and stock market capitalization) and in percentage (in the case of short-term interest rate and long-term interest rate). In these circumstances it is reasonable to assume that these variables are in fact stationary. Secondly, plots of our variables (Figure A1 to Figure A12 in the Appendix) also seem to suggest that they are stationary. Thirdly, the standard panel unit roots tests tend to assume that $T \to \infty$ and therefore they have low power and perform very poorly in the presence of macro panels in which the cross-sectional dimension N is higher than the period dimension T (Baltagi 2005; Jaroslava Hlouskova and Martin Wagner 2006; Cameron and Trivedi 2009; among others). Thus, in the case of macro panels with a small T, the risk of concluding that the whole panel is non-stationary in levels even when the panel has a large proportion of stationary data should not be discarded.

5. Empirical Findings

5.1 Linear Growth Model

We start by presenting the results of our estimates for the linear growth model for all years and all countries. The respective results are presented in Table 4. Six conclusions should be addressed. Firstly, our results corroborate the hypothesis on the steady-state convergence predicted by the neoclassical growth model, as in Hassan, Sanchez, and Yu (2011), Breitenlechner, Gächter, and Sindermann (2015), Alexiou, Vogiazas, and Nellis (2018) and Pariboni, Meloni, and Tridico (2020). Secondly and also as expected, the inflation rate exerts an adverse effect on economic growth on the EU countries due to the corresponding distortion on the allocation of resources that price variability tends to have. This result was also found by Rioja and Valev (2004a, b), Hassan, Sanchez, and Yu (2011), Breitenlechner, Gächter, and Sindermann (2015),

Ehigiamusoe and Lean (2017) and Barradas (2020). Thirdly, general government consumption has a harmful impact on the economic growth of the EU countries, which does not support the Keynesian argument that higher government spending stimulates aggregate demand. According to Alexiou, Vogiazas, and Nellis (2018), this result can be explained from a demand-side perspective and a supply-side perspective. From a demand-side perspective, higher government spending could impact economic growth negatively by representing a source of inflation pressures. From a supply-side perspective, higher government spending could impact economic growth negatively due to high public sector wages, inefficient State enterprises, high level of corruption, among other phenomena. A disruptive relationship between general government consumption and economic growth was also encountered by other empirical studies on this subject (Rioja and Valev 2004a, b; Hassan, Sanchez, and Yu 2011; Rousseau and Wachtel 2011; Cecchetti and Kharroubi 2012; Breitenlechner, Gächter, and Sindermann 2015). Fourthly, trade openness is statistically significant and has the expected positive sign, confirming its positive effect on the economic growth of the EU countries. This is a common result of empirical studies on the finance-growth nexus. Fifthly, the education level of the population does not affect the economic growth of the EU countries due to its statistical insignificance at traditional significance levels. Given that the education level of the population remained relatively stable in our sample (Figure A5 in the Appendix), its lack of statistical significance is not too surprising. Note that this result does not change if we had used primary school enrolment instead of secondary school enrolment (results available upon request). Sixthly and foremost, our results do not confirm the finance-growth nexus hypothesis. Effectively, the majority of proxies for finance are statistically significant at traditional significance levels and exhibit negative coefficients, which corroborates that finance impairs economic growth in the EU countries in the age of financialisation, as recognised by Aghion, Howitt, and Mayer-Foulkes (2005), Kose et al. (2006), Prasad, Rajan, and Subramanian (2007), Rousseau and Wachtel (2011), Cecchetti and Kharroubi (2012), Barajas, Chami, and Yousefi (2013), Dabla-Norris and Srivisal (2013), Beck, Degryse, and Kneer (2014), Breitenlechner, Gächter, and Sindermann (2015), Ehigiamusoe and Lean (2017), Alexiou, Vogiazas, and Nellis (2018), Barradas (2020) and Pariboni, Meloni, and Tridico (2020). Even so, the proxies linked with stock markets (i.e. the stock market volume traded and stock market capitalisation) are not statistically significant at conventional significance levels, which indicates that they do not cause any impact on economic growth in the EU countries. This result is not so surprising taking into account that the majority of the EU countries are "bank-based" and not "market-based" (Jakob de Haan, Sander Oosterloo, and Dirk Schoenmaker 2015), which means that the role of finance in the intermediation process between savings and investments occurs essentially through banking activity and its depth, size and efficiency. Efectively, Céline Gimet and Thomas Lagoarde-Segot (2012), by performing a panel data econometric analysis for 138 countries over the period from 2002 and 2009, identify what features of financial systems can strengthen the linkages between banks (and capital markets) and economic growth. They conclude that the beneficial role of finance on economic growth depends not only on their banking sector size, but also on interbank

competition, macro-prudential safeguards, capital market development, adequate civil rights and supports to entrepreneurship.

Table 4 Estimates of the Linear Growth Model for the Full Period (1990-2016)

Variable	Money supply	Domestic credit	Financial value added	Short-term interest rate	Long-term interest rate	Stock market volume traded	Stock market capit.
$Growth_{t-1}$	0.472***	0.383***	0.395***	0.343***	0.315***	0.442***	0.466***
	(0.040)	(0.056)	(0.042)	(0.037)	(0.039)	(0.045)	(0.045)
	[11.78]	[6.83]	[9.43]	[9.17]	[8.12]	[9.76]	[10.27]
$Inflation_t$	-0.006***	-0.016*	-0.071***	-0.098***	-0.215***	-0.057***	-0.007***
	(0.002)	(0.009)	(0.015)	(0.014)	(0.054)	(0.014)	(0.002)
	[-2.92]	[-1.76]	[-4.73]	[-6.83]	[-3.96]	[-3.96]	[-3.68]
Government consumption$_t$	-0.133*	-0.144	-0.145*	-0.144	-0.200**	-0.155*	-0.116
	(0.071)	(0.133)	(0.078)	(0.078)	(0.085)	(0.082)	(0.072)
	[-1.88]	[-1.09]	[-1.86]	[-1.46]	[-2.35]	[-1.88]	[-1.60]
Trade openness$_t$	0.016**	0.023**	0.014*	0.024***	0.015***	0.016**	0.014**
	(0.007)	(0.012)	(0.008)	(0.007)	(0.005)	(0.006)	(0.006)
	[2.23]	[2.00]	[1.83]	[3.23]	[2.71]	[2.44]	[2.28]
Education$_t$	0.003	0.015	0.015	-0.003	0.006	0.005	0.001
	(0.012)	(0.020)	(0.015)	(0.012)	(0.011)	(0.013)	(0.013)
	[0.26]	[0.75]	[0.99]	[-0.25]	[0.53]	[0.40]	[0.11]
Finance$_t$	-0.009	-0.018***	-0.230***	-0.229***	-0.312***	0.008	0.005
	(0.008)	(0.008)	(0.071)	(0.035)	(0.037)	(0.005)	(0.005)
	[-1.13]	[-2.19]	[-3.25]	[-6.55]	[-8.47]	[1.46]	[0.86]
Observations	609	372	559	597	543	574	575
Groups	28	28	28	28	28	28	28
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p-value Wald test	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Notes: Standard errors in ( ), z-statistics in [], *** indicates statistical significance at 1% level, ** indicates statistical significance at 5% level and * indicates statistical significance at 10% level. Coefficients, standard errors and z-statistics for the year dummies are not reported.

Source: Author's calculation.

As the Great Recession represented a strong negative shock in the EU countries (Figure A1 in the Appendix), we also present the results of our estimates for the linear growth model for all countries for both pre-crisis and crisis and post-crisis periods, respectively. The corresponding results are presented in Tables 5 and 6. Nonetheless, these results do not differ substantially in comparison with the results for the full period. In the pre-crisis period, the variables that are statistically significant are exactly the same as in the full period and they have the same effects on the economic growth of the EU countries. This is probably because the pre-crisis period represents the highest proportion of the total span in our sample. In fact, the lagged growth rate of the real *per capita* gross domestic product and trade openness remain positive determinants of economic growth in the EU countries, whilst the inflation rate, the general government consumption and finance persist as negative determinants of economic growth in the EU countries. In the crisis and the post-crisis periods, the most important change is related to the variable of inflation rate, which loses its statistical significance. As stressed by Alexiou, Vogiazas, and Nellis (2018), this is an expected result given the relatively stable inflation environment during that period in the EU countries (Figure A2 in the Appendix). The remaining variables do not change in terms of statistical significance and signs in comparison with the full period and the pre-crisis period,

respectively. It is still worth noting that the magnitude of the coefficients for the proxies of finance is higher in the crisis and post-crisis periods than in the pre-crisis period. This can reveal that the prejudicial effects of finance on economic growth are became worse in recent years in the EU countries.

Table 5 Estimates of the Linear Growth Model for the Pre-Crisis Period (1990-2008)

Variable	Money supply	Domestic credit	Financial value added	Short-term interest rate	Long-term interest rate	Stock market volume traded	Stock market capit.
$Growth_{t-1}$	0.471***	0.406***	0.337***	0.321***	0.318***	0.358***	0.474***
	(0.047)	(0.082)	(0.050)	(0.046)	(0.054)	(0.048)	(0.054)
	[9.99]	[4.97]	[6.70]	[6.95]	[5.89]	[7.51]	[8.71]
$Inflation_t$	-0.007**	-0.032***	-0.110***	-0.121***	-0.255***	-0.084***	-0.008***
	(0.002)	(0.009)	(0.013)	(0.013)	(0.053)	(0.012)	(0.002)
	[-3.57]	[-3.36]	[-8.60]	[-9.17]	[-4.79]	[-7.15]	[-4.10]
Government consumption$_t$	-0.129	-0.407**	-0.413***	-0.309***	-0.460***	-0.227***	-0.152*
	(0.087)	(0.181)	(0.097)	(0.083)	(0.109)	(0.085)	(0.080)
	[-1.48]	[-2.25]	[-4.26]	[-3.71]	[-4.23]	[-1.98]	[-1.90]
Trade openness$_t$	0.009	0.009	0.019**	0.031***	0.019***	0.016**	0.012
	(0.007)	(0.019)	(0.009)	(0.009)	(0.007)	(0.008)	(0.008)
	[1.26]	[0.46]	[2.23]	[3.28]	[2.66]	[1.98]	[1.58]
$Education_t$	0002	0.027	0.016	-0.006	-0.009	0.003	0.002
	(0.014)	(0.032)	(0.06)	(0.013)	(0.012)	(0.014)	(0.014)
	[0.12]	[0.85]	[1.01]	[-0.42]	-0.69	[0.19]	[0.15]
$Finance_t$	-0.013	-0.019*	-0.159	-0.115***	-0.050	0.007	0.007
	(0.009)	(0.011)	(0.101)	(0.036)	(0.053)	(0.004)	(0.006)
	[-1.42]	[-1.68]	[-1.58]	[-3.18]	[-0.95]	[1.50]	[1.14]
Observations	419	168	350	391	344	410	413
Groups	28	26	28	28	28	28	28
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p-value Wald test	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Notes: Standard errors in ( ), z-statistics in [], *** indicates statistical significance at 1% level, ** indicates statistical significance at 5% level and * indicates statistical significance at 10% level. Coefficients, standard errors and z-statistics for the year dummies are not reported.

Source: Author's calculation.

Table 6 Estimates of the Linear Growth Model for the Crisis and Post-Crisis Periods (2009-2016)

Variable	Money supply	Domestic credit	Financial value added	Short-term interest rate	Long-term interest rate	Stock market volume traded	Stock market capit.
$Growth_{t-1}$	0.334***	0.086	0.126**	0.079	-0.055	0.380***	0.372***
	(0.055)	(0.076)	(0.060)	(0.062)	(0.059)	(0.069)	(0.042)
	[6.09]	[1.14]	[2.10]	[1.27]	[-0.92]	[5.47]	[8.91]
$Inflation_t$	-0.152	0.016	-0.218	-0.082	-0.235	-0.285	-0.446**
	(0.185)	(0.197)	(0.184)	(0.165)	(0.185)	(0.214)	(0.187)
	[-0.82]	[0.08]	[-1.18]	[-0.50]	[-1.27]	[-1.33]	[-2.39]
Government consumption$_t$	-1.500***	-0.842***	-1.315***	-1.246***	-1.315***	-1.828***	-1.210***
	(0.315)	(0.264)	(0.259)	(0.244)	(0.234)	(0.316)	(0.316)
	[-4.75]	[-3.19]	[-5.08]	[-5.11]	[-5.63]	[-5.78]	[-3.83]
Trade openness$_t$	0.088***	0.033*	0.045**	0.035**	0.027	0.051**	0.052**
	(0.033)	(0.020)	(0.020)	(0.017)	(0.018)	(0.025)	(0.021)
	[2.66]	[1.66]	[2.32]	[2.07]	[1.53]	[2.04]	[2.45]
$Education_t$	0.029	0.010	0.044	0.025	0.030	-0.049	-0.053
	(0.030)	(0.029)	(0.028)	(0.026)	(0.027)	(0.051)	(0.063)
	[0.99]	[0.36]	[1.58]	[0.95]	[1.11]	[-0.96]	[-0.84]
$Finance_t$	0.009	-0.038**	-0.572***	-0.463***	-0.474***	0.010	0.014
	(0.032)	(0.016)	(0.212)	(0.129)	(0.084)	(0.023)	(0.020)
	[0.28]	[-2.36]	[2.70]	[-3.59]	[-5.66]	[0.43]	[0.71]

Observations	134	152	153	150	143	108	106
Groups	28	28	28	28	26	28	28
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p-value Wald test	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Notes: Standard errors in ( ), z-statistics in [], *** indicates statistical significance at 1% level, ** indicates statistical significance at 5% level and * indicates statistical significance at 10% level. Coefficients, standard errors and z-statistics for the year dummies are not reported.

Source: Author's calculation.

5.2 Non-Linear Growth Model

Now, we present the results of our estimates for the non-linear growth model for all years and all countries, in order to assess whether there is an inverted U-shaped effect of finance on economic growth in the EU countries. The respective results are presented in Table 7. The most important finding is connected with the non-statistical significance of the squared term of finance, which suggests that there is not a concave quadratic relationship between finance and economic growth in the EU countries. The only exception is related to the proxy of domestic credit, for which the squared term is statistically significant at traditional significance levels. However, its positive coefficient suggests that the relationship between finance and economic growth is really convex instead of concave, which is associated with a turning point of around 233% of the gross domestic product. This seems to suggest that domestic credit in the EU countries needs to supplant this threshold to start to exert a positive impact on economic growth. The remaining variables maintain their statistical significance and the same sign in comparison with the estimates of the linear growth model, confirming the robustness of our results.

Similarly to what we have done for the linear growth-model, we also present the results of our estimates for the non-linear growth model for all countries for both pre-crisis and crisis and post-crisis periods, respectively. The corresponding results are presented in Tables 8 and 9. The results do not change dramatically in comparison with the same results of the linear growth model. Two main conclusions deserve our attention. Firstly, the existence of a concave quadratic relationship between finance and economic growth in the EU countries is also rejected both in the pre-crisis period and in the crisis and post-crisis periods. Secondly, the convex relationship between domestic credit and economic growth also occurs in the pre-crisis period, albeit the turning point has decreased slightly to a threshold of about 215% of the gross domestic product.

Table 7 Estimates of the Non-Linear Growth Model for the Full Period (1990-2016)

Variable	Money supply	Domestic credit	Financial value added	Short-term interest rate	Long-term interest rate	Stock market volume traded	Stock market capit.
$Growth_{t-1}$	0.471***	0.345***	0.394***	0.344***	0.315***	0.438***	0.458***
	(0.040)	(0.057)	(0.042)	(0.037)	(0.039)	(0.046)	(0.045)
	[11.67]	[6.08]	[9.38]	[9.21]	[8.04]	[9.61]	[10.11]
$Inflation_t$	-0.006***	-0.015*	-0.071***	-0.087***	-0.211***	-0.058***	-0.007***
	(0.002)	(0.009)	(0.015)	(0.019)	(0.057)	(0.014)	(0.002)
	[-2.91]	[-1.71]	[-4.65]	[-4.64]	[-3.69]	[-4.02]	[-3.64]

Government consumption$_t$	-0.134* (0.071) [-1.87]	-0.209 (0.134) [-1.56]	-0.148* (0.080) [-1.84]	-0.119 (0.078) [-1.52]	-0.201** (0.085) [-2.35]	-0.152* (0.083) [-1.84]	-0.110 (0.073) [-1.51]
Trade openness$_t$	0.016** (0.007) [2.16]	0.022** (0.011) [1.96]	0.014* (0.008) [1.75]	0.023*** (0.007) [3.19]	0.015*** (0.005) [2.70]	0.017*** (0.006) [2.63]	0.015** (0.006) [2.37]
Education$_t$	0.003 (0.012) [0.27]	0.003 (0.020) [0.78]	0.015 (0.016) [0.98]	-0.022 (0.012 [-0.20]	0.006 (0.011) [0.53]	0.005 (0.013) [0.37]	0.002 (0.013) [1.33]
Finance$_t$	-0.011 (0.013) [-0.83]	-0.070*** (0.021) [-3.39]	-0.269 (0.228) [-1.18]	-0.208*** (0.042) [-4.99]	-0.302*** (0.053) [-5.66]	0.020* (0.011) [1.81]	0.017 (0.013) [1.33]
Finance^2_t	0.001 (0.003) [0.21]	0.015*** (0.006) [2.65]	0.123 (0.627) [0.20]	-0.259 (0.290) [0.89]	-0.096 (0.339) [-0.28]	-0.006 (0.005) [-1.30]	-0.006 (0.005) [-1.03]
Finance*	n.a.	233	n.a.	n.a.	n.a.	n.a.	n.a.
Observations	609	372	559	597	543	574	575
Groups	28	28	28	28	28	28	28
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p-value Wald test	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Notes: Standard errors in ( ), z-statistics in [], *** indicates statistical significance at 1% level, ** indicates statistical significance at 5% level and * indicates statistical significance at 10% level. Coefficients, standard errors and z-statistics for the year dummies are not reported.

Source: Author's calculation.

Table 8 Estimates of the Non-Linear Growth Model for the Pre-Crisis Period (1990-2008)

Variable	Money supply	Domestic credit	Financial value added	Short-term interest rate	Long-term interest rate	Stock market volume traded	Stock market capit.
Growth$_{t-1}$	0.471*** (0.047) [10.07]	0.373*** (0.080) [4.69]	0.334*** (0.050) [6.66]	0.326*** (0.046) [7.02]	0.311*** (0.054) [5.76]	0.351*** (0.048) [7.33]	0.455*** (0.053) [8.58]
Inflation$_t$	-0.007*** (0.002) [-3.56]	-0.031*** (0.010) [-3.31]	-0.110*** (0.013) [-8.49]	-0.109*** (0.019) [-5.87]	-0.250*** (0.053) [-4.69]	-0.085*** (0.012) [-7.24]	-0.008*** (0.002) [-4.07]
Government consumption$_t$	-0.129 (0.088) [-1.47]	-0.555*** (0.192) [-2.89]	-0.411*** (0.098) [-4.19]	-0.307*** (0.084) [-3.66]	-0.465*** (0.109) [-4.27]	-0.218** (0.085) [-2.56]	-0.142* (0.080) [-1.77]
Trade openness$_t$	0.009 (0.008) [1.19]	0.012 (0.019) [0.63]	0.021** (0.009) [2.18]	0.030** (0.009) [3.21]	0.019*** (0.007) [2.67]	0.019** (0.008) [2.35]	0.016** (0.008) [2.01]
Education$_t$	0.002 (0.014) [0.12]	0.024 (0.031) [0.76]	0.015 (0.016) [0.94]	-0.005 (0.014) [-0.35]	-0.008 (0.013) [-0.62]	0.002 (0.014) [0.15]	0.002 (0.014) [0.08]
Finance$_t$	-0.013 (0.015) [-0.91]	-0.086*** (0.033) [-2.59]	-0.043 (0.245) [-0.18]	-0.097** (0.044) [-2.23]	-0.038 (0.055) [-0.69]	0.019* (0.011) [1.83]	0.029** (0.012) [2.34]
Finance^2_t	0.000 (0.004) [0.08]	0.020** (0.009) [2.16]	-0.346 (0.668) [-0.52]	-0.293 (0.347) [-0.85]	-0.486 (0.713) [-0.68]	-0.006 (0.005) [-1.34]	-0.010* (0.005) [-1.94]
Finance*	n.a.	215	n.a.	n.a.	n.a.	n.a.	n.a.
Observations	419	168	350	391	344	410	413
Groups	28	26	28	28	28	28	28
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p-value Wald test	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Notes: Standard errors in ( ), z-statistics in [], *** indicates statistical significance at 1% level, ** indicates statistical significance at 5% level and * indicates statistical significance at 10% level. Coefficients, standard errors and z-statistics for the year dummies are not reported.

Source: Author's calculation.

Table 9 Estimates of the Non-Linear Growth Model for the Crisis and Post-Crisis Periods (2009-2016)

Variable	Money supply	Domestic credit	Financial value added	Short-term interest rate	Long-term interest rate	Stock market volume traded	Stock market capit.
$Growth_{t-1}$	0.330***	0.084	0.128**	0.091	-0.042	0.384***	0.386***
	(0.054)	(0.079)	(0.061)	(0.061)	(0.057)	(0.066)	(0.046)
	[6.14]	[1.06]	[2.10]	[1.49]	[-0.73]	[5.81]	[8.46]
$Inflation_t$	-0.162	0.021	-0.208	-0.200	-0.327*	-0.299	-0.388**
	(0.179)	(0.190)	(0.187)	(0.156)	(0.178)	(0.215)	(0.189)
	[-0.91]	[0.11]	[-1.12]	[-1.28]	[-1.84]	[-1.39]	[-2.05]
Government consumption$_t$	-1.356***	-0.840***	-1.263***	-1.119***	-1.244***	-1.848***	-1.112***
	(0.317)	(0.265)	(0.296)	(0.238)	(0.227)	(0.316)	(0.325)
	[-4.28]	[-3.17]	[-4.27]	[-4.71]	[-5.47]	[-5.84]	[-3.42]
Trade openness$_t$	0.093***	0.032	0.048**	0.036**	0.028*	0.067***	0.068***
	(0.032)	(0.020)	(0.020)	(0.016)	(0.017)	(0.025)	(0.023)
	[2.91]	[1.61]	[2.38]	[2.27]	[1.68]	[2.62]	[3.00]
Education$_t$	0.026	0.010	0.044	0.025	0.031	-0.057	-0.064
	(0.028)	(0.029)	(0.028)	(0.024)	(0.026)	(0.053)	(0.065)
	[0.91]	[0.36]	[1.60]	[1.03]	[1.19]	[-1.07]	[-0.99]
Finance$_t$	-0.065	-0.046	-0.940	-0.662***	-0.668***	-0.066	-0.061
	(0.089)	(0.056)	(0.898)	(0.124)	(0.121)	(0.059)	(0.042)
	[-0.73]	[-0.82]	[-1.05]	[-5.34]	[-5.52]	[-1.11]	[-1.45]
$Finance^2_t$	0.018	0.002	1.061	2.388	1.081	0.037	0.039**
	(0.026)	(0.016)	(2.548)	(3.420)	(0.659)	(0.024)	(0.018)
	[0.69]	[0.15]	[0.42]	[0.70]	[1.64]	[1.57]	[2.21]
Finance*	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Observations	134	152	153	150	143	108	106
Groups	28	28	28	28	26	28	28
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p-value Wald test	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Notes: Standard errors in ( ), z-statistics in [], *** indicates statistical significance at 1% level, ** indicates statistical significance at 5% level and * indicates statistical significance at 10% level. Coefficients, standard errors and z-statistics for the year dummies are not reported.

Source: Author's calculation.

5.3 Economic Effects

Finally, we present the economic significance (Deirdre McCloskey and Stephen T. Ziliak 1996; Ziliak and McCloskey 2004) of the proxies of finance that proved to be statistically significant on the linear growth models. This analysis only focuses on the estimates of the linear growth models due to the statistical insignificance of the non-linear relationship between finance and economic growth. This allows to assess properly the contribution of each proxy of finance to the economic growth of the EU countries since 1990. Results are presented in Table 10. Considering the full period as a whole, we conclude that the growth of finance has in fact contributed to a fall in economic growth in the EU countries. Effectively, the increase in domestic credit and of the financial value added contributed to a decline in economic growth by about 1.1 and 1.4 percent, respectively. In the pre-crisis period, this detrimental effect of finance on economic growth of the EU countries was even more pronounced. Economic

growth would have been higher by around 1.8 percent if there had not been a jump in the growth of domestic credit. In the crisis and post-crisis periods, there was a reversal in the growth of finance, which was beneficial for the economic growth of the EU countries. Effectively, the contraction of domestic credit and of financial value added in the aftermath of the Great Recession delineated an acceleration of economic growth in the EU countries by about 0.6 and 8.4 percent, respectively. The sustained fall in the level of real interest rates since 1990 contributed decisively to a higher level of economic growth in the EU countries, both in the pre-crisis period and in the crisis and post-crisis periods.

To sum up, our results do not support the finance-growth nexus hypothesis by confirming that finance has instigated a drop in the economic growth of the EU countries, particularly in the period leading up to the Great Recession where the growth of finance was more evident. As we observe since the Great Recession, a reversal in the importance of finance seems to be necessary in the coming years, i.e. a de-financialisation process, in order to sustain a higher level of economic growth in the EU countries. Otherwise, the hypothesis of a new "secular stagnation" in the current age of financialisation will gain momentum.

Table 10 Economic Significance of Our Statistically Significant Estimates of the Linear Growth Model

Period	Variable	Short-term coefficient	Long-term coefficient	Actual cumulative change	Economic effect
Full period (1990-2016)	Domestic credit	-0.018*** (0.008) [-2.19]	-0.029** (0.013) [-2.20]	0.394	-0.011
	Financial value added	-0.230*** (0.071) [-3.25]	-0.380*** (0.117) [-3.24]	0.038	-0.014
	Short-term interest rate	-0.229*** (0.035) [-6.55]	-0.349*** (0.054) [-6.50]	-1.127	0.393
	Long-term interest rate	-0.312*** (0.037) [-8.47]	-0.456*** (0.051) [-8.98]	-0.905	0.413
Pre-crisis period (1990-2008)	Domestic credit	-0.019* (0.011) [-1.68]	-0.032* (0.019) [-1.70]	0.554	-0.018
	Short-term interest rate	-0.115*** (0.036) [-3.18]	-0.169*** (0.052) [-3.27]	-0.823	0.139
Crisis and post-crisis periods (2009-2016)	Domestic credit	-0.038** (0.016) [-2.36]	-0.041** (0.017) [-2.44]	-0.145	0.006
	Financial value added	-0.572*** (0.212) [2.70]	-0.655*** (0.242) [-2.71]	-0.129	0.084
	Short-term interest rate	-0.463*** (0.129) [-3.59]	-0.503*** (0.138) [-3.65]	-1.320	0.664
	Long-term interest rate	-0.474*** (0.084) [-5.66]	-0.450*** (0.079) [-5.68]	-0.878	0.395

Notes: Standard errors in ( ), z-statistics in [], *** indicates statistical significance at 1% level, ** indicates statistical significance at 5% level and * indicates statistical significance at 10% level. The long-term coefficient is obtained through the division

between the short-term coefficient (estimated coefficient) and one minus the coefficient of the autoregressive estimation (estimated lagged growth rate of the real *per capita* gross domestic product coefficient) by performing the "nlcom" command in the Stata software. The actual cumulative change corresponds to the growth rate of the correspondent variable. The economic effect is the multiplication of the long-term coefficient by the actual cumulative change.

Source: Author's calculation.

6. Conclusion

This paper aimed to assess an empirical re-examination of the finance-growth nexus by conducting a panel data econometric analysis for all 28 European Union countries over 27 years from 1990 to 2016.

This is particularly challenging due to the emergence of several empirical studies that have not supported the hypothesis on the finance-growth nexus (Rioja and Valev 2004a, b; Aghion, Howitt, and Mayer-Foulkes 2005; Kose et al. 2006; Prasad, Rajan, and Subramanian 2007; Rousseau and Wachtel 2011; Cecchetti and Kharroubi 2012; Barajas, Chami, and Yousefi 2013; Dabla-Norris and Srivisal 2013; Beck, Degryse, and Kneer 2014; Breitenlechner, Gächter, and Sindermann 2015; Ehigiamusoe and Lean 2017; Alexiou, Vogiazas, and Nellis 2018; Barradas 2020; Pariboni, Meloni, and Tridico 2020), mainly in the period since the mid-1980s. During that time, the financial system has been subjected to strong liberalisation and deregulation by preventing its beneficial effects on the real economy. This phenomenon, typically called financialisation, points to a negative view of finance and contradicts the well-established hypothesis on the finance-growth nexus.

Hence, we estimated both a linear growth model and a non-linear growth model using the LSDVBC estimator taking into account that we have a dynamic panel data model due to the inclusion of the lagged growth rate among the control variables, an unbalanced panel due to the presence of some missing values in our sample, a macro panel due to the relatively small cross-sectional dimension N of our sample and the possible existence of endogeneity due to the aforementioned potential reverse causation between finance and growth and the omission of relevant variables. We used different proxies of finance (money supply, domestic credit, financial value added, short-term interest rate, long-term interest rate, stock market volume traded and stock market capitalisation) in order to offer a complete picture of the role of finance on economic growth and to capture different dimensions of finance, namely the financial depth, the overall size of financial intermediation activity and their corresponding efficiency (Beck, Degryse, and Kneer 2014; Breitenlechner, Gächter, and Sindermann 2015). In addition, our growth models also incorporate five control variables (the lagged growth rate of the real *per capita* gross domestic product, the inflation rate, the general government consumption, the degree of trade openness and the education level of the population) in line with other empirical studies around this matter (Rioja and Valev 2004a, b; Hassan, Sanchez, and Yu 2011; Rousseau and Wachtel 2011; Cecchetti and Kharroubi 2012; Beck, Degryse, and Kneer 2014; Breitenlechner, Gächter, and Sindermann 2015; Ehigiamusoe and Lean 2017; Barradas 2020).

The paper corroborates the results of these empirical studies, namely by confirming that the lagged growth rate of the real *per capita* gross domestic product and trade openness are positive determinants of economic growth in the EU countries, whilst the inflation rate and general government consumption are negative

determinants. The paper finds that finance impairs economic growth in the EU countries, both in the pre-crisis and in the crisis and post-crisis periods, thus not supporting the finance-growth nexus hypothesis. It is also concluded that the spectacular growth of domestic credit and of financial value added favoured a drop in economic growth in the EU countries since 1990 and particularly in the years leading up to the Great Recession. The paper also does not confirm the existence of a non-linear relationship between finance and economic growth in the EU countries, which seems to rule out the possibility of finance having an inverted U-shaped effect on economic growth in the EU countries.

Our results suggest that it is necessary to reduce the importance of finance in the coming years, i.e. to engage in a de-financialisation process, in order to sustain a higher level of economic growth in the EU countries. Otherwise, the hypothesis of a new "secular stagnation" in the current age of financialisation may become real.

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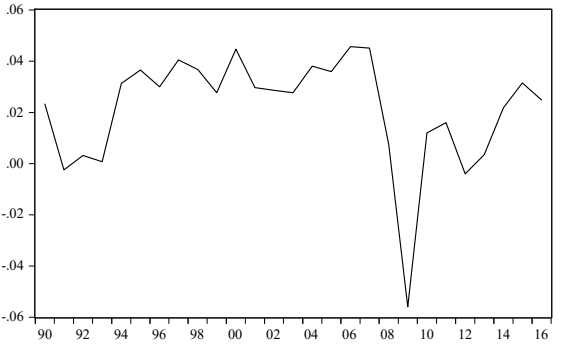
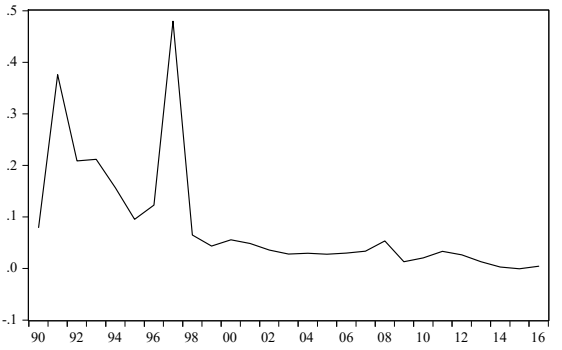
Appendix



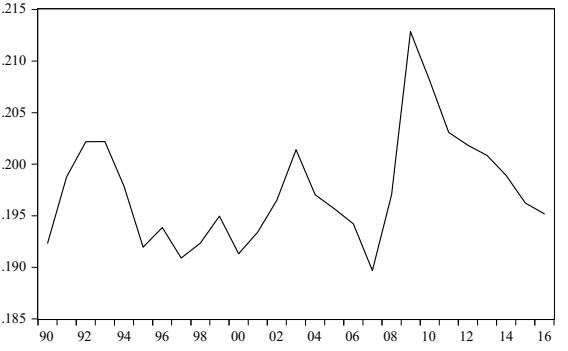
Source: Author's calculations.

Figure A1 Unweighted Mean of GDP *per capita* Growth (Annual %)



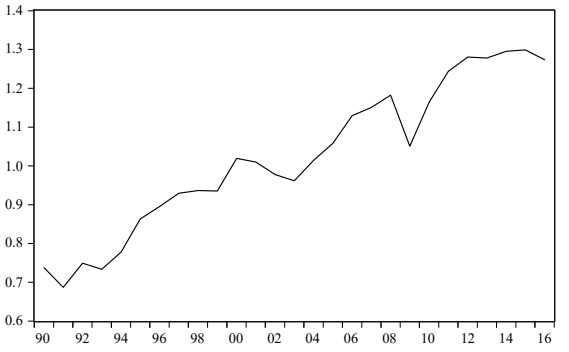
Source: Author's calculations.

Figure A2 Unweighted Mean of Inflation (Annual %)



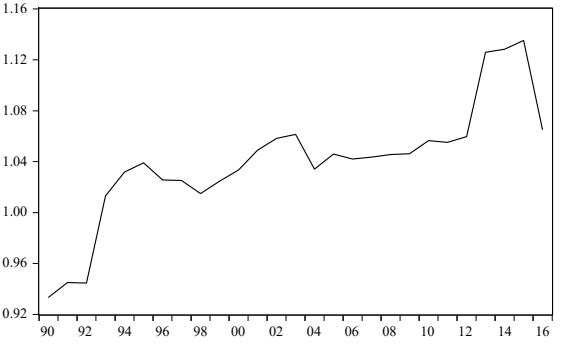
Source: Author's calculations.

Figure A3 Unweighted Mean of General Government Final Consumption Expenditure (% of GDP)



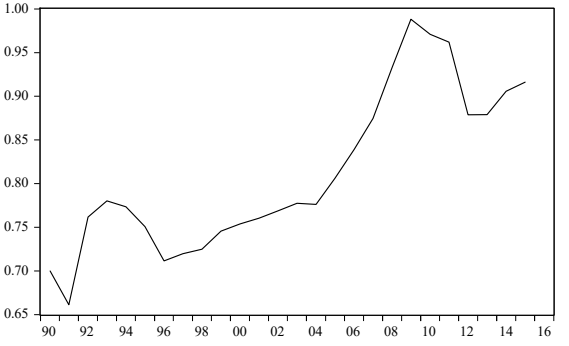
Source: Author's calculations.

Figure A4 Unweighted Mean of Exports and Imports of Goods and Services (% of GDP)



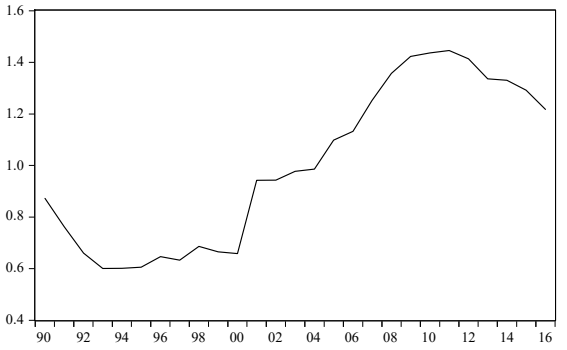
Source: Author's calculations.

Figure A5 Unweighted Mean of Secondary School Enrolment (% Gross)



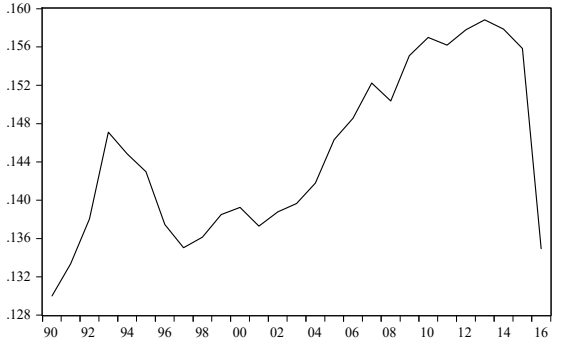
Source: Author's calculations.

Figure A6 Unweighted Mean of Liquid Liabilities (% of GDP)



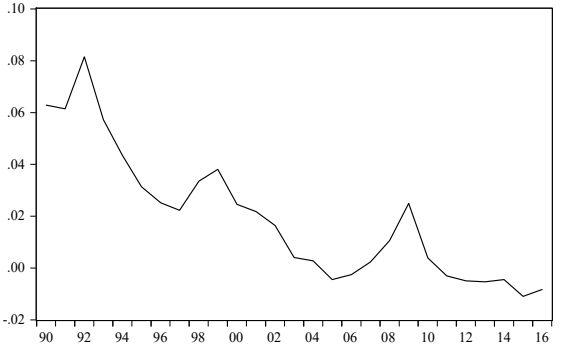
Source: Author's calculations.

Figure A7 Unweighted Mean of Domestic Credit Provided by Financial Sector (% of GDP)



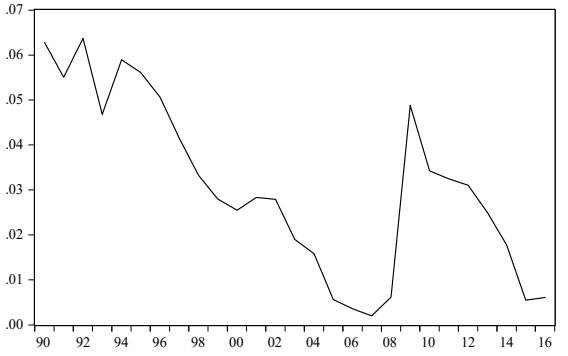
Source: Author's calculations.

Figure A8 Unweighted Mean of Gross Value Added of Financial Activities (% of Total)



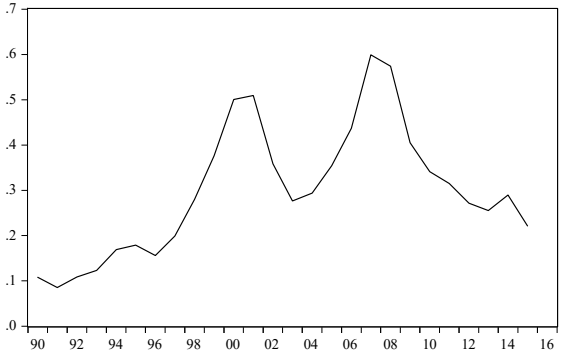
Source: Author's calculations.

Figure A9 Unweighted Mean of Real Short-Term Interest Rate, Deflator GDP (%)



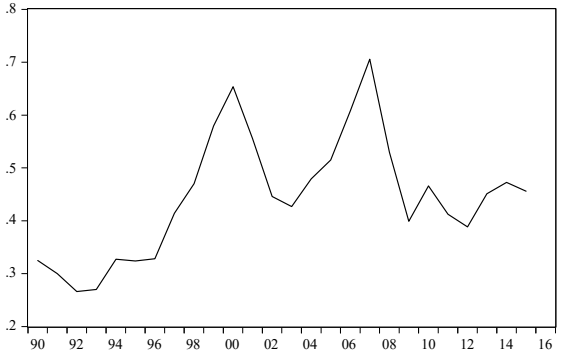
Source: Author's calculations.

Figure A10 Unweighted Mean of Real Long-Term Interest Rate, Deflator GDP (%)



Source: Author's calculations.

Figure A11 Unweighted Mean of the Stock Market Total Volume Traded (% of GDP)



Source: Author's calculations.

Figure A12 Unweighted Mean of Stock Market Capitalisation (% of GDP)