

The Literature on the Finance–Growth Nexus in the Aftermath of the Financial Crisis: A Review

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Abstract This article provides a survey of the recent literature on the finance and growth relationship, the so-called nexus, since the 2007 global financial crisis. We use simple bibliometric analysis to survey this literature. The crisis brought the nexus into question which is why we begin by reviewing the impact of the crisis on the pre-crisis consensus in the immediate aftermath of the crisis (2008–2014). Then, we review the evolution of the finance growth nexus after 2014. We discuss the current state of the pre-crisis consensus, and highlight the main features of the new consensus. We also propose a review of the methodological aspects of this recent literature, the econometrics of finance and growth in particular. Finally, we identify the actual limitations of literature and the key issues remaining unresolved which suggests avenues for future research.

Keywords Finance growth nexus · Financial crisis · Financial sector size · Nonlinearity · Too much finance

JEL Classifications G01 · G10 · G18 · G20 · 040

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Introduction

A common research question in macroeconomics is whether major economic events are followed by a paradigm shift *à la* Kuhn (1962). Our review of recent literature on the relationship between finance and growth indicates that this literature has actually undergone a paradigm shift in the aftermath of the financial crisis that started in 2007.

There was a “pre-crisis consensus” (Beck 2014a) on the finance growth “nexus” that started with work at the World Bank by Thorsten Beck and Ross Levine, on the basis of the work of Schumpeter among others. According to the IDEAS bibliographic database, Beck and Levine have published at least 45 articles dealing with the relationship between finance and growth over the period 1991–2016. The notion of “nexus” captures the idea that finance and growth were linked by a node of simple, first-order, and inextricable relationships that were robustly established in the literature. It was alleged that finance and growth were knotted by a strictly positive and linear correlation, such that one of the main research question remaining was to robustly determine the direction of causality between the two variables (Demetriades and Andrianova 2004, p. 42).

In the aftermath of the crisis, a growing body of the empirical literature instead highlighted that the relationship between finance and growth could be a complex Gordian knot: the relationship is often variable, nonlinear, or nonsignificant. This complexity in the *nexus* was not absent from the pre-crisis consensus, but was underestimated. On the contrary, following Rousseau and Wachtel (2011, 2017), Cecchetti and Kharroubi (2012) and Arcand et al. (2015) and available in an IMF working paper since 2012), the recent literature indicates that the relationship between finance and growth is not systematically positive. Rousseau and Wachtel (2011) show that a “rapid and excessive deepening” of the financial sector may weaken the *nexus*. Cecchetti and Kharroubi (2012), Law and Singh (2014) and Arcand et al. (2015) put forward the idea of “too much finance.” Their investigations indicate that there is a nonlinear finance–growth relationship suggesting that financial development would be good only up to a point beyond which finance harms economic growth.

As Beck (2014a) puts it, “too much of a good thing?” This “too much finance” result is currently becoming the new consensus in the literature. That is there is a bell-shaped or inverted U-shaped relationship implying that beyond a certain threshold, the relationship between growth and finance becomes negative. This new consensus is not entirely new; however, it represents a deepening of the analysis of the relationship between finance and growth. We evolved from a simple nexus to a richer, more complex and more nuanced nexus than before the crisis. Our economic understanding of the finance and growth relationship seems to have developed in the aftermath of the crisis.

The “too much finance” result motivates the following questions: What is the threshold from which we derive “too much finance,” in the sense that finance begins to impact growth negatively? What is the optimal level of financial development? Following the crisis, the main issue in the literature is the determination of the

threshold of nonlinearity, and less the determination of causality. Beyond the question of the precise threshold figure, exploring the reasons for this potentially nonlinear relationship is currently at the top of the research agenda of those interested in the finance–growth nexus.

As the review of the origins of finance and growth literature has already been undertaken (King and Levine 1993; Stolbov 2013; Arcand et al. 2015), we will not discuss this point further. For the same reason, we will also not include the finance and growth literature on the eve of the 2007 financial crisis, which has also been intensively surveyed (Levine 2005; Aghion 2007; Ang 2008; Jacquet and Pollin 2012). The developments in finance and growth literature in the immediate aftermath of the crisis, between 2008 and 2014, have also been the subject of numerous overviews (Boucher et al. 2012; Panizza 2012, 2014; Beck 2013; Pasali 2013). Hence, we will only briefly summarize the major trends for the period 2008–2014.

The main goal of this article is to survey the very recent literature, notably since Arcand et al. (2015), and show how it sheds light on a more complex view of the relationship between finance and growth. Our article provides a survey of the core research questions of this very recent state-of-the-art research on the finance growth nexus: How has the Beck–Levine–Schumpeter pre-crisis consensus been refined since the financial crisis? What are the recent developments in the critical issue of how to measure finance? What is the state-of-the-art econometric methodology in the finance and growth literature? What are the techniques employed to test the hypothesis of nonlinearity in the finance and growth relationship? Finally, looking to the future, we present the main directions for future research pointed out in this recent literature; in particular, how to explain nonlinearity in the relationship, how to incorporate regime shifts brought about by the crisis, how to deal with the challenge for finance represented by the ecological transition?

The rest of the article is organized as follows. The section “An overview of the impact of the crisis on the finance and growth literature, 2008–2014” briefly synthesizes the advancements of the finance growth nexus literature in the immediate aftermath of the crisis. The section “A new literature?” surveys this literature for the period 2015–2017, following the eminent article Arcand et al. (2015). The section “Unresolved issues and directions for future research” concludes by identifying the current limitations and potential future progress in finance and growth literature.

An Overview of the Impact of the Crisis on the Finance and Growth Literature, 2008–2014

According to search engine of the EBSCO database, the number of articles corresponding to the expression “finance and growth” (Fig. 1) has increased significantly in the aftermath of the crisis. A quick examination of the innumerable articles published since 1993 shows that the finance and growth literature addresses many fields in economics, including nearly the entire spectrum of the *Journal of Economic Literature* subject classifications (Fig. 2). Following the crisis, as in the

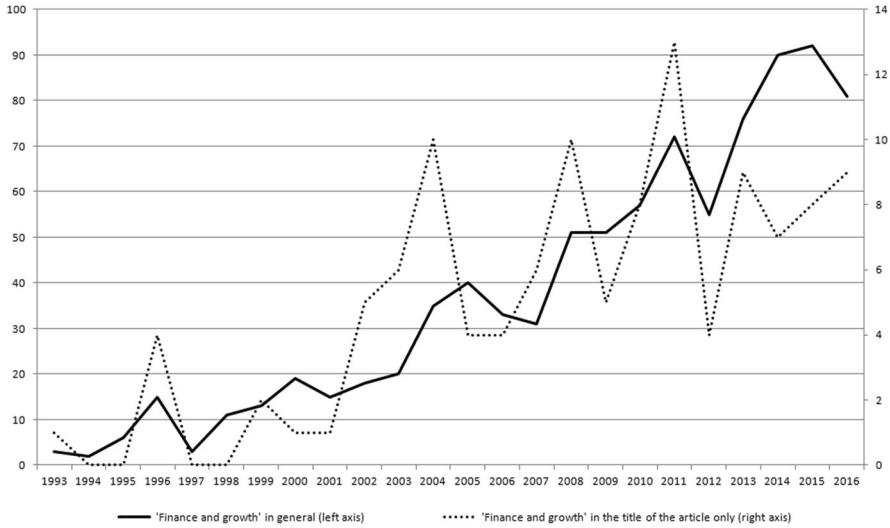


Fig. 1 Quantitative data on the number of articles on the finance and growth literature. Notes: We operate a selection and retain only the articles related to the finance and growth literature. We choose 1993 as the start of the sample period because the article from King and Levine (1993) is commonly seen as the starting point of the modern literature in finance and growth. Source: Authors, based on data from EBSCO

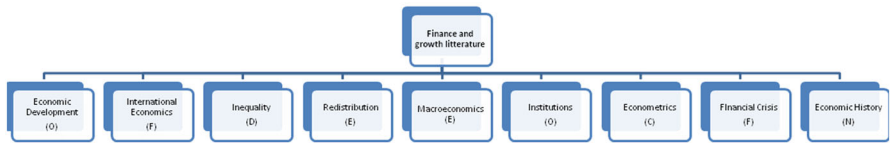


Fig. 2 Various aspects of the finance and growth literature. Notes: under brackets the letter corresponding to the JEL classification. Source: Authors

work in the 1990s, empirical studies continue to focus more on developing than developed countries.

An interesting extension of literature, in the wake of the crisis, analyzes the finance and growth relationship from an historical perspective. This branch of literature existed before the crisis, with notable contributions by Rousseau (1999, 2003), Rousseau and Wachtel (2000), Rousseau and Sylla (2003, 2005), and Bordo and Rousseau (2006). This historical analysis expanded following the crisis, and can be classified into two broad categories. One group of articles examines the finance and growth relationship within short historical periods (Schularick and Steger 2010; Diekmann and Westermann 2012; Jaremski and Rousseau 2013; Mitchener and Wheelock 2013), while the other group studies the nexus using long historical series of data (Bordo and Rousseau 2012; Campos et al. 2012; McMillan and Wohar 2012).

Pre-crisis consensus on the strength of the nexus, appears to remain essentially unchanged at the very beginning of the crisis, around 2007–2010. Both the link

between finance and growth, and the link between finance and reduced inequality were still presented as robust results (Demirgüç-Kunt and Levine 2009). On the contrary, around 2011–2012, an increasing number of articles began to question the pre-crisis consensus. Rousseau and Wachtel (2011), and Bordo and Rousseau (2012) gain the result of a “vanishing effect”: in recent periods, the relationship between finance and growth tends to disappear, while in the pre-crisis consensus, the finance and growth nexus was presented as a single and strongly established relationship. Wachtel (2011, p. 484) a few years past the financial meltdown, considers that “the financial sector’s influence on economic growth is a complex phenomenon.” Thus, the meaning of the nexus concept has changed due to the crisis. For Wachtel (2011, p. 487), the finance growth nexus has survived the crisis, but it now rests on much weaker foundations. Andersen et al. (2012) are even “skeptical” about the robustness of the linkages between finance and growth.

The number of citations of the “too much finance” result and of a nonlinear relationship between finance and growth begins to increase starting around 2012; including Boucher et al. (2012), Reinhart et al. (2012), Philippon and Reshef (2013), Gambacorta et al. (2014), and Panizza (2014). In particular, Pagano (2013) develops the idea that a hypertrophied financial sector, in comparison with the real economy, can be dysfunctional and degenerate into financial bubbles and systemic crises affecting the real economy, and hence, economic growth. Furthermore, several empirical studies strengthen the case for a bell-shaped relationship between finance and growth (Beck et al. 2014; Law and Singh 2014).

An important development during the period 2008–2014 was increased concern with the issue of distribution, inequality and endogenous growth. This strand of literature that Panizza (2014) depicts as the “allocation of talents,” is generally critical of the nexus. Philippon (2010) as well as Philippon and Reshef (2012) suggest that a contraction of the financial sector could be growth enhancing by reallocating talents toward economic activities providing higher social returns. Cecchetti and Kharroubi (2012) identify a bell-shaped relationship between finance and productivity, and between the financial sector’s share of employment and growth. Therefore, the growing “too much finance” literature is supported by leading economists from the Bank for International Settlements (BIS). Kneer (2013) empirically confirms the existence of this potentially negative impact of finance on the rest of the economy through the human capital channel. The brain drain to the financial sector could hurt research and development (R&D) intensive industrial sectors. According to Cochrane (2013), we merely rediscover an older literature focusing that a very large financial system can be detrimental to growth by absorbing valuable productive resources.

In reaction to the questions raised by the recent crisis, founders of the pre-crisis consensus on the finance-growth nexus and their followers have acknowledged the changes. For example, Beck (2013, p. 50) recognizes that the relationship between finance and growth is not a simple, but is an “ambiguous” one. Beck (2014a) admits that instability can increase with the size of the financial system, such that an over-sized financial system can have a high probability of a crisis which would be followed by a decline in growth. Beck and Feyen (2013), similar to Beck (2014a, b), concede that particularly in the high-income countries where the financial system is

more developed, we can observe nonlinear effects in the finance–growth relationship. Beck (2014b) draws several lessons from the current crisis for the nexus literature. He considers that in the future research agenda of the finance growth nexus, more attention should be paid not only to nonlinearity, but also to the size, composition, and regulation of the financial system. Cihak et al. (2013) propose refinements of the measure of finance to overcome the shortcomings of commonly used measures (such as credit-to-GDP), and to take into consideration the multidimensional nature of the financial system (size, access, efficiency, and stability).

On the whole, the positive impact of the financial deepening on the economic growth is still valid in a significant part of the literature. Beck et al. (2010) continue to find that increasing the size of banks could be socially beneficial. Similarly, Levine et al. (2014) find that banking deregulation reduces racial inequalities in the USA. In addition, despite the “dark sides of finance,” Beck (2013) re-asserts that *in fine* finance remains pro-growth. Moreover, Beck et al. (2014) maintain that the nexus remains valid in the long run, even if in the short-term large financial sectors can lead to higher volatility in high-income countries. Furthermore, with regard to the “allocation of talents” concerns, some recent results are more favorable to the classical Beck–Levine consensus; i.e., Pagano and Pica (2012) find that financial development is pro-employment. Similarly, Boustanifar (2014) documents a positive link between financial deregulation and employment. Ultimately, it remains an open question as to whether these developments following the crisis of represent the advent of what Panizza (2014) terms the “new literature.” One could consider that the post-crisis literature is instead a simple evolution, continuation or refinement of the pre-crisis literature on the nexus.

Toward a New Literature?

The peak of the number of articles related to finance and growth literature reached in 2015 (Fig. 1) may suggest an intensification of the investigation of the nexus after the financial crisis, perhaps pointing to a turning point in the evolution of the finance and growth literature.

Beck–Levine Consensus in Recent Literature

Numerous post-2015 articles still find a positive relationship between finance and growth. In 2015 and 2016, Thorsten Beck and Ross Levine published at least six articles on the finance growth nexus according to the IDEAS database. In particular, Laeven, Levine, and Michalopoulos (2015) build an endogenous growth model predicting that financial innovations promote growth, underemphasizing the important negative effects of financial innovations highlighted by the subprime crisis. With respect to Beck et al. (2016), even if they mention the “dark side” of financial innovation, they conclude that there is a positive net effect on growth. Another proof of the vitality of the traditional Beck–Levine view of the nexus is the forthcoming *Handbook of Finance and Development*, edited by Beck and Levine,

(Edward Elgar Publishers). Still, in the recent literature, the standard result of a positive relationship between finance and growth is found for developed countries as well as emerging countries (Arestis et al. 2015; Cojocaru et al. 2016; Durusu-Ciftci et al. 2017; Pradhan et al. 2017). Furthermore, Rashid and Intartaglia (2017) recover the standard result that finance plays a role in alleviating poverty.

However, as typical, the devil is in the details. In many of these studies in the vein of Beck and Levine, the strength of the links between finance and growth varies across countries, or can be dependent on the measure of finance used (see *infra* for further developments on the measure of finance). Results depend a lot on what we mean by finance. Thus, in this literature inspired by the Beck–Levine approach, the finance and growth relationship can be insignificant in some countries, or even negative. Consequently, the differences between this literature in the vein of Beck and Levine and the “too much finance” literature may be overemphasized. We observe a convergence of the various strands of the finance and growth literature on a more complex nexus than a simple linear relationship.

The post-2015 literature in the vein of Beck–Levine frequently differentiates between the short-term and long-run linkages between finance and growth. However, this common distinction tends to be superseded by the study of nonlinearities in the relationship between; in other words, the distinction between the positive and negative effects of finance on growth.

Meanwhile, a noticeable evolution of the finance and growth literature post-2015 is that there are fewer historical studies, with Bodenhorn (2016, 2017), and Rousseau and Wachtel (2017) being notable exceptions.

Is There a New Consensus on “Too Much Finance”?

The “too much finance” result is not new, and was established long before the 2007 crisis. A close result before the crisis was that the positive relationship between finance and growth can be unstable or even disappear in some specific cases with a nonsignificant statistical relationship (Rousseau and Wachtel 2002). This is what currently Rousseau and Wachtel (2011, p. 286), and Arcand et al. (2015) have called the “vanishing effect.” Before the crisis, De Gregorio and Guidotti (1995) find a negative relationship between finance and growth for Latin American countries. The dot com bubble in 2000 revived the thesis of “too much finance” (Houben et al. 2004). Easterly et al. (2001) show a nonlinear relationship. However, according to the EBSCO database, Arcand et al. are the first to write “too much finance” in the title of their working paper, followed by Law and Singh (2014). The latter surveys the nonlinear studies between finance and growth, mentioning at least eight articles. The phrase “too much finance” which was in the margin of finance and growth literature before the crisis, has gained popularity, and is now likely to become the new consensus (Fig. 3).

The recent literature emphasizing the evolution of the finance–growth *nexus* relies on essentially three components that deserve clarification: (1) nonlinearity, (2) a negative relationship, and (3) a threshold. In general, the main view on the *nexus* before the crisis, with a number of exceptions presented before such as Rousseau and Wachtel (2002), generally tends to assume a positive linear relationship

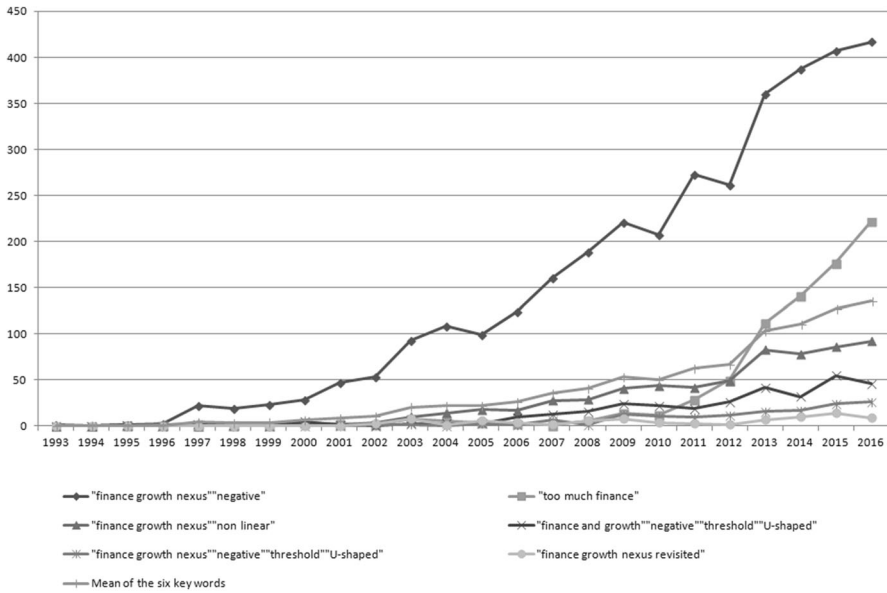


Fig. 3 Number of hits in Google Scholar for the key words of the new literature on finance and growth. *Source:* Authors, based on data from Google Scholar

throughout; meaning that any degree of financial development is beneficial to growth. This was the dominant view before the crisis, but to repeat, in the details, a minority of articles were presenting a more complex view of the nexus even before the crisis.

The current empirical findings of a negative relationship open the door for questioning the Beck–Levine conclusion of a simple nexus with a generally positive relationship. But to be fair, looking at the very details of the finance and growth literature before the crisis, this is an evolution rather than a revolution. The result of a negative relationship can be seen as a simple evolution of the “vanishing effect” result shown before the crisis. Furthermore, the negative relationship result is not a post-crisis novelty, it existed in the literature before the crisis; the “too much finance” result can be seen as a re-evaluation of an ancient result in light of the crisis.

In the current literature that shows a negative relationship (1) the nonlinearity, that is to say the shift from a positive to a negative relationship, arises when a country reaches a high level of financial development which starts to have (2) a negative effect on growth. In other words, nonlinearity results in an asymmetrical or nonmonotonic response of growth above a certain threshold of financial development. This implies that the finance and growth relationship takes the form of a bell-shaped or inverted U-shaped curve (Fig. 3). Moreover, according to the new consensus there is (3) a threshold effect: finance is beneficial to growth up to a certain threshold, after which finance has negative effects on growth (Arcand et al. 2015; Grjebine and Tripier 2016). Hence, the title of Arcand et al. (2015): “too much finance.”

A growing body of empirical studies exhibits a more complex relationship between finance and growth than the simple *nexus* of a positive relationship. A significant portion of very recent empirical studies establishes the “vanishing effect” *à la* Rousseau and Wachtel (2002): Capelle-Blancard and Labonne (2016), Demetriades and Rousseau (2016), Haiss et al. (2016) and Ben Naceur et al. (2017). A general finding of the latter studies is that the positive relationship between finance and growth is weakening in the more recent period, for countries with weak banking supervision and those affected by the financial crisis. Another important part of literature investigates nonlinearities, providing empirical evidence of a negative relationship between finance and growth (Aizenman et al. 2015; Mishra and Narayan 2015; Sahay et al. 2015; Samargandi et al. 2015; Lee et al. 2016; Prettnner 2016; Grjebine and Tripier 2016; Hou and Cheng 2017; Law et al. 2017; Prochniak and Wasiak 2017; Soedarmono et al. 2017). Cecchetti and Kharroubi (2015) construct a model, as well as empirical estimations, showing that an increase in financial development can negatively impact the total factor productivity growth. Some literature on nonlinearity is published by institutions and authors whose institutional affiliations suggest that three major institutions contribute to the re-examination of the World Bank pre-crisis consensus *à la* Beck–Levine, and contribute to the emergence of the new consensus: the Bank for International Settlements (Cecchetti and Kharroubi 2012, 2015), the International Monetary Fund (Sahay et al. 2015), and the Organization for Economic Cooperation and Development (Cournede and Denk 2015).

Some of the articles deal with various aspects of the financial industry that provide reasons for (Fig. 2) the “too much finance” result. Hence, some studies document that financial development can increase income inequality (Jauch and Watzka 2016; De Haan and Sturm 2017). Bertay et al. (2017) find that securitization and growth are negatively related as securitization tends to favor nonbusiness loans at the expense of business loans, dampening investment and finally leading to lower growth. Similarly, Lauretta (2017) shows that a high level of securitization of mortgage loans can be detrimental to growth.

The new literature also seeks to determine the optimal size of the financial sector, the point where the relationship between finance and growth becomes negative. When do we reach the breaking point of the nexus? Where is the turning point in the effect of financial development? Arcand et al. (2015) find a 100% credit-to-GDP threshold, which was also found by Cournede and Denk (2015). For the period before 2015, Cecchetti and Kharroubi (2012), but also Law and Singh (2014) find a credit-to-GDP threshold around 90%. Gambacorta et al. (2014) show a 40% threshold. The estimated threshold value varies depending on the type of countries considered (developed, developing countries or both), the panel of countries or the period considered.

The new literature also attempts to explain the reasons for the “too much finance” result. The first explanation relates to the financing structure of the economy or the type of financial system. The negative effect of finance (measured by credit-to-GDP) in developed countries with a large financial system could be due to such countries being bank-based financial systems relying on credit markets. At high levels of economic development, the demand in the economy for financial

markets services is supposed to increase relatively to the demand for banking services, notably because the latter are supposed to be less efficient than market-based financial systems in promoting economic development. Indeed, Allen and Gale (2000) suggest that markets are more efficient than banks for financing new technologies, and given the role of R&D in endogenous growth theory, that could explain why the highly bank-based financial structure (high level of credit-to-GDP) could contribute less to economic growth. Pagano et al. (2014) indicate that a highly developed bank-based financing system can suffer from misallocation of capital, because it tends to lend to households, instead of firms. This investment mix can lead to lower economic growth. Indeed, it tends to lower households' saving rate, and boost the low-productivity residential sector, and finally generate a credit-housing spiral that can turn into a financial crisis as in 2007. It could explain why developed countries keeping a highly bank-based financial structure could suffer from a lower or negative impact of financial sector expansion (measured by credit-to-GDP) on growth. These ideas are also developed in the studies of Boyd and Smith (1998), Demirgüç-Kunt et al. (2013), Gambacorta et al. (2014) and Peia and Roszbach (2015).

The second reason relates to the “dark side” of finance and the financial crisis in particular. The argument *à la* Rousseau-Wachtel is that the “vanishing effect” could result from financial crises. Excessive financial deepening may take the form of a credit boom and inflationary pressures in general that could cause financial crises eliminating the benefits of finance (Rousseau and Wachtel 2011). Indeed, a theory *à la* Keynes (1936), Minsky (1982) or Kindleberger (1989) suggests that the probability of crisis increases with the intensity of the risk-taking behavior approximated by the level of credit-to-GDP. The reason could be that by boosting economic development, a developing financial sector can create a wave of optimism among investors who take more and more risk, ultimately leading to a financial crisis. Financial development endogenously leads to a financial crisis via agents' optimistic expectations, the “animal spirits” *à la* Akerlof and Shiller (2009). This is a popular explanation of the 2007 financial crisis, notably at the BIS (Drehmann et al. 2011).

A related explanation, but based on rational agents, is that a high level of financial development can have perverse effects due to information issues. When agents detect that market liquidity and risk diversification are perfect due to complex financial products, or if they perceive perfect public information given by markets with no need to inspect private information of borrowers for instance, there is little incentive for screening (Loayza and Rancière 2006) (This was typically the case for subprime credits). Consequently, financial markets participants and banks take excessive risks that can result in financial crisis (Huang and Ratnovski 2011). On top of that, the literature identifies several other ‘dark sides’ of finance that could explain the “too much finance” result. A highly developed financial system can lead to increased interconnectedness between financial actors, so that the systemic risk can emerge endogenously (de la Torre et al. 2011). Another hypothesis is that a highly financialized economy can have a powerful financial sector lobby capable of regulatory capture; so that financial deepening is not necessary accompanied by financial liberalization and deregulation (Rousseau and Wachtel 2011). It could

result in a “forbearance” policy that reduces the effectiveness of the financial sector in monitoring risks which increases the likelihood of a financial crises that hurts economic growth (Johnson and Kwak 2010; Igan et al. 2012; Barth et al. 2012). Another argument *à la* Schumpeter is that when the size of the financial sector grows, nonrisk-adverse and unsophisticated actors are more likely to enter. Again it could decrease the flexibility, resilience and efficiency of the financial sector (Rajan 2005).

The third reason is related to the so-called allocation of talents and “brain drain,” following the seminal article of Tobin (1984). This last reason is re-examined by Cecchetti and Kharroubi (2015) showing that “too much finance” could result from the negative effect of the credit boom on what the endogenous growth theory identifies as key factors of growth: human capital and R&D. The financial sector competes with others R&D intensive industries for skilled labor and human capital, and this is the reason why a fast-growing financial sector can crowd out the other R&D intensive industries considered as sources of growth caused by the misallocation of labor resources. Aizenman et al. (2015) talk about a “financial Dutch disease”: faster the growth of the financial sector, slower the growth of the manufacturing sector. The reason could be that a booming financial sector diverts funding from financing the real economy into speculative financial activities. Once again, this explanation is consistent with Minsky’s theory, and leads to the misallocation of resources.

It continues to be common in the post-2015 literature, following Rousseau and Wachtel (2002), to identify threshold effects in the finance growth nexus by adding a third variable. The idea is to identify changes in the finance and growth relationship when the third variable exceeds a certain threshold (level). Hence, in the recent literature, the robustness of the finance growth nexus is tested according to the level of inflation, the level of income of the country (low or middle), or the level of institutional quality. Some recent papers highlight that the finance growth relationship varies based on the level of development of the country (Ben Naceur et al. 2017). They also find that the level of institutional quality could influence the nexus (Lee et al. 2016; Ben Naceur et al. 2017; Law et al. 2017). Ben Naceur et al. (2017) do not find robust evidence of a threshold effect related to the inflation level. Nevertheless, the heterogeneity of the results between studies is important in this branch of literature.

Finally, the “too much finance” result is debated in literature by a number of recent studies. Rousseau and Wachtel (2017) show that periods of a credit boom can be growth enhancing. We discuss this in the next section devoted to the methodological aspects of the recent finance and growth literature.

Methodology Issues

Several methodological issues are discussed in recent literature about the relationship between finance and growth: (1) empirical evidence varies with the choice of financial sector indicators and with econometric techniques, (2) nonlinearity tests, and (3) modeling issues.

Finance is gauged with a large set of indicators in the literature. According to the meta-analysis of Valickova et al. (2015) addressing the effect of finance on growth, one-third rely on measures related to liquid liabilities, one-third use indicators based on banking credit, and one quarter consider the dynamics of the stock market. The studies that use a synthetic index of financial variables, such as Samargandi et al. (2015), attempt to address the drawbacks of individual variables, even if it is imperfect. The choice of the financial depth measure is rarely discussed (Samargandi et al. 2015; Capelle-Blancard and Labonne 2016), while it could influence the conclusions of empirical papers testing the magnitude of the finance–growth link (Valickova et al. 2015; Arestis et al. 2015; Mishra and Narayan 2015).

Another methodological issue deals with econometric approaches and estimation techniques. While time series (Granger-causality tests, VAR, and VECM, such as Liu and Lee 2016) or cross-sectional approaches (Arcand et al. 2015) are common, the more recent empirical papers mainly use panel data analysis. This approach has three benefits. First, the empirical investigation benefits from an extended size of the sample as panel techniques combine time and spatial dimensions of data. Second, statistical biases of cross-sectional regressions (error terms biased due to country idiosyncrasies) and time series (low-frequency data) are avoided with the panel data method. The last benefit is the possibility to implement instruments for all explanatory variables. Indeed, even if ordinary least squares (OLS) or two-stages least squares (2-SLS) are used (Berger and Sedunov 2017), the GMM-system now prevails in empirical literature (Arcand et al. 2015; Cojocaru et al. 2016; Jauch and Watzka 2016; Ben Naceur et al. 2017; Law et al. 2017; Prochniak and Wasiak 2017; Rashid and Intartaglia 2017; Soedarmono et al. 2017). Familiar biases of OLS (omitted variables and endogeneity) and 2-SLS (requiring “external” instruments) are also avoided. Though it is widely applied, the method is also criticized for its “black-box” aspect and for the choice of instruments that remains questionable (Roodman 2009; Capelle-Blancard and Labonne 2016). The panel data approach is also applied with VAR models (Pradhan et al. 2016) and Error Correction Models (Prettner 2016). Similarly, panel time series estimators are more suitable for heterogeneous and small samples (in terms of periods and countries’ numbers) and have been implemented, such as the *pooled mean group* estimator (Samargandi et al. 2015; Hou and Cheng 2017), the *common correlated effects mean group* estimator, and the *augmented mean group* estimator (Durusu-Ciftci et al. 2017). We can finally refer to Luintel et al. (2016) who adopt the Bayesian estimation to find endogenously potential structural breaks in the intensity of the relationship between finance and growth.

Two methods are implemented to investigate the potential nonlinearity of the link between finance and growth. The most common option is to add a quadratic term for the financial variable to test a second order effect of the impact of finance on growth (Arcand et al. 2015; Law et al. 2017). A negative sign associated with this quadratic term would suggest a decreasing relationship between finance and growth beyond a given level of financialization. However, Cline (2015a, b) argues that that the result of a negative relationship between finance and growth is a “statistical illusion” which “may be an artifact of spurious attribution of causality.” He demonstrates that the coefficient of the quadratic term of an explanatory variable

is regularly negative in the convergence-type econometric modeling, when the independent variable is positively correlated the level of GDP per capita. Nonlinearity is alternatively tested with threshold models for Malaysia (Alaabed and Mansur 2016) or with a larger panel of countries (Samargandi et al. 2015; Lee et al. 2016).

Finally, regarding to the modeling issue, endogenous growth models continue to be used (Laeven et al. 2016), sometimes with an *agent-based model* as in Laurretta (2017).

This renewal of literature shows that we are far from the end of the research agenda, and that many open questions remain.

Unresolved Issues and Directions for Future Research

The advocates of the new consensus, but also those of the old consensus, have identified an array of avenues for future research, notably to explain the result of a negative relationship between finance and growth. We focus on these future research questions, while discussing the current limitations of finance and growth literature which also point toward several directions for future research.

A first limitation of finance and growth literature, mentioned by Rousseau and Wachtel (2017), is the lack of connection between two literatures: on the one hand, the finance growth nexus and on the other hand, literature on the financial cycle and financial instability, which is burgeoning in the aftermath of the crisis. To be more specific, the challenge is to articulate finance and growth literature with the credit cycle theory and related indicators of financial instability, as notably developed Borio et al. (2015) at the Bank for International Settlements. The credit-to-GDP ratio is indeed used as both an indicator of finance development in the finance and growth literature, and as a financial instability indicator in the credit cycle theory. Similarly, an additional effort is required to narrow the gap between finance and growth literature, and the historical works on the credit and financial cycles (Schularick and Taylor 2012; Jorda et al. 2017; Mian et al. 2017). Arcand et al. (2015) begin to make the linkages, but they need to be pushed further. It appears as though the finance and growth literature, despite the crisis, had not fully taken into account the idea that the financial system is not necessarily stable or stabilizing; thus a booming financial system may create systemic risks that negatively affecting the real economy. The establishment of this connection could lead to a more robust choice of the measure of financial development. At a higher level of analysis, this connection could lead finance and growth literature needs to depart from its original foundations in Schumpeter's theory (King and Levine 1993) and rely more on the Kindleberger–Minsky approach. It would be a transition from a teacher to a student as Minsky was a student of Schumpeter. After all, Schumpeter (1939) himself described a behavior of “reckless banking” which could degenerate into financial crisis. An increasing number of articles from the new consensus suggest this evolution toward Minsky. However, this “Minsky connection” remains to be established, even if Grjebine and Tripier (2016) can be considered as a first attempt.

A second area of potential improvement of the recent finance and growth literature is the historical perspective. Eichengreen (2012) focused on the historical turn in macroeconomics precipitated by the 2007 crisis. In spite of the few articles we mention, this historical turn is not particularly noteworthy in the finance and growth literature in the aftermath of the crisis. Currently, a large number of studies continue to focus on data from a relatively short period of history, notably compared to Schularick and Taylor (2012), and only a limited number of studies employ long historical series. As emphasized previously, the connection of finance and growth literature with the historical works of Schularick or Bordo would allow one to analyze the nexus in the long run. Even further, the connection between the three key elements, which are: (1) the finance growth nexus, (2) literature on the credit cycle in the long run and macrofinancial history *à la* Schularick, and (3) financial economic history *à la* Kindleberger, would make it possible to rediscover how in the course of history finance (credit in particular) is both a source of growth and crisis. This ancient conception of the ambivalence of finance resurrected by the recent “too much finance” result appears to be a promising approach for future research. Thus, the question remains whether the nexus literature could have, at least for the moment, underestimated the need for these connections with the Kindleberger–Minsky approach. The reason could be that these connections would lead to a more critical appraisal of the finance growth nexus.

A third limitation of the finance and growth literature concerns the measure of finance. If we accept the hypothesis that banks have changed their business models to adopt the originate-to-distribute model, does it remain relevant to measure finance using the ratio of credit-to-GDP? Indeed, in the new bank business model, the asset side of banks' balance sheet mainly comprises of securities, instead of loans (Rancièrè and Tornell 2016). Hence, the issues for further study are the role of financial innovations in economic growth, particularly securitization, as well as the role of nonbanks and shadow banking (Panizza 2014). The ratio of credit-to-GDP does not capture well these new actors of finance, notably because it generally focuses only on banks' credit. The impact of the financing *structure* of the economy (bank-based versus market-based system) is mentioned in recent literature (Beck 2014b; Leroy and Lucotte 2016). However, in light of the 2007 crisis, this question deserves more analysis, notably with the perspective of the European Commission's Capital Markets Union project. The use of monetary aggregates (M3 to GDP) as a measure of financial development appears even more questionable than the use of the credit-to-GDP ratio. This monetary indicator appears empirically decoupled from variables such as the balance sheet size of the banking sector (Schularick and Taylor 2012), probably for the reason stressed before: the new banks' business model where securities and debts have a growing importance compared to credit and deposits. Ultimately, one could consider that finding a single measure of finance is a challenging task, if not futile, if only because finance is multidimensional, and financial systems vary between countries (Cihak et al. 2013).

Another possible approach to expanding literature would be to further investigate the role of institutions, in particular financial regulation institutions. The finance and growth literature leads to a tripartite link between finance–growth–institutions, studying institutions in the framework of endogenous growth theory and

institutional economics. Nevertheless, the literature generally emphasizes the quality of institutions, but less frequently studies the institutions of financial regulations. Is there a link between regulatory capture (central bank capture in particular) by the financial sector and economic growth? This question is rarely addressed in finance and growth literature (Beck 2013, 2014b; Pagano 2013).

At the frontier of finance and growth literature is also the question of the *size* of the financial sector. We have shown that the new consensus, with its “too much finance” result, investigates the optimal size of the financial sector. This is also the case in Beck and Feyen (2013) searching for the “financial depth frontier” determining the maximum sustainable size of the financial sector. This strand of literature concludes that the size of the financial sector should be limited to prevent it from exceeding this maximum size. This implies that finance and growth literature should further investigate the impact of financial repression (narrow banking) on economic growth (Huang and Wang 2011; Xu and Gui 2013).

A final unresolved issue of finance and growth literature concerns the ecological transition. How to finance the ecological transition? If the financial sector does not actively contribute to financing the ecological transition, what would be the impact on economic growth? The Governor of the Bank of England, Mark Carney (2016), identifies the ecological transition as a systemic risk of the financial system. It follows from the concern that ecological transition calls for an extension of the traditional finance growth nexus to the triptych “finance–growth–ecological transition.” In other words, if ecological transition appears to be an explanatory factor of growth, how should the finance growth nexus be rethought? Currently, the finance and growth literature remains relatively silent on this issue. Following Cecchetti and Kharroubi (2012, 2015), we can question whether a big financial sector can crowd out economic growth driven by environmental R&D and innovations. In addition, previous findings of finance and growth literature on the role of state-owned banks and the state in general, could be revisited in light of the current revival of interest in industrial policy in relation to the environment (Beck 2013; Panizza 2014). This “green” endogenous growth could lead to a renewal of the role of the state in the economy.

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