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Abstract

This paper reviews and appraises the body of empirical research on the association between financial markets and economic growth that has accumulated over the past quarter-century. The bulk of the historical evidence suggests that financial development affects economic growth in a positive, monotonic way, yet recent research endeavors have provided useful and important qualifications of this conventional wisdom. Moreover, the proliferation of micro-level datasets has enabled researchers to study more precise links between theory and measurement. The paper highlights the mechanisms through which financial markets benefit society, as well as the channels through which finance can slow down long-term growth.

JEL classification: O4, G1.

Keywords: financial markets, growth.

Non-technical summary

Despite the fact that the empirical finance-and-growth literature is now a quarter-century old, opinions still diverge on whether financial development stimulates economic development in a causal sense. While the majority of researchers have argued that over the long sweep of history, the contribution of financial markets to economic growth has been "too obvious for serious discussion" (Miller, 1998), others have complained that the importance of financial markets in economic development is severely exaggerated in academic discussion (Lucas, 1988). Moreover, the global financial crisis of 2008–09 reinforced the view that finance can degenerate into a rent-seeking activity (Zingales, 2015), and even a powerful force for planting the seeds of future financial crises (Schularick and Taylor, 2012; Mian and Sufi, 2014), with adverse implications for long-term growth and for social welfare. Consequently, in the wake of the crisis, finance was openly blamed for the Great Recession, the public's trust towards bankers dissipated (Sapienza and Zingales, 2012), and policy makers on both sides of the Atlantic warmed up to the idea that only through tight regulation of financial activity can a financial crisis of a similar magnitude be prevented from wreaking havoc on the real economy in the future.

Understanding the impact that the financial sector can have on economic activity is of first-order importance. To that end, this chapter evaluates the substantial body of empirical work on the impact of the operation of financial markets on economic growth. It makes clear that our understanding of the link between finance and growth has evolved with the scope and quality of the datasets which have become available to us and which ultimately condition the hypotheses that can be tested. In the earlier stages of the empirical finance-and-growth literature, the most important advances were methodological, with researchers employing ever more sound econometric methods for deriving robust conclusions from country-level and industry-level datasets. More recently, the biggest headway in the literature has been associated with the proliferation of—and with improved access to—micro datasets, such as firm-level and household-level data. This has enabled researchers to push further than in the past into causality territory by evaluating narrow and precise theoretical mechanisms.

One particular advantage of micro datasets, relative to more aggregate data, is that they allow the researchers to employ a more symmetric approach in studying the finance-and-growth nexus. Such datasets make it possible to not only answer the question "Does more finance lead to more growth?", but also the question "Does lack of finance lead to less growth?" One prominent example is the proliferation of datasets which make it possible to construct direct empirical proxies for financing constraints faced by households or by firms. Armed with such data, researchers are able to robustly evaluate the negative effect of credit constraints on growth-enhancing activities, such as capital investment or the adoption of innovative processes.

The summary of the literature presented in this chapter produces four broad policy-relevant conclusions. First, the bulk of the historical evidence indicates that on average, financial development has a positive, monotonic effect on economic growth. This conclusion is reached in studies based on aggregate data, on industry data, and on firm data; it obtains in studies relying on modern data as well as in studies utilizing historical time series; it is reached both in samples dominated by industrialized countries and in samples dominated by emerging markets; and it is

robust to numerous econometric techniques aimed at gauging a causal relationship between financial and economic development in the data.

Second, more recent studies have cast doubt on the proposition that the effect of financial development on economic growth is not just positive, but also monotonic. A number of papers have pointed to non-linearities in the finance-and-growth nexus, and have compared different types of financial activities with respect to their growth-enhancing properties. The broad conclusion of this line of research is that the positive effect of finance on growth dissipates beyond a threshold level of financial development. Among the potential explanations for this effect pursued in the literature are a brain drain away from the real into the financial sector, a trade-off between growth and fragility that is exacerbated by financial development, and the fact that some types of finance—such as mortgage credit—are considerably less conducive to sustainable economic development than other types of finance, such as enterprise credit. This insight can inform the discussion on the conduct of optimal supervision of bank activities, with a view of how to secure a higher and at the same time more sustainable contribution of financial intermediaries to real economic activity.

Third, while much of the earlier literature suggested that a country's financial structure—i.e., the mix of financial intermediaries operating in the economy—has no independent effect on economic growth, more recent evidence has challenged this view. As per capita income rises, countries' financial structures tend to move towards non-bank financing. Market-based intermediation has thus grown faster than bank-based one, notably in advanced countries, also due to advances in technology, the greater availability and use of hard information, and more internationalized financial systems. A number of recent papers have shown that the marginal contribution of banks to economic growth declines, while that of capital markets increases with economic development, notably because market finance is better at promoting innovation and productivity, and at financing new sources of growth. This insight has important implications for the lively debate on the optimal mix of financial activities that is currently taking place at the European level in the context of the Banking Union and of the Capital Market Union.

Fourth, various aspects of financial development can have a non-negligible social impact, beyond their first-order effect on economic growth. For example, recent evidence has suggested that in particular banking competition is associated with a decline in both income and of gender inequality, as the increase in economic activity associated with the deregulation of previously parochial banking markets creates economic opportunities for agents that in the past found it difficult to join the formal labor market. At the same time, the impact of finance on investment in human capital appears to be more ambiguous: while some researchers find that financial development increases the demand for education by affecting both the return to and the cost of schooling, others find evidence that children of entrepreneurs with better access to formal credit tend to drop out of school earlier to join the family firm, and that a finance-driven increase in local economic activity can have the same effect by increasing the return to unskilled labor. Given the structural imperfections of labor markets in many European countries, it is important to understand whether financial markets really increase economic inclusion, and what their impact on human capital accumulation is.

1 Introduction

Surveys on the link between financial markets and economic growth routinely cite scores of distinct papers,¹ and yet the abundance of both theoretical and empirical research on the subject is only matched by the disagreement within the economic profession about the overall conclusion. Some have argued that a developed financial system is a key condition for industrialization (Gerschenkron, 1962), and that over the long sweep of history, the contribution of financial markets to economic growth has been "important" (Stiglitz, 2010), "pivotal" (Schumpeter, 1912), or even "too obvious for serious discussion" (Miller, 1998). Others have claimed that the importance of financial markets in economic development is severely exaggerated in academic discussion (Robinson, 1952; Lucas, 1988). Yet others have argued that without proper rules, finance can grow excessively, degenerating into nothing but a rent-seeking activity (Zingales, 2015), and even a powerful force for planting the seeds of future financial crises (Schularick and Taylor, 2012; Mian and Sufi, 2014), with adverse implications for long-term growth and for social welfare. Levine (2005) provides the closest semblance of a professional consensus by admitting that "We are far from definite answers to the question: Does finance cause growth, and if it does, how?"

Understanding the impact that the financial sector can have on economic activity has rarely been more pressing than it is now. During a very short period of time around the global financial crisis of 2008–09, the political discourse in many countries around the globe went through a familiar, time-honored emotional cycle from "Hosanna!" to "Crucify!". Before the crisis, finance was generally considered to be an essential economic activity, and Wall Street investment bankers were typically held in high esteem. The conventional wisdom was that financiers were smart and ingenious professionals, and that the less we interfered with their work, the better-off we all would be.² A few years later, the same financiers were openly blamed for the financial crisis and for the Great Recession, the public's trust towards bankers dissipated (Sapienza and Zingales, 2012), and

¹For comprehensive surveys of the finance-and-growth literature, see Rousseau (2003), Levine (2005), and Beck (2008, 2012), among others.

²This stance is best summarized by Allan Greenspan's famous "Worry a lot, interfere little." (CNN, 1997).

the political pendulum swung closer than at any time in recent memory towards the idea that only through over-regulation can we make sure that Wall Street can never hurt Main Street again.

As usual, the truth is somewhere in between. The bulk of the historical evidence does indicate that on average, financial development affects economic growth in a positive, monotonic way. Yet, more recent evidence has suggested that this is not necessarily the case for all types of financial activity and at all levels of financial development. We need a deep, unbiased understanding of both sides of the story, to the benefit of how society uses and regulates the financial sector in the future. President Truman's imaginary "one-handed economist" would probably have made it easier to formulate policies, but an old-fashioned two-handed economist is still more likely to help governments adopt the *right* policies.

This chapter will evaluate the substantial body of empirical work on the impact of the operation of financial markets on economic growth that has accumulated over the past quarter of a century. It will make clear that our understanding of the link between finance and growth has evolved with the scope and quality of the datasets which have become available to us and which ultimately condition the hypotheses that can be tested. In the earlier stages of the empirical finance-and-growth literature, the most important advances were methodological, with researchers employing ever more sound econometric methods for deriving robust conclusions from country-level and industry-level datasets. More recently, the biggest headway in the literature has been associated with the proliferation of—and with improved access to—micro datasets, such as firm-level and household-level data. This has enabled researchers to push further than in the past into causality territory by evaluating narrow and precise theoretical mechanisms.

One particular advantage of micro datasets, relative to more aggregate data, is that they allow the researchers to employ a more symmetric approach in studying the finance-and-growth nexus. Such datasets make it possible to not only answer the question "Does more finance lead to more growth?", but also the question "Does lack of finance lead to less growth?" One prominent example is the proliferation of datasets which make it possible to construct direct empirical proxies for

financing constraints faced by households or by firms. Armed with such data, researchers are able to robustly evaluate the negative effect of credit constraints on growth-enhancing activities, such as capital investment or the adoption of innovative processes.

For these reasons, I will organize the discussion of the earlier finance-and-growth literature around econometric approaches, and the discussion of the more recent literature around micro mechanisms through which we expect financial development to have an impact on economic growth. In Section 2, I will review and assess the empirical finance-and-growth literature which is based on cross-country growth regressions, and I will discuss empirical techniques aimed at teasing out a more causal argument in this setting. In Section 3, I will discuss studies that have exploited cross-industry or cross-regional within-country heterogeneity to bridge more convincingly the gap between statistical association and causality. In Section 4, I will summarize more recent evidence based on micro-datasets, such as bank and firm balance sheets, SME and household surveys, and individual-level data. I will discuss how these data have allowed researchers to evaluate ever more narrow theoretical predictions about the impact of access to finance on growth and growth-enhancing activities.

The progress of the review from Section 2 to Section 4 will hopefully make it clear that the move toward more micro-level data has mainly allowed for an increasingly tighter identification of the impact of finance on growth. Still, what all three Sections will have in common is that in all of them I will pay attention to questions related to the impact of both bank-based and non-bank-based finance, and I will discuss the channels through which theory predicts that the easing of financial constraints can boost growth-enhancing activities, such as new business creation, firm investment in physical and human capital, employment growth, R&D and innovation, and the optimal reallocation of resources.

In Section 5, I will review recent studies which have cast doubt on the proposition that the effect of financial development on economic growth is positive and monotonic. Here, I will focus on papers that have studied non-linearities in the finance-and-growth nexus, and on papers that have

compared different types of financial activities with respect to their growth-enhancing properties. The broad conclusion of this section will be that the positive effect of finance on growth dissipates beyond a threshold level of financial development, and that some types of finance—such as mortgage credit—are considerably less conducive to sustainable economic development than other types of finance, such as enterprise credit.

In Section 6, I will discuss the evidence on whether and how financial structure—i.e., the mix of financial intermediaries operating in the economy—affects economic growth. The bulk of the empirical evidence suggests that banks and markets have an independent positive effect on economic growth. I will review the evidence on how they interact to bolster growth, and on how their contribution to growth varies with economic and financial development.

In Section 7, I will review recent evidence in the literature on the social impact of financial development. I will focus on socio-economic phenomena that are theoretically related to the concept of economic growth, such as education or income inequality. I will argue that our profession is in need of both more empirical research and of more theoretical underpinnings of the impact of financial development on societal advances that improve general welfare and at the same time go beyond the basic concept of economic growth.

Finally, in Section 8 I will conclude by discussing promising avenues of future research.

2 Finance and growth: Cross-country studies

2.1 Evidence of statistical association

The idea to link finance and growth in a conceptual sense goes back more than a century, to two seminal contributions. Bagehot (1873) argues that during the Industrial Revolution in England, finance played a crucial role by facilitating the mobilization of capital for "immense works." Schumpeter (1912) contends that efficient financial intermediaries spur technological progress by reallocating investment funds to those entrepreneurs with the best chances of successfully imple-

menting innovative products, a process known as "creative destruction."

The modern-day revival of the empirical interest in the finance-and-growth nexus starts with the study by Goldsmith (1969). This study uses data on the assets of financial intermediaries relative to GNP, and data on the sum of net issues of bonds and securities, together with changes in loans relative to GNP, for 35 countries during the period 1860–1963, and finds evidence for a positive association between financial development and economic growth. While illuminating and pathbreaking, this study suffers from a number of data and econometric problems, such as a limited number of observations, failure to control for alternative growth determinants, questionable choices of empirical proxies for financial development, and no attempt to identify the direction of the causality. It would be fair to say that the literature spawned by this study has mostly focused on correcting for these shortcomings.

The seminal empirical study into the finance-and-growth nexus is the paper by King and Levine (1993) who attempt to improve upon the early methodology in a number of ways. They study a large cross-section of countries (77) over a fairly long period of time (1960–1989). They also systematically control for a large variety of other country-specific indicators, borrowing the approach of Barro (1991), that can have an impact on economic growth, such as initial wealth, secondary school enrollment, and population growth. Moreover, they use various proxies for financial development: the liquid liabilities of the financial system normalized by GDP; bank credit divided by bank credit plus central bank domestic assets; and credit to the private sector normalized by GDP. Finally, they look into some of the theoretical channels through which finance should have an impact on growth, such as capital accumulation and TFP growth. The authors find in the data a strong and significant association between contemporaneous measures of financial development and economic growth. Neglecting causality, their estimates suggest that a country that increased its level of financial development from the mean of the slowest-growing to the mean of the fastest-growing quartile of countries in the sample would have increased its growth rate by about 1 percent per year, thus eliminating about 20 percent of the difference in average growth between the fastest-

and the slowest-growing countries.

The authors next offer the first attempt to establish causality within the finance-and-growth nexus by adopting a *post hoc ergo propter hoc* approach. In particular, they study how much of the cross-country variation in average economic growth over the sample period 1960–1989 is explained by the value of financial development in 1960. Their regressions indicate that the beginning-of-period financial depth is a good predictor of subsequent rates of economic growth over the next 30 years—after controlling for beginning-of-period income, education, and proxies for monetary, trade, and fiscal policy—explaining about 60 percent of the overall variation in post-1960 growth. Finally, the authors also look at the channels that explain the association between financial development and economic growth. They find that the beginning-of-period financial development is linked to the rate of physical capital formation and the efficiency of resource allocation during the sample period.

A number of cross-country studies inspired by King and Levine (1993) have subsequently tried to improve upon their analysis in at least one important dimensions, namely, extending the analysis of the finance-and-growth nexus beyond bank credit. In an attempt to capture the non-bank segment of a country’s financial industry, Levine and Zervos (1998) employ a number of measures of stock market development—such as stock market capitalization and stock market turnover—to study the association between properties of equity markets and economic growth. They do so for a sample of 42 countries over the period 1976–1993, they control for other factors that explain the variation in economic growth, and they study how two principal channels of aggregate growth—capital accumulation and productivity growth—are affected by stock market development. Their cross-section growth regressions suggest that—controlling for banking sector development, as well as for initial income, schooling, inflation, government spending, and political stability—stock market liquidity has independent positive effects on economic growth. They also find that the beginning-of-period levels of stock market liquidity are positively and significantly correlated with subsequent rates of physical capital accumulation and productivity growth over the next 18 years. Interestingly,

the data fail to reject the hypothesis that stock market size—proxied by stock market capitalization normalized by GDP—is not robustly correlated with growth, suggesting that it is the ability to trade a stock, rather than the ability to list it, which fosters investment, resource reallocation, and ultimately growth.

In another extension of this line of research, La Porta, Lopez-de-Silanes, and Shleifer (2002) depart from size measures of financial depth and examine the degree to which a particular aspect of the financial system—public ownership of the banking sector—impacts economic growth. Their cross-country regressions show that a higher degree of public ownership of the banking sector during 1960–1970 is accompanied by slower subsequent growth. The authors also decompose aggregate growth and find that while state ownership of banks has a small and normally insignificant effect on future investment, it has a large negative impact on future productivity growth. These results are robust to controlling for the initial size of the capital markets and for a host of institutional quality controls.

2.2 From statistical association towards causality

While informative about the strength of the statistical association between finance and growth, studies based on cross-country growth regressions suffer from a number of shortcomings that are as serious as they are well-known. First, it is virtually impossible to account for all plausible determinants of economic growth in cross-country regressions, raising issues about omitted variable bias. Second, using even predetermined values of financial development does not fully eliminate concerns about reversed causality as various proxies for financial development could simply increase in anticipation of future productivity growth. Third, pooling together countries that differ vastly in their degree of financial and economic development makes parameter heterogeneity a non-negligible concern.

2.2.1 Instrumental variables

While staying in the realm of studies that employ cross-country data, the first methodological improvement since the seminal study by King and Levine (1993) aimed at identifying a causal impact of financial development on economic growth, has been the use of instrumental variables in order to extract the exogenous component of financial development. Following the influential papers by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997, 1998, henceforth LLSV), the predetermined legal origin of countries has been used as an instrument for financial development. The argument in favor of this approach is that there is a clear theoretical case for why the country's inherited legal system should satisfy the relevance condition for being a valid instrument. LLSV show that legal origin—i.e., whether a country's Commercial/Company law originated from British, French, German, or Scandinavian law—affects the national approach to laws concerning the protection of creditors, as well as the enforcement of such laws. Because financial transactions are contract-based, a legal system which produces laws that are more friendly to external investors and which enforces their rights more effectively will better promote financial development, and will correspondingly be associated with deeper, more developed, and more efficient financial system. The broad conclusion in the law and finance literature is that common law legal origin is best suited to promote a contract-based activity such as finance.³ Second, within a sample of mostly emerging markets and developing countries, which acquired their legal systems through a foreign country's colonial rule or protracted occupation, a country's legal origin can plausibly be treated as an exogenous factor that is not driven by economic or financial development.

Building on the law and finance literature, Levine (1997) finds—using the King and Levine sample—that the exogenous component of financial intermediary development—the component defined by the legal and regulatory environment—is positively associated with economic growth. Beck, Levine, and Loayza (2000a,b) use proxies for legal origin to extract the historically predetermined component of financial development on growth. In particular, they employ dummies

³Beck, Demirguc-Kunt, and Levine (2003) further identify the reasons why legal tradition influences the depth and efficiency of the financial system.

assigning values of one if the country's legal system derives from British, French, German, or Scandinavian law, respectively. They show that the finance-and-growth nexus remains statistically significant after employing this approach, strengthening the argument for a causal effect going from financial development to economic growth. They also show that the data do not reject the test of the over-identifying restrictions, and they argue that this fact, alongside a strong positive correlation between legal origin dummies and proxies for financial development in the first-stage tests, suggests that the instruments are appropriate. Furthermore, they show that the point estimates derived from IV regressions are larger than in the OLS case.

There are four main challenges to this approach. First, legal systems may affect economic growth through other channels, for example, by affecting economic agents' propensity to save or through the regulation of economic activity. If this is the case, the exclusion restriction is not satisfied, putting the validity of the instrument in question. Second, Rajan and Zingales (2003) show that countries with British common law systems were not financially more developed than other countries in 1913, casting doubt on whether legal origin satisfies the relevance condition for a valid instrument. They argue that a theory with a more variable factor is needed to explain both the time-series variations and the cross-sectional heterogeneity in financial development. Third, the fact that legal origin is time-invariant renders it unsuitable for panel regressions and limits the cross-country variations in the instrumented estimates.⁴ Finally, while the IV approach yields consistent estimates, it produces biased estimates in small samples, something that is often the case in those cross-country studies which—due to data limitations—rely on data from no more than several dozen countries.

⁴Various authors have tried to circumvent this problem by employing time-varying instruments for financial development. For example, Madsen and Ang (2016) use unionization and the share of agriculture in economy-wide GDP as instruments for financial development.

2.2.2 Panel data and time series studies

Cross-country studies of finance and growth have also employed panel data techniques to put to rest the most serious econometric issues associated with cross-sectional cross-country analysis. Shortly after Goldsmith (1969), McKinnon (1973) examines four emerging markets (Brazil, Indonesia, Korea, and Taiwan) over time and shows that a country's money balances increase rapidly when the real rate of interest becomes positive, and that in the same years, it appears also to be the case that GNP grows faster. The author attributes one to the other, arguing that higher real interest rates increase investment, though he offers no supporting evidence that there are actual changes in physical capital formation as interest rates rise.

The two pioneering modern studies in this regard are the ones by Beck, Levine, and Loayza (2000a,b). In both, the authors use panel GMM estimators, in the spirit of Arellano and Bond (1991) and Arellano and Bover (1995). This estimator improves upon pure cross-country work in three ways: it maximizes the time-series content of the data; it eliminates omitted variable bias associated with unobserved country-specific time-invariant factors; and it permits the use of time-varying instrumental variables for financial development. Within this analytical framework, Beck, Levine, and Loayza (2000a,b) find that financial development continues to exert a positive and statistically significant effect on economic growth. Because of the nature of the methodology they employ, their findings are unlikely to be due to potential biases induced by simultaneity, omitted variables, or unobserved country-specific effects.⁵

To account for parameter heterogeneity, Loayza and Ranciere (2006) employ the dynamic panel pooled mean group estimator developed by Pesaran and Smith (1995) and Pesaran, Shin, and Smith (1999). In addition to employing fixed-effects that control for time-invariant unobservable characteristics, this technique allows for short-run heterogeneous country effects, while constraining

⁵There are three main disadvantage of this approach. First, the models used to interpret the data are typically models of steady-state growth, and so panel data, which by definition is a poor proxy for long-term relationships, may yield an imprecise assessment of the finance-and-growth link. Second, the efficiency of employed dynamic panel technique depends crucially on the availability of a sufficiently long time span. Finally, this approach is very sensitive to outliers and small model permutations (Favara, 2003).

the long-run effect of the regressors to be equal across the panel. The main benefit of this approach is that it allows for financial development to have differential effects across countries. Armed with this technique, the authors find that while there is a robust, significant, positive long-run relationship between financial development and growth, in the short-run this relationship turns negative for many countries. This finding adds to the cross-country results on a significantly positive long-run effect of financial intermediation on growth, but at the same time shows that fast-expanding credit can lead to financial crises and slower growth. Similarly, Rousseau and Wachtel (2002) show that the relationship between finance and growth varies with the inflation rate, with financial deepening no longer affecting growth when annual inflation is above a threshold of about 13 percent.

Employing Granger-causality tests in a vector autoregression framework, Arestis and Demetriades (1997) show that the finance-and-growth relationship is driven by both factors affecting each other. Thus, although these studies show that financial intermediaries development contributes to growth, they also emphasize the issue of reverse causality. Another example in this line of research is Rousseau and Wachtel (1998), who use data on five industrialized economies (i.e., Canada, Norway, Sweden, the UK, and the US) from 1870 to 1929, and show that the finance-growth nexus is mainly driven by financial intermediation variables affecting growth. Similar evidence is presented in Neussler and Kugler (1998) for the case of OECD countries. Xu (2000) uses a VAR approach in a sample of 41 countries between 1960 and 1993, rejecting the hypothesis that financial development simply follows shocks to GDP growth. Demetriades and Hussein (1996) find that the direction of the causality runs both ways between financial development and growth, especially in the case of developing countries. Using panel cointegration analyses and data from ten developing countries, Christopoulos and Tsionas (2004) find that long-run causality runs from financial development to growth and that there is no evidence of causality running the other way around.⁶

⁶Most cross-country studies typically cover a time span of at most 30 to 40 years. Exceptions are the study by Rousseau and Sylla (2003) who examine the nexus between financial development and growth in per capita income for 17 countries over the period 1850–1997 using the ratio of broad money stock to GDP as a measure of financial development, and Bordo and Rousseau (2012) who apply dynamic panel data models on a sample of 17 "Atlantic" economies using data since 1880. Both studies confirm a robust positive correlation between financial development and economic growth.

Empirical research has also made progress towards analyzing the impact of other non-bank financial intermediaries on economic growth. For example, Rousseau and Wachtel (2000) estimate vector autoregressions for a set of 47 countries with annual data for the period 1980–1995. Their results suggest leading roles for stock market liquidity and the intensity of activity in traditional financial intermediaries in the growth of per capita output. Fink, Haiss, and Hristoforova (2003) use Granger causality tests and co-integration methods in a sample of 13 developed countries over the period 1950–2000 and show that bond market development is positively associated with real economic activity. Pradhan, Arvin, Bennett, Nair, and Hall (2016) examine the causal relationship between bond market development and economic growth in 35 countries for the period 1993–2011, using the extent of public and private bond issuance as a proxy for bond market development. They employ a panel vector auto-regression model to reveal the nature of Granger causality among the two variables, and they find that bond market development may be a long-run causal factor for economic growth. Drawing on Schumpeterian growth theory, Ang and Madsen (2012) use panel data for 77 countries over the period 1965–2009 to test the roles of risk capital and private credit in stimulating knowledge production, and find that countries with more developed financial systems tend to be more innovative.

One often neglected issue in this line of empirical work is the impact of financial innovation on growth. This omission is surprising, given for example the broad agreement in the literature that financial innovation in the form of specialized investment banks and accounting systems to facilitate screening and monitoring by distant investors was at the root of the financing of the construction of the US railroad system which in turn played an instrumental role in the Industrial Revolution. Part of the reason for this omission is the difficulty in constructing a reliable empirical proxy for financial innovation. Moreover, economists did not for a long time develop models of the coevolution of technology and finance in which both technological and financial improvements reflect the actions of profit-maximizing agents. Two recent studies have attempted to bridge that gap. Laeven, Levine, and Michalopoulos (2015) develop a Schumpeterian growth model with disruptive financial

innovation. To bring their model to the data, they develop a proxy for financial innovation based on how quickly each country adopted a private credit bureau to share information about potential borrowers. Employing a panel GMM estimation, they find that financial innovation boosts the rate of economic growth, especially for countries much poorer than the economic leader. Beck, Chen, Lin, and Song (2016) analyze a sample of 32 countries over the period 1996–2010, and find that different measures of financial innovation, capturing both a broad concept and specific innovations, are associated with faster bank growth. They also find that financial innovation is associated with higher growth in countries and industries with better growth opportunities. However, their data provide a point of caution in that financial innovation is also associated with higher bank fragility and worse bank performance during the recent crisis.

2.2.3 Financial liberalization

A somewhat hybrid approach combining panel data techniques and instruments for financial development takes advantage of policies that exogenously affect the extent of a country's financial development. Prime among such policies are various types of financial liberalization that open the country's economy to foreign direct or portfolio investment. Examples include equity market liberalization, credit market liberalization, and capital account liberalization. From a neoclassical perspective, there is a direct link between such liberalizations and output growth: improved risk sharing post-liberalization should decrease the cost of capital and increase investment (Bekaert and Harvey, 2000). When markets are imperfect, financial liberalization could have strong effects as well. Financing constraints make external finance more costly than internal finance and cause investment to be sensitive to cash flows (e.g., Gilchrist and Himmelberg, 1999). Financial liberalization directly reduces financing constraints in the sense that more foreign capital becomes available, and foreign investors could insist on better corporate governance, which indirectly reduces the cost of internal and external finance. Hence, the cost of capital could go down because of improved risk sharing, or because of the reduction in financing constraints, or both. Moreover, better corporate

governance and investor protection should promote financial development (La Porta et al., 1997) and hence growth.

The review of the literature on financial liberalization and growth admittedly warrants its own survey. Therefore, I will focus on those papers that provide the most immediate analogue to the cross-country finance-and-growth literature discussed so far. Bekaert, Harvey, and Lundblad (2001, 2005) study a sample of 95 countries, 47 of which removed capital account restrictions during the period 1980–1997. The authors use a GMM estimator which maximizes the time-series content in the regression by making use of overlapping data. To eliminate the resulting autocorrelation in the residuals, the authors adjust the standard errors for the resulting moving average component in the residuals using a cross-sectional extension to Hansen and Hodrick (1980). Their framework also allows them to control for country fixed-effects and general time trends. Their results suggest that stock market liberalization resulted in an overall increase of the annual per capita GDP growth of approximately half to one percent. Although these studies do not decompose growth into its various components—such as productivity, physical, and human capital accumulation—parallel work by Henry (2000, 2001, 2003) on 12 Latin American and East Asian countries that liberalized their financial system during the 1980s suggests that this growth effect stemmed mainly from increased investment (rather than TFP growth). In particular, Henry (2000, 2001) shows that financial liberalizations yield an overall decline in the cost of capital of around 100 basis points.

Other cross-country studies, however, have not uniformly confirmed a strong positive association between liberalization and growth. While some studies find that financial liberalization exerts a positive effect on growth (Quinn, 1997; Levine, 2001), others (e.g., Grilli and Milesi-Ferretti, 1995) find no statistical effect, and yet others find that the effect of liberalization on growth is negative (Eichengreen and Leblang, 2003).

While providing a very useful alternative for addressing all types of endogeneity concerns that the early cross-country finance-and-growth literature invites—such as omitted variable bias and unobserved country heterogeneity—the use of financial liberalization as an instrument for financial

development is not immune to critique. For one, financial liberalization is not necessarily an exogenous event because governments may choose to implement financial reforms precisely at a time when the country is facing good growth opportunities. In this case, a positive association between financial liberalization and growth rates may simply be explained by anticipatory effects. Second, because industrialized economies typically opened their markets to foreign capital before conventional datasets start recording data on country-level output growth, such studies have nothing to say about the quantitative association between finance and growth at higher levels of economic and financial development. Bekaert, Harvey, and Lundblad (2005) perform two important checks to advocate the causal interpretation of their results. First, they show that this effect is robust to controlling for other reforms (such as privatization, trade liberalization, product market deregulation) that usually coincide with financial reforms. This gives more confidence that the estimates are not capturing other liberalization policies that are typically in the same policy agenda. Second, they control in their empirical model for future country-level growth opportunities, using the country's industrial mix.⁷ However, real progress towards a more convincing interpretation of a causal link between financial liberalization and growth, as well as to a more robust measurement of the true effect, can only be provided by using more disaggregated data. I will return to this point later.

2.2.4 Instrumental variables approach, panel evidence, and time series studies: The channels of growth

Studies using these techniques to gauge causality in the finance-and-growth nexus have also paid attention to the channels through which finance influences economic activity, with conflicting results. Beck, Levine, and Loayza (2000a) use a sample of at most 63 countries over the period 1960–1995, and find that financial intermediaries exert a large, positive impact on total factor productivity growth, which feeds through to overall GDP growth. However, they also find that the long-run links between financial intermediary development and both physical capital growth and private

⁷Bekaert, Harvey, Lundblad, and Siegel (2007) improve upon this strategy by using industrial sectors' global price-to-earnings ratios, in combination with the country's industrial composition, as a proxy for growth opportunities.

savings rates are tenuous. Their results are mirrored in the case of financial liberalization by Bonfiglioli (2008) who provides empirical evidence from a sample of 70 countries observed between 1975 and 1999. In her study, the results for both *de jure* and *de facto* indicators of financial openness suggest that financial integration has a positive direct effect on productivity, but it does not directly affect capital accumulation. Contrary to these studies, Benhabib and Spiegel (2000) use a balanced panel of five-year periods for 90 countries from 1965 and 1985, and show that indicators of financial development are correlated with both total factor-productivity growth and investment. However, they admit that the indicators of financial development that are correlated with factor-productivity growth differ from those that encourage investment. Moreover, their results are sensitive to the inclusion of country fixed effects, which may indicate that the financial-development indicators are proxying for broader country characteristics. Aghion, Angeletos, Banerjee, and Manova (2010) analyze a panel of 21 OECD countries between 1960 and 2000 and show that the share of long-term investment to total investment is procyclical when firms face credit constraints. Consequently, through its effect on the cyclical component of investment, financial development leads to higher mean growth. Rioja and Valev (2004a) use the same methodology and dataset as Beck, Levine, and Loayza (2000a,b). They find that in poor countries, financial development mostly bolsters growth by increasing the rates of capital accumulation, while in richer countries, it contributes to growth primarily by speeding-up productivity growth.

Ang (2011) uses patent and R&D data on 22 OECD and 22 non-OECD countries over the period 1973–1995, and shows that financial development facilitates the accumulation of new ideas. At the same time, he shows that the implementation of financial reform policies (financial liberalization) is negatively associated with knowledge accumulation, contrary to the notions of higher incentives to invent through improved monitoring and reduced moral hazards, and consistent with theories of financial repression (e.g., Stiglitz, 2000). Using data for 21 OECD countries over the period 1870–2009, Madsen and Ang (2016) find that financial development has a positive impact on growth through all theoretical channels (ideas production, savings, fixed investment, and schooling).

3 Finance and growth: Exploiting within-country heterogeneity

Regardless of the progress made in moving beyond statistical correlations and towards a causal interpretation, there are a number of conceptual and econometric problems that are endemic to studies using country-level aggregates to measure the impact of finance on growth. To begin with, a host of other determinants of economic growth, such as human capital, macroeconomic stability, and institutional quality are likely to correlate (across countries) and move at the same pace (within countries) with financial development, introducing multi-collinearity in cross-country growth regressions. Second, a host of factors that can have a material impact on growth—such as the propensity to save or attitudes towards risk taking—are difficult to proxy for, raising non-trivial concerns about omitted variable bias. Third, financial markets can deepen in anticipation of better future growth, making cross-country studies an easy target for questions about reversed causality. Panel data techniques cannot easily address the issue of reversed causality, and the hunt for the perfect instrument is doomed by the fact that some conceptually appealing instruments (such as the country’s legal origin) are time-invariant, while others (such as policies promoting financial openness) may not be fully exogenous to growth opportunities, or may affect growth through channels other than finance, thus failing to satisfy the exclusion restriction for a valid instrument. Finally, cross-country studies find it difficult to shed light on the theoretical mechanisms of how finance contributes to economic growth.

To that end, a growing number of studies have tried to exploit two sources of within-country heterogeneity: the economy’s industrial composition and the country’s regional heterogeneity. The idea behind the former is that some industries have a higher natural tendency to respond to changes in the cost and availability of financing, making it simultaneously possible to wash away the confounding effect of factors common to all industries in a country, and to identify some of the theoretical channels through which finance affects economic growth. The idea behind the latter is to focus on narrow geographic units—such as U.S. states, MSAs, or counties—under the assumption that most of the potentially important unobservable factors are common to all such units within a

country.

3.1 Industry-level analysis

3.1.1 Financial dependence

In a groundbreaking paper, Rajan and Zingales (1998) proposed a cross-industry cross-country approach that addresses many of the limitations of the purely cross country work just discussed. Specifically, the authors start from the assumption that more efficient financial intermediaries help overcome market frictions that drive a wedge between the prices of external and internal finance. Therefore, industries that rely more heavily on external finance for technological reasons—related to, e.g., variations in the scale of projects, gestation period, the ratio of hard vs. soft information, the ratio of tangible vs. intangible assets, follow-up investments, etc.—should benefit disproportionately more from financial development compared to other industries. Employing financial statements of large U.S. listed firms, the authors construct an industry-level benchmark for dependence on external finance. This proxy has two clear conceptual appeals. First, because it derives from large unconstrained firms’ use of finance, it is uncontaminated by demand considerations. Second, because it derives from U.S. industries’ use of finance, it is arguably orthogonal to industrial demand for funds in any other country. Then, using cross-country cross-industry data on value added growth, Rajan and Zingales test whether sectors that rely more on external finance tend to grow faster. Using data for 41 countries and 36 manufacturing industries during the 1980s, Rajan and Zingales find strong evidence in favour of this hypothesis, for a number of empirical proxies for financial development (such as private credit, stock market capitalization, and accounting standards).

The cross-country cross-industry regression set-up in Rajan and Zingales (1998) improves upon cross-country studies in at least two dimensions. It puts to the test a clear theoretical channel for how finance should affect growth. It also allows for the inclusion of both country and industry fixed-effects that net out the impact of unobservable factors that are common to all industries in

a country, such as the demand for manufacturing versus demand for services, and to the same industry across countries, such as technology. Furthermore, by including the initial share of an industry in a country, the authors control for a convergence effect whereby industries with a large share can grow more slowly.

Subsequent studies confirm the relatively stronger positive effect of financial development on the growth of industries that depend relatively more on external finance. For example, Claessens and Laeven (2003) show that the differential effect of financial development on financially-dependent sectors is robust to accounting for the effect of property rights institutions on intangible-intensive sectors. Braun (2003) shows that financial development is particularly useful for intangible-intensive and R&D-intensive sectors. Guiso, Jappelli, Padula, and Pagano (2005) confirm the disproportionately higher impact of financial development on the growth of financially dependent sectors in a larger sample of 36 industries in 61 countries over the period 1980–1995. Using cross-sectional data on 32 manufacturing industries in 20 countries, Svaleryd and Vlachos (2005) find that countries with well-functioning financial systems tend to specialize in industries highly dependent on external financing. Beck (2003) uses industry-level data on firms' dependence on external finance for 36 industries and 56 countries to study whether financial development translates into a comparative advantage in industries that use more external finance. The evidence suggests that countries with better-developed financial systems have higher export shares and trade balances in industries that use more external finance.

The main appeal of the cross-country cross-industry approach using a US industry benchmark is that investment in a financially developed country should closely reflect anticipated demand and productivity shifts, which are partly global. The downside, however, is that any US-specific proxy for an industry-specific reliance on external finance introduces measurement error into the empirical analysis. When proxies are based only on data from a particular country, there is additional noise as industry characteristics are partly country-specific. Country-specific opportunities may therefore result in a biased estimate of the role of financial development for growth in finance-dependent

industries, due to classical measurement error bias.⁸

3.1.2 Growth opportunities

In another influential paper, Fisman and Love (2007) contend that external financial dependence may not be the most appropriate industry-specific benchmark to look at. Instead, they argue that financial markets affect industrial growth less through a reduction in the cost of external finance, and more through a reallocation of resources towards their most productive use. This argument dates back to Bagehot (1873) and Schumpeter (1912) who argue that efficient financial institutions speed capital reallocation to sectors that are anticipated to grow faster and thus face better investment prospects, or growth opportunities.

In order to test this hypothesis, Fisman and Love (2007) use data on the sales growth of large manufacturing listed firms in the US during the 1980s to construct an empirical proxy for "growth opportunities". The argument behind this approach is that the growth rates of financially unconstrained firms in the United States is a good proxy for the potential growth of their industries, globally. Then they employ the same dataset and the same time period as Rajan and Zingales (1998) to test whether financial development exerts a disproportionately larger growth impact on industries that face good growth prospects. They show that financially developed countries experience faster value added growth in the sectors which grow faster in the United States. They also show that variations in industry-specific growth opportunities explain a larger portion of the variation in growth rates across countries with different degree of financial development than variations in industry-specific dependence on external finance. Using a somewhat different approach, Fisman and Love (2004) find that industry value added growth patterns are more closely correlated for country pairs with similar levels of financial development.

Wurgler (2000) takes a different empirical approach by studying how financial markets allocate

⁸Ciccone and Papaioannou (2006) address this shortcoming by introducing a world-average value-added industry growth which captures industry growth in a hypothetical, financially developed country subject to world-average demand and technology shifts.

capital to sectors with good prospects. His analysis also proceeds in two steps. First, using manufacturing data in 65 non-socialist countries over the period 1963–1995, he constructs country-level indicators of the responsiveness of sectoral investment to value added growth. He does so by regressing country-by-country industry investment growth on value added growth. Neglecting issues of endogeneity and data quality and under the assumption that current output growth is a good proxy for future productivity, Wurgler's idea is that investment should be more responsive to output growth in financially advanced countries. Second, Wurgler examines whether, conditional on various other country characteristics, countries with larger capital markets display greater investment responsiveness to value added growth. His main finding is that in financially developed countries, there is faster reallocation of productive resources towards "booming sectors", confirming that financial systems do perform the main function that Schumpeter (1912) ascribed to them. Using data on 28 manufacturing industries in 65 countries between 1963 and 2003, Hartmann, Heider, Papaioannou, and Lo Duca (2007) show that certain aspects of corporate governance, the efficiency of legal systems in resolving conflicts in financial transactions, and some structural features of European banking sectors increase the size of capital markets and thereby enhance the speed with which the financial system helps to reallocate capital from declining sectors to sectors with good growth potentials.

3.1.3 Alternative industry benchmarks

This strand of research has been expanded substantially in terms of industry benchmarks. A number of papers have also exploited the industries' dependence on R&D investment to gauge the causal effect of finance on growth through the ability of financial markets to ensure the funding of innovative ideas. For example, Ilyina and Samaniego (2011) explore a range of technological characteristics that theory suggests might underpin differences across industries in their need or their ability to raise external finance. Using data for 28 manufacturing industries between 1970 and 1999, they find that industries that grow faster in more financially developed countries display

greater R&D intensity and investment lumpiness, indicating that well-functioning financial markets direct resources toward industries where growth is driven by R&D.

Fisman and Love (2003) start from the proposition that because financial markets more effectively allocate capital to firms with high value projects, for firms in poorly developed financial markets, implicit borrowing in the form of trade credit may provide an alternative source of funds. They test this hypothesis using the Rajan and Zingales dataset, and show that industries with higher dependence on trade credit financing exhibit higher rates of growth in countries with weaker financial institutions, with most of the effect coming from growth in the size of preexisting firms.

Beck, Demirgüç-Kunt, Laeven, and Levine (2008) go deeper than before into the question about the cross-firm distributional effects of financial development. They construct an industry benchmark based on the share of small firms (i.e., with fewer than 20 employees) and hypothesize that because small and opaque firms benefit the most from a reduction in the cost of external finance, financial development should have a relatively larger effect on industries which for technological reasons are primarily comprised of small firms. Using a large cross-industry, cross-country dataset, their results are consistent with the view that financial development exerts a disproportionately positive effect on small firms.⁹

In a recent paper, Strieborny and Kukenova (2016) start from the proposition that banks promote economic growth by facilitating relationship-specific investment between buyers and suppliers of intermediate goods. This argument is related to a theoretical literature that argues that rational agents underinvest in assets whose value is higher inside a relationship than outside of it (Grossman and Hart, 1986; Hart and Moore, 1990). Consequently, a supplier is reluctant to undertake relationship-specific investment as she cannot observe the planning horizon of the buyer, however, banks can mitigate this information asymmetry. Empirical results from 28 industries in 90 countries confirm that industries dependent on relationship-specific investment from their suppliers grow disproportionately faster in countries with a well-developed banking sector.

⁹This result is also related to the results in Beck, Demirgüç-Kunt, and Levine (2005) who find—in a sample of 45 countries—a strong, positive association between the importance of SMEs and GDP per capita growth.

3.1.4 Alternative proxies for financial development

This line of work has also been complemented by studies which exploit different proxies for financial development. For example, Beck and Levine (2002) confirm the Rajan and Zingales result for a number of a host of alternative measures of financial development and industrial structure.

Carlin and Mayer (2000) put to the test the renegotiation literature, which argues that fragmented banking systems and credit markets are associated with high-risk R&D investments, while concentrated credit markets are associated with long-term investments in more mature industries. They use a sample of 27 manufacturing industries in 18 countries over the period 1970–1995. Their findings point to a strong relation between the fragmentation of banking systems and the growth of equity financed and skill-intensive industries. Consistent with information and renegotiation theories, the growth of equity dependent industries is particularly high in advanced countries with good information disclosure and dispersed banking systems. Cetorelli and Gambera (2001) augment the original Rajan and Zingales (1998) dataset with proxies for banking sector concentration. They provide further evidence that bank concentration promotes the growth of those industrial sectors that are more in need of external finance by facilitating credit access to younger firms. Claessens and Laeven (2005) add to the Rajan and Zingales model a measure of the degree of competition in the country's banking system as a term that interacts with the sectoral measure of financial dependence. Using the interaction variable between each industrial sector's external financing dependence and the index of the degree of competition in the country's banking system, they find that industrial sectors that typically require more external financing grow faster in countries with more competitive banking systems.

Researchers have also looked at the effect of financial liberalization on growth, using the Rajan and Zingales framework, in order to address econometric concerns related to reverse causality and omitted variable bias. Gupta and Yuan (2009) investigate the effect of a stock market liberalization on industry growth in a sample of 27 industries in 31 emerging markets. Consistent with the view that liberalization reduces financing constraints, they find that industries that are more externally

dependent and face better growth opportunities grow faster following liberalization. As a point of caution, they also find that this growth effect appears to come from an expansion in the size of existing firms rather than through the entry of financially constrained new firms. Qualitatively similar results are recorded in different samples, for different time periods, and for different definitions of financial openness by Levchenko, Ranciere, and Thoenig (2009) and by Popov (2011).

Some studies have applied the cross-industry regression framework to questions related to the impact of market finance on growth. For example, in a seminal study, Kortum and Lerner (2000) show that the dramatic increase in Venture Capital (VC) financing during the 1980s and early 1990s was associated with a material increase in the rates of industrial innovation. Controlling for public and private R&D investment, their estimates imply that while the ratio of VC to R&D averaged less than 3% from 1983 to 1992, venture capital accounted for about 8% of industrial innovation in that period. To account for the endogeneity of VC investment to local growth opportunities, the authors introduce an instrument based on a 1979 policy change to the "Prudent Man" rule that determined the extent to which pension funds could invest their assets in risk capital. However, more recent studies have questioned whether this result can be transposed to other empirical settings. For example, Hirukawa and Ueda (2008) extend the Kortum and Lerner (2000) sample to the 2000s. They confirm that the positive impact of VC on innovation is still present and even becomes stronger during late 1990s when the VC industry experienced an unprecedented growth. However, the authors do not find that VC investment affects total factor productivity growth. They do find that VC investment is positively associated with labor productivity but this positive impact is originated from the technology substitution from labor to other productive inputs such as energy and material. Their finding suggests that, at industry level, VC investment increases the patent propensity but may not necessarily improve the productive efficiency. Similarly, Popov and Roosenboom (2012) find that the effect of VC on innovation does not hold in a large sample of 21 European countries over a later period (1991–2005), suggesting that the success of the US VC industry during the 1980s and 1990s cannot be easily exported abroad.

Another important question concerns the impact of non-bank finance on new business creation. Popov and Roosenboom (2013) investigate the impact of risk capital markets on growth using a comprehensive database of 20 industries from 21 European countries over the period 1998–2008. They take advantage of the fact that venture capital investment data is already reported at the sectoral level for each country, making it redundant to rank industries along their receptiveness to financing. They find strong evidence that venture capital investment has a positive effect on the rate of new business creation. Their results suggest that—controlling for country and industry characteristics and for the endogeneity of VC—venture capital promotes growth by bringing new ideas to the marketplace in the shape of new companies.

3.2 Regional evidence

A lot of recent research effort has been aimed at exploiting within-country regional heterogeneity deriving from the staggered implementation of policies that promote financial development. The idea is that if one narrowly defined geographic region in a country implements a policy that reduces the cost of external financing to firms and households a decade before another region in the same country, then the first region will experience a boost to its growth earlier than the second one. There are two main advantage of this approach. First, under plausible assumptions, a number of factors that can contaminate the causal link between finance and growth—such as characteristics of consumers or of government policy—are common across the two regions. Second, the measurement error in the typical empirical proxies for financial development is lower.

3.2.1 United States

The impetus for this empirical approach derives from a seminal paper by Jayaratne and Strahan (1996). The authors exploit differences in the timing of the deregulation of local banking markets in the United States to assess the impact of banking sector competition on growth.¹⁰ Because these

¹⁰In the United States between 1970 and 1994, 38 states removed regulatory restrictions on branching. In addition, during the period 1978 to 1992 almost all states removed restrictions on interstate bank ownership. See Strahan

were staggered changes, they allow for controlling for state and year unobserved characteristics and trends. The authors' estimates imply that state banking deregulation was associated with a 0.6 to 1.2 percent increase in real per capita state growth. The evidence also implies that the gains on growth emerged from enhanced productivity rather than from increased investment. The authors also show that the share of non-performing loans and write-offs dropped significantly after the reforms (approximately -0.3% to -0.6%). Jayaratne and Strahan (1998) show that banking reforms resulted in a fall of non-interest costs, wages, and loan losses. These efficiency gains translated into lower loan prices. Stiroh and Strahan (2003) argue that the spur in bank acquisitions (the annual acquisition rate rose by 1.6 percent after the approval of laws allowing inter-state banking) and other forms of consolidation enabled banks to seize scale economies and specialization benefits.

While conceptually appealing as an exogenous policy experiment, the empirical set-up based on staggered banking deregulation is not perfectly exempt from econometric challenges. For example, pro-competitive banking reform can be induced by an expectation of future growth opportunities unobservable to the econometrician.¹¹ To address this issue, Huang (2008) analyzes changes in growth rates for contiguous counties across state borders. Because such counties are immediately adjacent neighbors, they are plausibly similar in both observable, and more importantly, unobservable conditions, and to follow similar economic paths in the absence of changes in bank entry barriers. Huang (2008) shows that the main results in Jayaratne and Strahan (1996) still obtain even in this considerably more restrictive specification, albeit the magnitude of the impact of banking deregulation on growth declines.

Researchers have subsequently tried to shed light on the mechanisms through which banking deregulation in the United States boosts state-level economic growth. Black and Strahan (2002) provide further evidence that deregulation enhanced competition, which in turn fostered entrepreneurship (new firm incorporations and growth in the number of establishments). They estimate

(2003) for a review.

¹¹As a counterargument, Kroszner and Strahan (1999) show that deregulation was mainly driven by the relative power of interest groups that were likely to benefit from deregulation, rather than by efficiency considerations.

that new firm incorporations increased by 4 to 8 percent per year after deregulation. Cetorelli and Strahan (2006) apply the Rajan and Zingales methodology and show that these reforms had a relatively larger impact on new business creation in industries dependent on external finance. Kerr and Nanda (2009) qualify these findings by looking at the rates of business churning. They find that interstate banking deregulation increases entry by new firms but also leads to higher levels of exit among new entrants. Nevertheless, it is still not well understood whether the post-deregulation gains in new business creation come from a reduced cost of external financing. For example, Zarutskie (2006) finds that newly formed firms substitute more contributed equity finance for external debt and invest less following deregulation, while Erel (2011) provides evidence that small borrowers generally pay lower interest rates to banks expanding their operation through mergers, and Rice and Strahan (2010) find that small-business loan terms improve following removal of restrictions on interstate branching.

Regarding the effect of banking deregulation on innovation, the evidence is mixed. Amore, Schneider, and Zaldokas (2013) provide evidence that interstate banking deregulation had a beneficial impact on innovation by public firms, whereas Cornaggia, Tian, and Wolfe (2012) find the opposite, and Hombert and Matray (2016) find that intrastate deregulation decreased innovation by all firms. Chava, Oettl, Subramanian, and Subramanian (2013) reconcile the two findings by arguing that intrastate banking deregulation—which increased the local market power of banks—decreased the level and risk of innovation by young, private firms, while interstate banking deregulation—which decreased the local market power of banks—increased the level and risk of innovation by young, private firms. Using an econometric approach borrowed from portfolio theory, Acharya, Imbs, and Sturgess (2011) show that banking deregulation in the United States increased allocative efficiency in the sense that it led to higher rates of state-wide growth for the same level of growth volatility. Michalski and Ors (2012) study the effect of deregulation on trade flows between states. Their difference-in-differences estimates suggest that the trade share of state-pairs that allowed pairwise interstate entry increased by at least 14% over 10 years relative to non-integrated

state-pairs.

The banking deregulations of the 1970s and 1980s are not the only empirical set-up in which the within-US regional heterogeneity can be exploited. For example, Jaremski and Rousseau (2013) construct a bank-level dataset that contains the location, dates of operation, and annual balance sheet items of each antebellum bank between 1837 and 1862, allowing the authors to examine the number and loans of both free and charter banks by county over time. The authors then link financial factors to growth using Census data and focusing on two specific measures of growth (manufacturing capital and farm capital) and one indirect measure (urbanization) also at the county level. Their empirical analysis indicates that free banking did not have a direct impact on economic growth.

A number of research papers have exploited the regional heterogeneity within the US to study the effect of non-bank finance on economic growth, or the channels thereof. Samila and Sorenson (2011) use a panel of 329 US metropolitan areas between 1993 and 2002 to study the regional effect of VC investment on local growth. They find that an increase in the supply of VC investment positively affects the rates of new business incorporation, employment, and regional growth. Using data on 12 industries across the 50 US states between 1992 and 2001, Popov (2014c) finds that an increase in the supply of venture capital affects positively mean firm size by increasing the relative share of medium-sized and larger firms. The empirical evidence is consistent with the idea that VC promotes the “elitization” of firm entry by boosting the entry and survival of superior projects that over time evolve into industrial champions.

Another important financial sector development is associated with the deepening of the mortgage market. This development can have a causal impact on local economic growth if it allows firms and individuals to convert housing wealth into productive investment. A second channel through which housing booms can stimulate local economic activity is one whereby the positive income shock that home owners experience during a housing boom can increase their levels of consumption, especially if they feel that the shock is not transitory. Loutskina and Strahan (2015) exploit

the regional heterogeneity in changes in house prices during the latest U.S. housing boom, and find that positive shocks to local house prices exert a strong positive effect on local economic growth. Lending support to the hypothesis that this development is related to higher lending against housing collateral, Adelino, Schoar, and Severino (2015) use a similar empirical set-up and document that U.S. areas with a bigger increase in house prices between 2002 and 2007 experienced a strong increase in small business employment relative to large business employment. They show that this is also the case in tradeable sectors, alleviating concerns that the effect is driven by the income shock provided to home-owners by local property price increases.

3.2.2 Europe

Another natural laboratory for studying the impact of bank deregulation on growth are the French banking reforms of 1985 which eliminated subsidized loans and monthly ceilings on credit growth, unified banking regulation, and privatized a number of banks. Using detailed firm and industry-level data for the period 1978 to 1999 that cover all sectors of the French economy, Bertrand, Schoar, and Thesmar (2007) analyze the effects of banking deregulation on growth. Controlling for business cycle effects, industry-specific trends, and unobserved characteristics, the authors document that the reforms led to increased firm-level productivity (proxied by firm return on assets) and to higher rates of entry and exit of business firms in bank-dependent industries. In addition, after the reforms, worse performing firms became more likely to exit the market, suggesting enhanced efficiency in product markets.

Guiso, Sapienza, and Zingales (2004) study cross-regional differences in financial development in an otherwise integrated banking market (Italy). They construct an indicator of financial development by estimating a regional effect on the probability that, *ceteris paribus*, a household has no access to the credit market. By using this indicator, they find that financial development promotes the entry of new firms and boost regional growth. These effects are present even when the authors instrument modern-day financial development with the structure of the local banking markets in

1936, which, because of regulatory reasons, affected the supply of credit in the following 50 years.

3.2.3 Rest of the world

Regional evidence on how banking affects local growth, coming from the rest of the world, mostly derives from using foreign bank entry as an exogenous shock to local banking conditions. Theoretically, it is unclear how foreign bank entry should affect local economic activity. It could simply increase competition, in which case the entry of foreign banks in a local market should have the same effect as bank branching deregulation in the US. Alternatively, if foreign banks have a higher propensity to cherry pick and a lower ability to evaluate soft-information-intensive projects, their entry can exacerbate information asymmetries.

The evidence in the literature is decidedly mixed. Using data for 89 low-income and lower-middle-income countries, Detragiache, Gupta, and Tressel (2008) find that a larger foreign bank presence is associated with shallower credit markets and slower credit growth. Beck and Martinez Peria (2010) study Mexico, where foreign bank participation rose from 2% to 83% of assets during 1997–2005. Their bank-municipality-level estimations show a decline in the number of deposit and loan accounts. Gormley (2010) studies the entry of foreign banks into the 575 Indian districts, and finds that only a small set of large and very profitable firms benefit in terms of improved credit access, while on average firms were 8 percentage points less likely to have a loan after a foreign bank entry because of a systematic drop in domestic bank loans. The overall drop in credit appears to adversely affect the performance of smaller firms with greater dependence on external financing. At the same time, using bank-level data for four Latin American countries (Argentina, Chile, Colombia and Peru) during the mid-1990s, Clarke, Cull, Martinez Peria, and Sanchez (2005) find that on average foreign banks seem to lend less to small businesses. However, they also find that large foreign banks often surpass large domestic banks in their share and growth of lending to small businesses. Burgess and Pande (2005) find that the expansion of rural banking in India following a policy change in the Central Bank’s licensing policy enabled the development of an extensive rural

branch network, and that this, in turn, allowed rural households to accumulate more capital and to obtain loans for longer-term productive investments.

4 Finance and growth: Micro evidence

So far, I have discussed evidence of the finance-and-growth nexus deriving from empirical proxies that capture financial development at an aggregate (country, industry, or region) level. This is in sharp contrast with the theoretical mechanisms developed in the literature which mostly deal with micro effects (e.g., the relaxation of liquidity or credit constraints at the household or the firm level). And while in practice it is difficult to make the quantitative step from micro estimates to aggregate effects absent a number of heroic assumptions, micro-level datasets make for a much tighter identification of the impact of finance on growth-enhancing activities, such as capital investment or innovation.

Arguably, the biggest development in the empirical finance-and-growth literature in recent years has been associated with the proliferation of micro-level datasets which have allowed researchers to perform more precise tests of such theoretical mechanisms. A separate trend within this literature has been associated with the development of ingenious methods whereby researchers make sure that they have identified truly exogenous shocks to micro-level financial shocks that are uncorrelated with individual-level unobservables, such as firm-specific growth opportunities or household-specific demand. In this section, I will discuss both developments.

4.1 Access to finance and growth: The early studies

The micro literature on access to finance starts from the simple premise that capital market imperfections which drive a wedge between the price of external and internal funds may prevent the firm from reaching efficient levels of investment. This wedge relates to theoretical mechanisms deriving from, for instance, information asymmetry or corporate governance. Thereby, credit or liquidity constraints hinder the growth of firms. Conversely, financial development of any kind which re-

duces the relative cost of external finance should promote the growth of firms, and by extension, aggregate growth.

While intuitively appealing, the early papers in this literature found it difficult to test this mechanism in practice due to the unavailability of reliable proxies for credit constraints. The seminal work by Fazzari, Hubbard, and Petersen (1988) provides the first such test. Their hypothesis is that if capital-market imperfections force firms to face binding financing constraints, proxies for internal funds or liquidity will affect firms' investment, holding investment opportunities constant. Therefore, if one finds in the data that the firm's investment responds to shocks to the firm's cash flow, this will imply that such firms are credit constrained. Otherwise they would be able to tap into external funds to finance their optimal level of investment, making their investment policy orthogonal to their internal funds. They use the Q model of investment as a benchmark because it relies on Tobin's Q as a summary statistic for investment opportunities. Their null hypothesis is that regressing changes in investment on the firm's cash flow, controlling for the firm's Q, should yield a positive coefficient as long as firms are credit constrained, and a coefficient of zero absent capital-market frictions, as long as Q controls adequately for investment opportunities.

The authors then use a panel of 421 manufacturing firms from 1970 to 1984. They group the firms in three categories, in decreasing likelihood of being credit constrained: high retention, medium retention, and low retention. They find significantly larger coefficients on the cash-flow elasticity of investment for high-retention firms. This cross-sectional differences in the cash-flow sensitivity of investment leads them to conclude that financing constraints are likely to be important in firms' investment decisions. The cross-sectional differences in this "cash-flow" effect remains when sales or user cost of capital are introduced in the regression and when the data are further decomposed by two-digit SIC industry classes. The basic finding of the paper—that a priori groupings of "constrained" and "unconstrained" firms have different determinants of investment, with internal funds being an important explanatory variable only for the former group—has subsequently been corroborated in studies of data for countries outside the US (e.g., Hubbard, 1995; Schiantarelli,

1995).

The main criticism against this empirical approach is that shocks to cash flows are not orthogonal to (unobservable) investment opportunities for which the firm's Q is a poor empirical proxy. In particular, investment opportunities may be favorable precisely when cash flow is increasing, in which case the point estimate from a regression of changes in investment on changes in cash flows is probably biased by this omitted variable effect. Then, a positive correlation between cash flow and investment becomes uninformative about the impact of (the relaxation of) financing constraints on firm investment and growth. This point is made forcefully in a series of papers by Kaplan and Zingales (1997, 2000), Cleary (1999), Alti (2003), and Moyen (2004), to name but a few.

The paper by Demirgüç-Kunt and Maksimovic (1998) represents another attempt to use micro data in order to get at the interaction between financial development, financing constraints, and investment. The authors use data on the largest publicly traded manufacturing firms in 26 countries to calculate the rate at which each firm would be growing using only internal funds and/or short-term borrowing. They then compare firms' predicted growth and their actual growth rates, and calculate the proportion—in each country and point in time—of firms that grow faster than predicted by the internally financed growth model. They find that the proportion of firms that grow faster than their internal resources would predict is higher in countries with higher banking system development, stock market liquidity, and efficient legal systems. Beck, Demirgüç-Kunt, and Levine (2001) confirm these findings using an extended sample. Later papers have expanded on this methodology. For example, Love (2003) also uses firm level data to examine whether financial development relaxes credit constraints. She finds that the sensitivity of investment to internal funds is greater in countries with more poorly developed financial markets.¹²

Access to micro data has also allowed to evaluate some of the predictions of the law-and-finance literature, in particular regarding the efficiency of public versus private banks. For example, in

¹²In an interesting departure from this line of research, Hoberg and Maksimovic (2015) score 10-K text to obtain annual measures of financial constraints, with separate measures for firms reporting equity and debt financing issues, and they show that such proxies outperform others used in the literature in predicting investment cuts following negative shocks.

a sample of Chinese firms, Allen, Qian, and Qian (2005) find that state-owned banks play an important role in the growth of private firms during their start-up and subsequent periods, together with private credit agencies and founders' friends and families. They also find that within the regions that witnessed the most successful economic growth and improvement in living standards, properly motivated government officials support and participate in the growth of private sector firms.

4.2 Using survey-based proxies for credit constraints

In an attempt to establish a proper causal link from financing constraints to firm financing and performance, researchers have used micro surveys to look at the impact of self-reported credit constraints. In a seminal study, Beck, Demirgüç-Kunt, and Maksimovic (2005) use data for 4,000+ firms in 54 countries, drawing on a World Bank survey of SMEs. The novelty of this approach is that firms are asked to report their own assessment of whether they are constrained by a number of factors, including financial markets, the working of the legal system, and corruption of state officials. The authors find that financing constraints have a differential effect on firms' growth, with smaller firms being more likely to be constrained. Financial and institutional development weakens the constraining effects of financial, legal, and corruption obstacles and it is again the small firms that benefit the most.

A number of subsequent papers have confirmed the importance of credit access for firm growth. Using the same survey, Beck, Demirgüç-Kunt, Laeven, and Maksimovic (2006) further show, in a sample of 10,000 firms in 80 countries, that institutional development is the most important country characteristic explaining cross-country variation in firms' financing obstacles. Beck, Demirgüç-Kunt, and Maksimovic (2008) confirm that small firms and firms in countries with poor institutions use less external finance—and in particular bank finance—which severely limits their growth potential. Ayyagari, Demirgüç-Kunt, and Maksimovic (2008) show that of all types of constraints that firms face, financing constraints deter growth the most. Ayyagari, Demirgüç-Kunt, and Mak-

simovic (2010) examine firm financing patterns and growth using the Investment Climate Survey, a major survey conducted in China in 2003 and led by the World Bank, which contains firm-level information on around 2400 Chinese firms. Using a direct measure of credit access, they find that while a relatively small percentage of firms utilize bank loans, bank financing is associated with faster growth whereas informal financing is not. Controlling for selection, they find that firms with bank financing grow faster than similar firms without bank financing. Importantly, the results are not driven by bank corruption or the selection of firms that have accessed the formal financial system.

Using survey data, a number of researchers have linked self-reported credit constraints to a number of growth-enhancing activities at the firm level. For example, Campello, Graham, and Harvey (2010) employ a survey of business firm executives shortly after the collapse of Lehman Brother in 2008. They show that firms which are or expect to become credit constraints as a result of their exposure to financial intermediaries affected by the turmoil in financial markets plan to cut investment and employment more than unconstrained firms.¹³ Ayyagari, Demirgüç-Kunt, and Maksimovic (2012) use a sample of 19,000 firms in 47 countries and find that firms with better access to external finance are more likely to be engaging in innovative activities. Popov (2014b) uses a survey database of 8,265 firms from 25 transition economies and finds that lack of access to finance in general, and to bank credit in particular, is associated with significantly lower investment in on-the-job training. This effect is stronger in education-intensive industries and in industries facing good global growth opportunities. To address endogeneity issues, the author uses the structure of local credit markets as an instrument for credit constraints at the firm-level. The link between credit access and on-the-job training is quantitatively important, too, given that in developed economies

¹³Other micro-level proxies for financing constraints have also been employed to study the impact of access to finance on investment. For example, Zarutskie (2006) analyzes empirically how competition among banks determines how capital is allocated to firms and entrepreneurs that may be the future engines of growth. the impact of the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994, which increased the competitiveness of U.S. banking markets, on a large panel of privately-held firms. She finds that following the deregulation, newly formed firms used significantly less external debt, were smaller and had higher returns on assets, consistent with them investing less due to greater financial constraints.

such as the United States, total annual spending on on-the-job training amount to about one third of total expenses on formal education (Mincer, 1962).

4.3 Identifying exogenous shocks to credit access

In the absence of direct measures of credit constraints, the main effort in this line of research has been invested in isolating a reliably exogenous shock to the cost of external finance that is plausibly orthogonal to the firm's investment opportunities. A number of recent papers have used ingenious identification techniques aimed at isolating an exogenous component of the firm's cost of finance that is uncorrelated with its investment opportunities. For example, Lamont (1997) uses changes in oil prices to study the investment behavior of the non-oil segment of large firms that need to allocate resources away from potential profitable opportunities in order to prop up their oil segment in the wake of a decline in oil prices. Rauh (2006) takes advantage of shocks to firms' defined pension contributions schemes to study their investment behavior. Faulklender and Petersen (2012) use the temporary shock to the cost of firms' internal financing, brought about by the American Jobs Creation Act which significantly lowered US firms' tax cost when accessing their unrepatriated foreign earnings, to examine the role of capital constraints in firms' investment decisions. These papers broadly confirm that shocks to financing constraints affect firms' investment, with material implications for subsequent growth.

While survey datasets have clear advantages, such as providing a direct, often quantitative proxy for access to finance, they also have a number of disadvantages. The fact that the information is self-reported raises questions about reliability, and the fact that business owners are time constrained results in such surveys being normally scarce on firm-level balance sheet information. The frontier in this line of research is to construct surveys where the information is cross-checked by independent third parties, but more importantly, where mechanisms are hardwired to ensure that the survey can be linked to more detailed data sources—for instance, through firm identifiers—in order to augment the dataset with a larger set of balance sheet items.

An important source of (both positive and negative) exogenous shocks to firms' and individuals' access to finance is provided by the dynamics of housing markets. As property prices fluctuate over the cycle, so does the wealth of economic agents with access to residential or non-residential property. With sophisticated financial markets, such access enables economic agents to convert immovable property into productive investment.¹⁴ The first channel whereby this is possible is related to the provision of business loans against tangible collateral, a function that both residential and non-residential property fulfills by default. The second channel is related to the ability of homeowners to extract home equity from their property through mortgage markets. Chaney, Sraer, and Thesmar (2012) provide evidence for the working of the first channel in the case of business firms. Studying a sample of 5,584 large listed firms across the United States during the period 1993–2007, they find that investment responds positively to positive shocks to the value of the firm's real estate assets. In particular, they show that the representative US corporation invests \$0.06 out of each additional \$1 of real estate collateral. Schmalz, Sraer, and Thesmar (2016) show that the same mechanism can also be operational in the case of small business firms. In particular, using micro data from France, they show that home owners are substantially more likely to start new businesses than renters, suggesting that access to residential property makes it easier to obtain a business loan. Regarding the second channel, Corradin and Popov (2015) use a sample of 78,7693 unique households across the United States drawn from the Survey of Income and Program Participation (SIPP) of the U.S. Census Bureau, from 1997 to 2006. Because the SIPP contains individual information on home values and on mortgage size, it also allows the authors to calculate home equity at the household level. In that way, they can compare the propensity to start a new business within the sample of home owners, alleviating concerns that home owners and renters differ in ways that are important for entrepreneurship, such as in their attitude to risk. They find that a 10% increase in home equity raises the probability that a non-business-owning household will switch to entrepreneurship in the next period by up to 7%. This effect translates into an increase in the

¹⁴This idea goes back to De Soto (2000) who advocates that regulations and financial services adjust to allow the poor to convert the vast assets they possess in the informal sector into wealth.

share of households in the sample who switch to self-employment from around 1% to 1.07%, from one year to the other. Crucially, the authors also find a strong positive correlation between new business ownership and the change in mortgage debt. This implies that once they switch away from fixed income to entrepreneurship, individuals tend to draw down their home equity to finance their business investment, confirming that developed financial markets can support entrepreneurship through the channel of home-equity-based borrowing.

Progress has also been made, using micro-level datasets, in establishing a tight causal link between access to finance and innovative activities, such as patenting and investment in R&D. For example, Brown, Fazzari, and Petersen (2009) estimate dynamic R&D models for high-tech firms and find significant effects of cash flow and external equity for young, but not mature, firms. The financial coefficients for young firms are large enough that finance supply shifts can explain most of the dramatic 1990s R&D boom, which implies a significant connection between finance, innovation, and growth. Brown, Martinsson, and Petersen (2013) study a broad sample of firms across 32 countries and find that strong shareholder protections and better access to stock market financing lead to substantially higher long-run rates of R&D investment, particularly in small firms, but are unimportant for fixed capital investment. At the same time, they find that credit market development has a modest impact on fixed investment but no impact on R&D. Their results are consistent with the idea that access to stock market financing is particularly important for R&D investment because the intangible nature of R&D sharply limits firms' ability to use debt finance.

Another recent strand of research has sought to identify the impact of tightening credit constraints on firms' employment decisions. This question is related to economic growth in at least two ways. First, unemployment spells can have significant negative effect on workers' employability. Job-specific skills deplete quickly in an environment of continuous adoption of new technologies, and this process can turn cyclical unemployment into permanently high structural one (Ljungqvist and Sargent, 1998), with material effect on the accumulation of human capital in the economy. Second, by potentially inducing higher unemployment, tighter credit can lead to higher income

inequality and crime (Raphael and Winter-Ebmer, 2001).

Recent studies have used micro datasets to confirm that credit access has a significant impact on firm-specific employment decisions. Chodorow-Reich (2014) uses syndicated loan data to show that firms that before the crisis were borrowing from banks that subsequently became impaired, reduced employment more than firms associated with healthier banks. Duygan-Bump, Levkov, and Montoriol-Garriga (2015) find that during recessions, workers in small firms are more likely to become unemployed in industries with high external financial needs. Popov and Rocholl (2016) study the impact of exogenous funding shocks to German savings banks during the U.S. subprime mortgage crisis on the labor decisions of 30,000+ private and public firms in Germany. They find that firms with credit relationships with affected banks experience a significant decline in labor demand relative to firms with credit relationships with healthy banks, manifested in a simultaneous reduction in firm-level employment and average wages.

5 Finance and growth: Caveats and qualifications

5.1 Non-linearities in the finance-and-growth nexus

While only a handful of studies have asserted that financial markets exert a *negative* effect on growth¹⁵, Rousseau and Wachtel (2011) show that the positive relationship between finance and growth is not as strong in more recent data as it was in the original studies with data for the period from 1960 to 1989, and Demetriadis and Rousseau (2016) show in a sample of 91 countries over 1973–2004 that financial depth as traditionally measured is no longer a significant determinant of long-run growth (but sound banking regulation and supervision is). To fix ideas, let's start from the observation that a non-negligible body of empirical work has recently cast doubts on the claim that the effect of finance on growth is monotonic. Using the original King and Levine sample, Deidda and Fattouh (2002) put to the test the empirical implications of an overlapping generations model of growth and find that the positive association between financial development and economic

¹⁵See, for example, Luintel and Khan (1999).

growth disappears beyond a threshold of around \$852 of initial income. Rioja and Valev (2004) apply GMM dynamic panel techniques in a panel of 74 countries over the period 1960–1995, and show that the relationship between financial development and economic growth varies according to the level of financial development, divided in three regions. For countries with very low levels of financial development, additional improvements in financial markets have an uncertain effect on growth; in the intermediate region, financial development has a large, positive effect on growth; and in very financially developed countries, the effect is positive, but small. Shen and Lee (2006) study the relationship between financial development and real GDP per capita growth in 48 countries. They find that the relationship between growth and bank development is best described as a weak inverse U-shape which becomes stronger when additional stock market variables are squared.

All of these studies thus find a non-linear relationship between financial development and growth. Arcand, Berkes, and Panizza (2015) seek to quantify the threshold beyond which financial depth no longer has an effect on economic growth. Using data on 67 countries between 1970 and 2000 and employing a host of empirical approaches, they show that financial depth starts having a negative effect on output growth when credit to the private sector reaches 100 percent of GDP. Beck, Georgadis, and Straub (2014) estimate dynamic panel regressions on a sample of 132 countries between 1980 and 2005, and find a similar threshold (around 109% of GDP, when not controlling for banking crises). Finally, Manganelli and Popov (2013) take a stab at the same question by using the Rajan and Zingales (1998) dataset and cross-country cross-industry regression methodology to counter the concern that in cross-country data, financial markets may predict economic growth simply because they anticipate future growth. They find that beyond a private credit-to-GDP ratio of around 0.7-0.74, a further expansion of the financial sector is associated with a weaker effect on the growth of financially dependent industries and in industries facing high growth opportunities than in industries that do not depend on external finance and face low growth opportunities. Importantly, this is not an out-of-sample result: fully 9 of the 41 countries in the dataset have credit markets which are larger than the estimated threshold. Thus, a number of

recent studies using various datasets, empirical methodologies, and time periods, have uncovered robust non-linearities in the finance-and-growth nexus.

5.2 Mechanisms

There are three broad theory-based explanations for the non-linearities in the finance-and-growth nexus uncovered in these studies. The first one is related to the fact that at high levels of financial development, the further deepening of financial markets can be associated with a type of financial services that have a lower growth potential, such as mortgage finance. The second deals with the hypothesis that there is a trade-off between economic development and macroeconomic risk, and that developed financial intermediaries exacerbate this trade-off. The third one is that financial markets deplete human capital from the real economy, reducing the rates of innovation and growth.

Evidence from the years before the global financial crises suggests that at later stages of financial development, and in high-income economies, the composition of bank credit shifts away from business credit towards household credit. Thus, it is entirely possible that beyond a certain empirical threshold, a further expansion in credit is associated with a less productive use of financial resources. Beck, Büyükkarabacak, Rioja, and Valev (2012) explore the differential growth effects of enterprise and household credit. Consistent with theory, they find that the growth effect of financial deepening comes through enterprise rather than household credit. While household credit has been shown to also stimulate entrepreneurship (Adelino, Schoar, and Severino, 2015; Corradin and Popov, 2015; Schmalz, Sraer, and Thesmar, 2016), mortgage lending tends to crowd out business credit. For example, Chakraborty, Goldstein, and MacKinlay (2016) show that during the 1988–2006 period, US banks which were active in strong housing markets increased mortgage lending and decreased commercial lending. Firms (in particular, credit constrained ones) that borrowed from these banks had significantly lower investment. Based on a sample of 77 countries for the period 1980–2007, Beck, Degryse, and Kneer (2014) find that intermediation activities increase growth and reduce volatility in the long run, but that an expansion of the financial sectors along other

dimensions has no long-run effect on real sector outcomes. Alternatively, banking markets may be too developed relative to the quality of corporate governance. For example, Levine, Lin, and Xie (2016) use firm-level data from 36 countries from 1990 through 2011 and find that the adverse consequences of banking crises on equity issuances, firm profitability, employment, and investment efficiency are larger in countries with weaker shareholder protection laws, suggesting that too much finance with too poor corporate governance can result in a weaker association between financial development and long-run growth. The combined evidence thus might explain to a certain degree the insignificant finance-growth relationship across high-income countries.

Second, while an influential paper by Ramey and Ramey (1995) argues that stability breeds growth by reducing investment uncertainty, it is possible that there is a trade-off between economic growth and macroeconomic risk which financial markets may exacerbate. The evidence on this front is mixed. Using different dataset and methodologies, Stiglitz (2000), Kose, Prasad, Rogoff, and Wei (2006), and Levchenko, Ranciere, and Thoenig (2009) argue that greater access to foreign capital increases volatility both in domestic financial markets and in the real economy. However, Beck, Lundberg, and Majnoni (2006) and Larrain (2006) analyze finance-volatility patterns in large samples of countries, and find no evidence for a positive association between financial development and output volatility. Ranciere, Thornell, and Westermann (2008) study the link between financial liberalization, growth, and crises. In their model, in a financially liberalized economy with limited contract enforcement, systemic risk taking reduces the effective cost of capital and relaxes borrowing constraints. This allows greater investment and generates higher long-term growth, but it raises the probability of a sudden collapse in financial intermediation when a crash occurs. The authors test empirically their theoretical mechanism in large cross-country data and find a strong positive link between long-term growth and financial fragility. Popov (2014a) uses aggregate and sectoral data for a sample of 93 countries and finds that over the 1973–2009 period, countries that became financially open experienced a large increase in the negative skewness of GDP growth relative to otherwise similar countries that remained closed to foreign portfolio investment. This result obtains

with equal strength in the aggregate data and in the sectoral data, and it is disproportionately stronger in sectors that require more external finance. The skewness effect of financial openness is stronger in countries which experienced a banking crisis after liberalization, suggesting that financial-development-stimulating openness increases the probability of long-term-growth-reducing banking crises.

The third potential explanation of the disappearing effect of finance on growth at high levels of development may be the absorption of talent into the financial sector. Already Tobin (1984) suggested that “...we are throwing more and more of our resources, including the cream of our youth, into financial services remote from the production of goods and services, into activities that generate high private rewards disproportionate to their social productivity”. Philippon and Reshef (2012) document the transformation of the U.S. financial sector into high-skill high-wage industry and the emergence of economic rents in this sector in the 1980s. They find that changes in the skill demand and wages in the financial sector were mainly driven by financial regulation. Moreover, the attractiveness of a career in finance to the educational elite increased substantially over time, at least before the recent financial crisis (Goldin and Katz, 2008; Kedrosky and Stangler, 2011). There is a clear theoretical case for why rent-seeking activities such as legal services can reallocate productive talent away from the real economy (e.g., Murphy, Shleifer, and Vishny, 1991). Philippon (2010) studies the allocation of human capital in an economy with production externalities and career choices, and shows that an inefficient allocation of agents across the financial sector and the real sector can emerge if innovators face borrowing constraints and require the services of financiers in order to invest efficiently. Bolton, Santos, and Scheinkman (2016) argue that due to the negative externality of cream-skimming in financial markets, financiers can extract informational rents when buying assets, a mechanism that ends up attracting too much talent into financial services relative to the social optimum. Kneer (2013) lends empirical gravitas to this claim by showing that the relaxation of interstate branching restrictions in the US disproportionately reduced the labour productivity of skill-intensive manufacturing industries. Nevertheless, such evidence is

as of yet very sparse, and it can only be made more robust by exploiting individual-level mobility across sectors in response to exogenous shock to labor compensation in the financial sector.

There is another plausible explanation for the uncovered non-linearities in the finance-and-growth nexus which is not based on a theoretical argument. Instead, it relies on the conjecture that financial development is measured inaccurately, especially in highly financially developed economies. The financial system performs many concurrent functions, some of which—such as the pooling and intermediating of savings and the screening and monitoring of borrowers—are complementary to each other. In the absence of readily available variables capturing the individual functions of the financial sector, the literature has used imperfect proxy variables focusing on the size and activity of financial intermediaries and markets, most prominently, the ratio of private credit to GDP. Given its crude nature, there are clear shortcomings in the private credit-to-GDP measure. To name just a few: it indicates quantity not quality; it focuses only on regulated financial institutions; it does not capture the maturity structure of intermediation; it does not capture how widespread the use of credit services is among enterprises and households; and it does not capture the ease with which enterprises and households can access credit (for a more detailed discussion, see Beck, 2015). Most importantly, while private credit to GDP might be a good measure of the financial services available to the economy at many levels of economic development, it is not in very financially developed countries where much of the financing is done through sophisticated market mechanisms, such as venture capital and crowdfunding.

6 Finance and growth: Banks versus markets

Throughout this chapter, I have presented extensive evidence to the fact that both bank finance and market finance are supportive of economic development. In fact, that these two, independent components of the financial system individually shape growth is one of the most remarkable insights from the finance-and-growth literature. In this section, I will summarize what empirical research has to say on a related question: does the financial structure—or the mix of financial markets and

intermediaries operating in an economy—affect economic growth? Put alternatively, are markets or banks better at promoting growth, and does their contribution to growth vary with the country's degree of economic and financial development?

Early research concluded that—conditional on the quality of a country's legal, regulatory and general institutional systems—there was no general rule that bank-based or market-based financial systems were better at fostering growth. What is particularly noteworthy is that this conclusion was reached using both aggregate, sectoral-level, and micro-economic evidence. For example, in a cross-country context, Arestis, Demetriades, and Liuntel (2001) use quarterly data on growth and employ proxies for both stock market and banking sector development. They show that both types of finance stimulate growth; nevertheless, their results raise questions about the size of the effect, and their sample is very small. Levine (2002) finds that after controlling for overall financial development, the data do not suggest that distinguishing between bank-based and market-based financial systems is a first-order concern in understanding the process of economic growth. Using industry-level data, Beck and Levine (2002) confirm that greater financial development accelerates the growth of financially dependent industries. When adding a proxy for the country's mix of bank versus market finance, however, they find that the financial structure does not help explain the differential growth rates of financially-dependent industries across countries. Applying GMM techniques for dynamic panels, Beck and Levine (2004) investigate the impact of stock markets and banks on economic growth using a panel data set for the period 1976–1998. On balance, they find that both stock markets and banks positively influence economic growth. Finally, using firm-level evidence, Demirgüç-Kunt and Maksimovic (2002) show that overall financial development helps explain the excess growth of firms across countries. In other words, the proportion of firms that grow at rates exceeding the rate at which each firm can grow with only retained earnings and short-term borrowing is positively associated with overall financial development. However, the degree to which countries are bank-based or market-based does not help explain excess growth. The earlier literature thus concluded that the fact that many advanced countries had quite different structures,

yet similar levels of development, buttressed the view that financial structure was not so important for economic development.

More recent research—especially such focusing on the experience with the most recent financial crisis—has provided somewhat of a reassessment of this view. For example, in a sample of 48 countries, Shen and Lee (2006) find evidence that only stock market development has a positive effect, and that banking development has an unfavorable, if not negative, effect on growth. Focusing on the European experience, Langfield and Pagano (2016) report a negative association between growth and the ratio of bank to market-based intermediation. While this result may be due to the outsized development of some European banking systems and adverse effects of large-scale housing financing, the more limited impact of banking on growth as income rises appears to be more general.

Such evidence can be rationalized in light of the second insight from this line of research, which is that while both bank-based and market-based financial systems support economic growth on average, their contribution varies with the extent of economic and financial development. Early evidence from Tadesse (2002) suggests that while market-based systems outperform bank-based systems among countries with developed financial sectors, bank-based systems are far better among countries with underdeveloped financial sectors. In a more recent empirical contribution, Demirgüç-Kunt, Feyen, and Levine (2013) use a large cross-country sample and show that as countries develop economically, the association between an increase in economic output and an increase in bank development becomes smaller, and the association between an increase in economic output and an increase in securities market development becomes larger. Gambacorta, Yang, and Tsatsaronis (2014) study relationships between per capita economic growth and various forms of finance, and document diminishing effects of banking at higher levels of development and increasing effects of securities markets. Recent research has also found that capital markets also induce greater productivity gains, innovation, and technological change than banking markets. For example, Hsu, Tiang, and Xu (2014) use a large data set that includes 32 developed and emerging countries and a fixed effects identification strategy, to identify the economic mechanisms through which the

development of equity markets and credit markets affects technological innovation. They show that industries that are more high-tech intensive exhibit a disproportionately higher innovation level in countries with better developed equity markets.

To summarize, these findings are consistent with theories predicting that as economies develop, the services provided by securities markets become more important for economic activity, whereas those provided by banks become less important.¹⁶ As per capita income rises, countries' financial structures tend to move towards non-bank financing. Market-based intermediation has thus grown faster than bank-based one, notably in advanced countries, also due to advances in technology, the greater availability and use of hard information, and more internationalized financial systems. The literature on the real effects of financial structures has broadly concluded that both markets and banks exert a positive effect on economic growth. However, more recent analyses has shown that the marginal contribution of banks to economic growth declines, while that of capital markets increases with economic development, notably because market finance is better at promoting innovation and productivity, and at financing new sources of growth.

7 Socio-economic effects of financial development

I will now review the relatively small, burgeoning literature on the impact of financial markets on economic growth through individual or group socio-economic circumstances. While not directly related to a growth objective, some social factors that financial development can have a direct effect on can in turn exert a causal impact on economic development. For example, it has long been shown that rising income inequality can have a negative effect on economic growth, while increasing levels of education, on the other hand, exert a sustainable positive impact on long-term growth (Barro, 2000). At the same time, theory offers conflicting predictions about the nature of the interactions between finance, income distribution, and poverty. For example, some models

¹⁶For a comprehensive review of the literature on the costs and benefits of developing capital markets, see Laeven (2014).

argue that by reducing information asymmetries, financial development benefits disproportionately the poor who do not have the collateral to access bank credit (Banerjee and Newman, 1993; Aghion and Bolton, 1997). Others argue that—especially at early stages of economic development—access to financial services, is limited to the wealthy and connected (Haber, 1991; Lamoreaux, 1994). Yet others posit that there is a non-linear distribution between financial development and income inequality, whereby at early stages of development, greater financial development mostly channels more capital to a select few, but with aggregate economic growth, more people can afford to join the formal financial system, with positive ramifications on economic growth (Greenwood and Jovanovic, 1990).

Recent research has shed light on the impact of financial development on a number of social factors that can potentially have an important, second-round effect on growth. For example, Beck, Demirgüç-Kunt, and Levine (2007) show that about 40% of the long-run impact of financial development on the income growth of the poorest quintile is the result of reductions in income inequality, while 60% is due to the impact of financial development on aggregate economic growth, and that financial development is associated with a drop in the fraction of the population living in extreme poverty. Beck, Levine, and Levkov (2010) show that banking deregulation in the United States materially tightened the distribution of income by boosting incomes in the lower part of the income distribution. They investigate the exact labor market channels and find that deregulation tightened the distribution of income by increasing the relative wage rates and working hours of unskilled workers. Pushing this argument a bit further, Levine, Levkov, and Rubinstein (2014) show that banking deregulation decreased racial inequality. They argue that enhanced competition in the banking sector boosted black workers' relative wages by facilitating the entry of new firms (labor demand effect) and by reducing the manifestation of racial prejudices (discrimination effect).¹⁷

Another research avenue that has been gathering steam as of late is the link between finance and the gender gap. For example, Popov and Zaharia (2016) show that by increasing the demand

¹⁷For an analysis of the link between finance and inequality in an international setting, see Claessens and Perotti (2007).

for service-based jobs and by reducing the cost of education loans at a time when the female supply of labor was relatively more elastic, the U.S. banking deregulations reduced the gender gap in labor markets, both in terms of labor force participation and in terms of wage income. Ongena and Popov (2016) show that access to bank finance for female entrepreneurs is easier in countries with a lower inherited gender bias. Beck, Behr, and Guettler (2013) demonstrate empirically that the gender structure of a bank's loan officer force affects the allocation of credit across male and female loan applicants. Aterido, Beck, and Iacovone (2013) do not find evidence of gender discrimination or lower inherent demand for financial services by enterprises with female ownership participation or by female individuals in Sub-Saharan Africa when key characteristics of the enterprises or individuals are taken into account

Recent evidence also points to the fact that the demand for higher education increased in deregulated states as private student loans from banks to students became cheaper and more readily available (Sun and Yannelis, 2016), a finding that relates to the results in Levine and Rubinstein (2013). However, two recent papers caution against being overly optimistic about the effect of finance on education. Augsburg, De Haas, Harmgart, and Meghir (2015) find that school-age children of entrepreneurs in Bosnia and Herzegovina with better access to finance are less likely to be in school, potentially because family businesses prefer family labor to hiring external labor. Laeven and Popov (2016) find that in MSAs which experienced large increases in house prices during the US housing boom of the early to mid-2000s, young adults were substantially more likely to forego a higher education and join the workforce, lowering skill formation and increasing their probability of being unemployed during the subsequent bust.

Access to finance can also have a material impact on local economic development, and by extension, crime. Garmaise and Moskowitz (2006) argue that bank mergers result in substantially higher property crime rates, because lower access to finance depresses local economic growth and raises the relative benefit of illegal activity. A sub-strand of this literature has looked into what shapes entrepreneurship at the individual level (Levine and Rubinstein, 2016). It is important to

deepen empirical research in this direction in order to tease out such and other growth-enhancing channels that have so far remained neglected.

8 Conclusion

In this chapter, I have reviewed notable examples of empirical work over the past quarter of a century on the relationship between financial development and economic growth. An early body of empirical analyses based on cross-country regressions strongly suggested that there is a significant positive association between how deep financial markets are and the rates of economic growth. Later research based on time-series and panel techniques, on exploiting regional or sectoral within-country variation, and on using event studies has demonstrated that the strong positive association between financial development and economic growth may lend itself to a causal argument, namely, that "finance causes growth." More recent micro-economic analyses, taking advantage of well-defined proxies for financing constraints at the firm and household level, has taken this argument a step further by illuminating specific theoretical mechanisms for how access to finance should affect economic growth. By and large, the evidence has suggested that both financial intermediaries and markets matter for growth, in a wide range of countries and during a wide range of periods.

Nevertheless, there are a number of questions that recent research has raised, as well as a number of additional research avenues that remain unexploited. For one, some researchers have challenged the view that the effect of finance on growth is monotonic, and have argued that beyond a threshold of economic and financial development, the positive impact of an additional unit of value added in the financial sector on the real economy disappears. It is very important that we understand better the root causes of this empirical regularity. While a number of avenues have been exploited—such as excessive risk taking, the misallocation of human capital, and the exacerbation of the growth-risk trade-off at high stages of financial development—much remains to be done to advance this line of research. Moreover, we are still lacking convincing analytical frameworks that can be used to quantify the welfare implications of financial development in a world where long-run

economic growth and microeconomic risk can simply be two sides of the same coin.

A second area that has received surprisingly little interest relates economic performance to the *quality* of financial intermediation. Notable exceptions include Berger, Hasan, and Klapper (2004), Hasan, Koetter, and Wedow (2009), Koetter and Wedow (2010), and Hakenes, Hasan, Molyneux, and Xie (2015). This relative omission is puzzling given well-understood theoretical arguments in the literature about how financial development influences growth through both a quantity and a quality channel (e.g., Pagano, 1993). However, it is hardly surprising, given the data and econometric challenges associated with constructing reasonable empirical proxies for the quality of financial services. It is important to deepen this line of research with direct measures of the efficiency of financial intermediaries, going beyond indirect measures such as bank size.

A third relatively underresearched area that—due to improving data at the firm level—has recently been making important gains in our understanding of the finance-and-growth nexus is related to the capital structure of firms. How do firms, and in particular SMEs, finance themselves? Does it matter if capital markets are better developed? And does it matter for firm performance? Recent studies have documented a number of interesting patterns relating financial development to the capital structure of large firms (Becker and Ivashina, 2014; Brandao, Levine, and Schmukler, 2015) and of small firms (Robb and Robinson, 2014), but we still have much to learn. One particularly interesting avenue is related to documenting the patterns of informal finance, of which there is currently very little in the literature (e.g., Ayyagari, Demirgüç-Kunt, and Maksimovic, 2010).¹⁸

A number of research areas have not been summarized here, as they merit their own review. One such area is the literature on the impact of financial development on trade. While not a first-order question in the finance-and-growth literature, this is a question intimately related to the determinants of economic growth, due to the well-documented potential of international trade to boost economic growth (e.g., Frankel and Romer, 1998). Starting with the seminal contribution of Beck (2002), a number of studies have shown that financially more developed and more open coun-

¹⁸For a conceptual framework for SME finance, see Berger and Udell (2006).

tries export more, in particular in sectors more dependent on external finance (see, e.g., Levchenko, 2005; Do and Levchenko, 2007; Manova, 2008; Manova, 2013). Another research area which I have not touched studies the effect of financial crises on growth. A number of recent contributions have studied that effect of banking crises, as well as of the policy response to those, on both country and industry growth (e.g., Kroszner, Laeven, and Klingebiel, 2007; Dell’Ariccia, Detragiache, and Rajan, 2008; Laeven and Valencia, 2013). Digging deeper into the mechanisms through which this effect takes place and juxtaposing the relative importance of banking crises on capital accumulation, TFP growth, or new business creation—in particular using micro-level datasets—would be a fruitful avenue of future research, as would be research on the interactions between financial reforms, financial fragility, and growth.

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