Financial Markets Banks and Growth: Disentangling the Links

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Abstract

The paper reviews the state of the economic literature on the link between financial development and growth. We first examine the issue of measurement of financial development and the debate on the direction of causality between finance and growth. Next, we extensively discuss the various channels through which the financial sector can affect growth, including the increase in the efficiency of capital allocation, the reduction in information costs, the improvement of risk management, and the support of innovation. The analysis is conducted referring both to the theoretical literature and to the most recent empirical findings. We conclude by drawing lessons for the current debate on the reform of the financial sector in the aftermath of the Great Recession.

Keywords: Financial Development, growth, banks, stock markets, crises.

JEL classification: G0, G2, O1, O3.

Introduction

Does financial development affect economic growth? This is probably one of the most challenging and fascinating research questions that macroeconomists and financial economists have faced in the last fifty years or so. A formalization of the idea that finance affects economic growth dates back to Schumpeter's discussion on the sources of development (Schumpeter, 1961). Schumpeter argued that the services provided by financial intermediaries are essential for technological innovation and economic development. Although several theoretical and empirical studies later supported this hypothesis, a consensus is far from being reached. While some scholars endorse the Schumpeterian idea, others contend that financial development simply follows economic growth or, at least, that the relationship between financial and economic development has been "over-stressed" (Lucas, 1988).

The last decade of the 20th century witnessed renewed interest for the topic. The emergence of the endogenous growth theories (Romer (1990), Grossman and Helpman (1991), and Aghion and Howitt (1992)) induced scholars to pose the question whether the development of the financial sector can be an engine of growth. On the empirical side, the increasing availability of large cross-country data sets on income and financial institutions paved the way for more rigorous tests on the finance-growth link (Tsuru, 2000).

The debate on the topic has become even more intense in the late 1990s and at the beginning of the new century. The financial turbulences that hit first South East Asia in the late 90s and more recently the United States have stimulated interest towards the impact of financial development on crises and macroeconomic volatility. The literature has then started to acknowledge the possibility that financial development fosters long-run economic growth at the cost of generating higher volatility in the short run, for example by amplifying the impact of small aggregate shocks.

Financial development is defined by the World Economic Forum (2012) as the policies, factors, and institutions that lead to efficient intermediation and effective financial markets. In a neoclassical Arrow-Debreu model, in which information is perfect, risk is fully and efficiently internalized in the price system, suppliers of funds deal directly with users of funds in the financial market, and, in turn, the financial market always adjusts to the equilibrium level of the interest rate that equalises supply and demand for funds.

Economies are however plagued by frictions. For instance, the problems of asymmetric information present in financial transactions lead to the well-known market failures of adverse selection and moral hazard. The financial system can ameliorate such problems. More in general, Levine (2005) points out five broad functions that financial intermediaries and financial markets play and that could be relevant for economic growth: (i) production of ex-ante information about investment opportunities; (ii) ex-post monitoring of investments; (iii) trading, diversification, and management of risk; (iv) mobilization and pooling of savings, and (v) exchange

of goods and services. By performing these functions, the financial sector can promote the formation of (physical and human) capital, increase the degree of efficiency in the allocation of capital, minimize the cost of information acquisition, improve the management of risk, and promote innovation.

This review of the the literature on the link between financial development and growth is organised as follows. Section 1 lays the grounds for the analysis, by defining financial development and discussing how it can be measured. Section 2 addresses the debate on the direction of causality between financial development and growth. Section 3 examines the specific channels through which financial development can affect growth. Section 4 outlines directions for future research and concludes.

1 Defining and measuring financial development

If the late 80s and early 90s saw the development of several theoretical studies aimed at analyzing the link between financial development and economic growth, in the last two decades a large number of econometric studies have tried to empirically evaluate the impact of financial variables on growth. Performing these econometric analyses has required to advance in the construction of quantitative measures of financial development. The measurement of the performance and activities of financial institutions and markets relies on several indicators, such as the depth, size, accessibility, and soundness of the financial system. There is however little consensus on the choice of the most effective quantitative measures. Indeed, an issue that generates contradictory results in the empirical literature is the lack of a single indicator that captures adequately the various aspects of financial development.

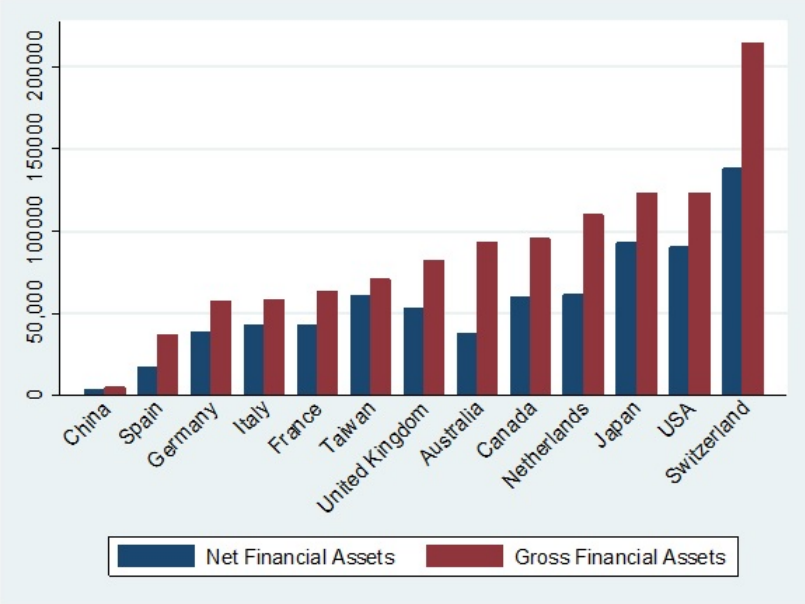
Quantitative measures of financial development

King and Levine (1993) employ several measures to capture the size of financial intermediaries: the proportion of liquid liabilities to the GDP, the ratio of credit to private enterprises to the GDP, and the ratio of assets of commercial banks to the sum of commercial banks' assets and assets of central banks. Demetriades and Hussein (1996) simply consider the ratio of bank deposit liabilities to the GDP. Huang (2005) uses different indices depending on the object of measurement. To capture the depth of financial intermediation, he includes the amount of liquid liabilities, banks' overhead costs and net interest margins. To assess stock market development, instead, he puts forth three main variables: stock market capitalization, total value traded, and turnover ratio.

Saci and Holden (2008) measure the importance of the banking sector by considering, in addition to the previous indicators, the ratio of commercial bank assets to commercial plus central bank assets, the ratio of credit issued to the private sector to liquid liabilities, and the ratio of domestic credit to the private

sector to the GDP. To capture stock market development they add the number of listed companies to the previous indicators. Finally, Antzoulatos and Thanopoulos(2008) construct a more structured index of financial development, computed as a weighted index of banks', financial institutions', stock market, and bond market development. The proxies for banking sector development include bank deposits over the GDP, banks' overhead costs, banks' concentration, banks' net interest margins. The proxies for the development of non-bank financial institutions include life and non-life insurance premia. The development of the stock market is evaluated through the ratios of stock market capitalization to the GDP, stock market total value traded to the GDP, and the turnover ratio of the stock market. Finally, the proxies for bond market development include the ratios of private bond market capitalization to the GDP and public bond market capitalization to the GDP. From the above review, it emerges that the most used measure of the overall size of the financial system is the value of some type of financial assets generally expressed as a ratio of the GDP (see Figure 1).

Figure 1: Financial Assets per capita (EURmln)



Source: Allianz, 2012

Many financial systems of advanced economies feature not only a strong presence of banking institutions, but also of other institutional actors such as pension funds, insurance companies, hedge funds, and mutual funds. Therefore, despite the aggregate size of the financial sector certainly provides useful information, it should be integrated with specific information about the relative importance of sub-sectors. In the Handbook on Financial Sector Assessment, the International Monetary Fund (2005) stresses that a correct assessment of the development of the financial structure should cover all the different players engaging in financial intermediation: commercial and merchant banks, savings institutions, development finance institutions, insurance

companies, mortgage entities, and pension funds. Moreover, in order to take into account the different activities they perform, money, foreign exchange, and capital markets (including bonds, equities, and derivative and structured finance products) should also be covered in the assessment (see Table 1).

Table 1: Assessing the development of the various financial sector actors

SECTOR	INDICATORS	
Banking	-Total number of banks -Number of branches and outlets -Number of branches/ thousand population	-Bank deposits/GDP (%) -Bank assets/total financial assets (%) -Bank assets/GDP (%)
Insurance	-Number of insurance companies -Gross premia/GDP (%)	-Gross life premia/GDP (%) -Gross non-life premia/GDP (%)
Pensions	-Types of pension plans -Percentage of labor force covered by pensions	-Pension fund assets/GDP (%) -Pension fund assets/total financial assets (%)
Mortgage	-Mortgage assets/total financial assets	-Mortgage debt stock/GDP
Leasing	-Leased assets/total domestic investment	
Money markets	-Types and value of money market instruments -New issues and growth in outstanding value	-Number and value of daily (weekly) transactions in the instruments
Foreign exchange markets	-Volume and value of daily foreign exchange transactions	-Adequacy of foreign exchange (reserves in months of imports, as ratio to short-term ext. debt or to broad money)
Capital markets	-Market capitalization/GDP (%) -Value traded/mrkt capitalization (%) -Size of derivative markets -Number and value of new issues (bonds and equities)	-Number of listed securities (bonds and equities) -Share of households, corporations, banks, and NBFIs in the holdings of securities
Collective investment funds	-Types and number of schemes (unique and mixed funds) -Total assets and growth rates (nominal and as percentage of GDP)	-Total number of investors and average balance per investor -Share of households, corporations, banks, and NBFIs, in total mutual funds assets

Source: IMF (2005)

Pitfalls of the quantitative measures

The measures described above might not accurately capture financial development. For instance, the growth of the credit-to-GDP ratio may reflect a financial bubble and not the financing of sound investment projects. The severity of the recent financial crisis has allegedly been due to the fact that in many countries banks had expanded their balance sheets (i.e., increased their credit) without a corresponding increase in the level and quality of capitalization. While, on the one hand, the expansion of credit may enable rapid economic growth by allocating capital to growth prospects, on the other hand excessive leverage may amplify the volatility of returns inducing greater probability of default.

A review of the literature on the relationship between excess of leverage, asset bubbles and economic growth is beyond the scope of this paper. Nevertheless it is worth citing two contributions that show that a mere expansion of the financial sector is not necessarily positive for economic development. Geanakoplos (2010) elaborates a theory in which the possibility of default creates the need for collateral. This in turn entails variations in leverage that affect the price of assets, contributing to bubbles and busts. According to his view, when leverage (defined as the ratio of collateral values to the required downpayment) grows rapidly in boom times, asset prices tend to increase. In this leverage cycle, when the bubbles burst bad news cause the asset price to crash much further than it would if leverage was not excessive, and the crash takes place even if there is no subsequent crash in the fundamentals.

A second paper that shows that more intense financial activity (more precisely, higher liquidity in the financial market) could be harmful to economic growth is Brunnermeier and Pedersen (2009). They show that market liquidity (i.e., the ease with which trades occur) and traders' funding liquidity (i.e., the ease with which they can obtain funding) are mutually reinforcing, leading to "liquidity spirals". While market liquidity (i.e. the volume and value of daily financial transactions) is often seen as positive per se, the authors show that, since it is correlated with volatility, loss spirals could arise if speculators hold a large initial position that is negatively correlated with customers' demand shock. In this scenario, if investors become unable to face funding market illiquidity, they are forced to engage in fire sales, causing a further asset price drop, and so forth. Therefore the apparent expansion of financial markets leads to a more fragile economic environment and to more severe effects of financial crises[1].

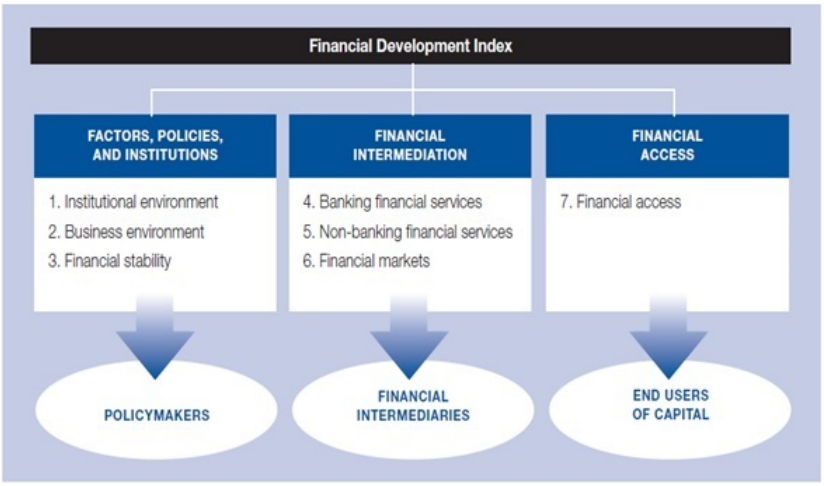
In a different vein, Petersen and Rajan (1995) suggest that another mere quantitative index of financial development, the number of banks, is not necessarily a synonymous of a more efficient financial sector. When the credit market is concentrated, creditors are more likely to finance credit constrained firms, because it is easier for them to internalize the benefits of assisting firms. The ability of creditors to finance firms along the lifespan of their activity allows them to smooth interest rates over the life cycle of the firms, charging a lower-than-competitive rate when a firm is young and a higher-than-competitive rate when the firm ages. A larger number of credit market actors could impose constraints on the ability of firms and creditors to intertemporally share surplus, making firms worse off as they cannot obtain cheap funds when mostly needed, that is, in the initial phase of their life cycle.

[1] Banking sectors can also act as a mechanism of amplification of negative shocks (see, e.g., Guerrieri, Iacoviello and Minetti (2012)).

More comprehensive measures of financial development

A more comprehensive measure of the financial development of a country is perhaps represented by the Financial Development Index computed by the World Economic Forum since 2008. Despite not having been largely used in the economic literature, this index may convey a broad picture of the current global status of financial development. In defining this index, seven factors (along with their mutual interactions) are expected to influence the provision of financial services (see Figure 2).

Figure 2: Composition of the Financial Development Index



Source: World Economic Forum, 2012

Table 2: The Financial Development Index 2012 rankings

1	Hong Kong	11	Germany	21	Kuwait
2	United States	12	Denmark	22	Austria
3	United Kingdom	13	Norway	23	China
4	Singapore	14	France	24	Israel
5	Australia	15	South Korea	25	Bahrain
6	Canada	16	Belgium	26	United Arab Emirates
7	Japan	17	Finland	27	Portugal
8	Switzerland	18	Malaysia	28	South Africa
9	Netherlands	19	Spain	29	Chile
10	Sweden	20	Ireland	30	Italy

Source: World Economic Forum,2012

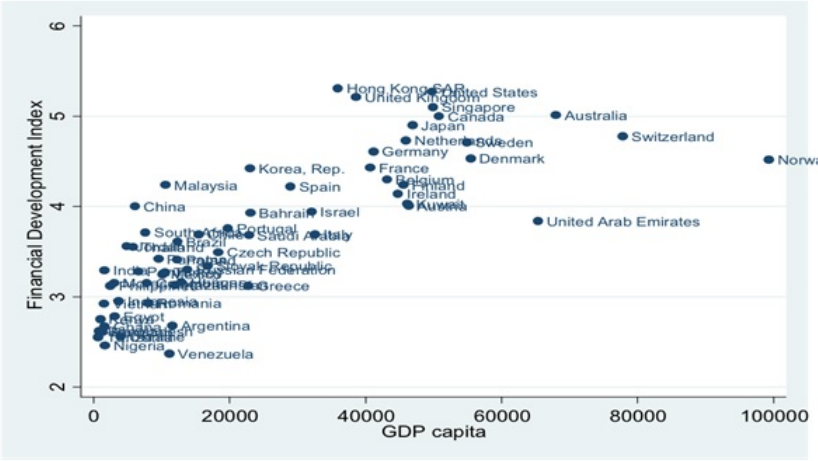
The first three pillars capture the ability of the policy maker to lay the foundations for the development of financial activities: i) the institutional environment; ii) the business environment; and iii) the degree of financial stability. The second group of factors, instead, assess the effective development of the various players of the financial sector: i) banking financial services; ii) non-banking financial services (e.g., investment banks and insurance firms); and iii) financial markets. The third category comprises measures of access to capital and financial services.

Table 2 reports the 30 top-ranked countries according to the 2012 Financial Development Index. Comparing the ranking with that of previous years (not reported), it appears that there has been little change within the list, showing how advancing on the path of financial development is a long-run effort. A similar stickiness, albeit slightly lower, appears also in the analysis of the ranking of the single pillars. Institutional environment, business environment, and non-banking financial services exhibit lower rank movement; by contrast, the degree of financial stability, banking financial services, financial markets, and financial access pillars show greater movement in the ranking (World Economic Forum, 2012). The analysis of the single pillars is not that important for the movements per se, but because it reveals the main drivers of financial development.

2 Financial development and growth: the direction of causality

Having defined financial development, the next step of our analysis consists of examining its link with economic growth, meant as GDP growth or the per capita GDP. Figure 3 plots the Financial Development Index and GDP per capita for 63 countries. The figure displays a positive relationship between the index of financial development and the per capita GDP, thus supporting the view that financial sector development goes along with economic development. King and Levine (1993) show that the positive correlation between the two variables is robust to using various measures of financial development. However, such a correlation does not offer insights into the direction of causality. Is financial development that stimulates economic growth, or does financial development respond to the demand for financial services of a growing real sector?

Figure 3: Financial Development Index and per capita GDP in 2012



Source: World Economic Forum,2012

The macroeconomic approach

Analysing the possible direction of causality, Patrick (1966) puts forward a "supply-leading hypothesis" and a "demand-leading hypothesis". According to the first, a more developed financial infrastructure promotes growth because it supplies new and more efficient financial services. This idea was first proposed by Schumpeter (1961) and then refined theoretically and supported empirically by McKinnon (1973), King and Levine (1993), Neusser and Krugler (1998), and Levine and Zervos (1998). Applying a GGM technique to a panel of 71 countries for the period 1960-1995, Levine et al. (2000) find a link that goes from a higher level of banking sector development to GDP growth and total factor productivity growth. Xu (2000) finds support for the idea that financial development promotes growth: through a VAR approach, he unveils a positive long-term relationship between the development of the financial sector and increases in investment and GDP at least in 27 of the 41 economies examined over the period 1960-1993. More recently, Christopoulos and Tsionas (2004) combine cross-sectional and time series data and find a one-directional (from finance to growth) positive relationship for 10 developing countries. Using a modified OLS technique to estimate the cointegrating relation, they demonstrate that there is no short-run causality between financial deepening and output, while there is a structural positive effect in the long run. According to the demand-leading hypothesis, instead, the increasing demand for financial services that stems from a growing real sector induces the financial sector to expand. Based on this hypothesis, therefore, the lack of a developed financial sector in less developed countries is not a constraint to their economic growth, but merely a manifestation of the lack of demand for financial services by the real sector. Robinson (1979) initially supported this hypothesis, lately followed by the works of Gurley and Shaw (1960), Goldsmith (1969) and Jung (1986). Greenwood and Jovanovic (1990) develop a model where financial intermediation promotes growth by increasing the returns to capital and, at the same time, a more developed economy allows the financial sector to offer more costly financial services. Their model would thus suggest that the chicken-egg dilemma cannot be solved, as growth and financial structure are intrinsically linked and mutually reinforce each other. Goldsmith (1969) concludes that "there is no possibility of establishing with confidence the direction of the causal mechanism".

Nevertheless, many macroeconometric techniques have been used to to disentangle the direction of causality. Calderòn and Liu (2003) apply the so-called Geweke decomposition test: they decompose the link between financial development and growth, considering the two possible causality directions (growth to finance and finance to growth) and the instantaneous causality between the two. They find that in 109 developing and industrialized countries in the 1960-1994 period financial development leads to economic growth, thus supporting the supply-leading hypothesis. However, splitting the sample between developed and developing countries, they also find bi-directional causality, concluding that especially in developed economies real sector

growth could significantly influence the development of the financial sector.

Patrick (1966) suggests that the direction of causality is indeed different in developed and in developing countries (stage-of-development hypothesis)[2]. During the initial stage of economic development, the financial sector would stimulate economic growth, mainly by favouring capital formation and higher savings (supply-leading hypothesis). As economic development proceeds, however, the financial sector would have to feed the innovation of the real sector, through the development of new financial services (demand-leading hypothesis). In an attempt to verify this conjecture, Hassan et al. (2011) use a panel regression with cross-sectional and time series-proxy measures, and find a positive relationship between domestic credit development and economic growth in low- and middle-income countries, and a negative one in high-income economies. This stage-of-development hypothesis has also been corroborated by the empirical works of Demetriades and Hussein (1996) and Shan et al. (2001) who, using time-series techniques, find that the direction of causality can run either way, according to the stage of development. This conclusion, however, has recently been questioned by Rioja and Valev (2004) who examine a broad sample of 74 countries over the period 1960-1995 and uncover evidence that financial development exerts a strong positive effect on economic growth only once it has reached a certain threshold; the effect then fades away once economic development reaches very high levels. Using GMM dynamic panel techniques, they find that a 10% increase in financial development would lead to a 0.2 percent higher growth rate in high-income countries, without any statistically significant effect in low-income ones.

Most of these empirical results appear sensitive to the sampling method (period, classification of countries) and to the econometric technique. Just to give examples of this sensitivity, using Granger causality tests, Hassan et al. (2011) find that, in the short run, there is a two-way causality between finance and growth in all regions, except for the Sub-Saharan and East Asia & Pacific regions, where causality runs from growth to finance. Despite the fact that these two regions are the most underdeveloped in their sample (thus supporting the idea of a non-linear relationship between economic growth and financial development), the result contrasts with the negative relationship found by De Gregorio and Guidotti (1995) for Latin America (where instead Hassan et al. find a positive statistically significant coefficient).

The microeconomic approach

Macroeconometric studies encounter various problems including omitted variables, selection bias and multi-collinearity. For instance, Driffill (2003) shows that the inclusion of relevant outliers and of regional dummies (especially those for the "Asian Tigers") makes the coefficients on financial development estimated by Levine and Zervos (1998) almost insignificant. Due to such problems, more micro approaches have been developed

[2]This hypothesis was later supported by the empirical analysis of Jung (1986).

looking for industry/firm level evidence of the direction of causality between financial variables and growth. One of the first microeconometric approaches is the one used by Demirguc-Kunt and Maksimovic (1995), who estimate the proportion of firms' growth that could have been supported only by internal resources and the portion that could be related to external finance, notably financial markets. By using financial firm-level data for a sample of thirty countries from 1980 to 1991, they investigate how several measures of stock market development (the ratio of market capitalization to GDP, the ratio of total value traded to GDP, and the ratio of total value of shares traded to market capitalization) interact with firms' performance and financing decisions. Their findings support the finance-to-growth hypothesis, but they also underscore that the development of the stock market initially benefits only the largest firms.

The cornerstone of this micro-based empirical literature is probably the work of Rajan and Zingales (1998). The authors stress that financial development and growth could be driven by common omitted variables, such as the propensity of households to save. To overcome this issue, they look at U.S. sector specific data: using financial statement data, they construct a proxy for each industry's need for external finance, defined as the difference between investments and cash flow generated from operations. Under the assumption that capital markets in the United States are relatively frictionless (i.e., U.S. listed firms' access to financial markets is not subject to frictions) they construct the technological demand for external financing of each industrial sector. Next, they use cross-country industry data (41 countries and 36 sectors) to test whether sectors that rely more on external finance tend to grow faster, given the level of financial development of the country. A key assumption behind this estimation methodology is that technology (and, hence, the demand for funding) could vary across industries but not across countries. By this procedure, they demonstrate that the causality goes from finance to economic growth, as the ex-ante development of financial markets facilitates the ex post growth of sectors dependent on external finance. Based on the assumption that investments in new establishments are more likely to be carried out by new firms (which depend more on external finance than established ones), the authors show that financial development has almost twice the effect on the growth of the number of establishments as it has on the growth of the average size of establishments. These results carry through after controlling for country and industry fixed effects.

Guiso et al. (2005) use a similar approach to quantify the effect of financial development in the European Union, obtaining supportive evidence for the finance-to-growth hypothesis. Using a panel of firm-level data for companies in EU and transition countries for the period 1996-2001, they broaden the Rajan and Zingales' approach using also firm-level data in order to check the robustness of the results. Although the magnitude of the estimated effect reflects different country and sector specificities, they find that financial development has a direct positive effect on countries' and sectors' growth. The extension to firm-level data allows to obtain additional insights into the structure of the link between financial development and real variables.

Their estimates highlight, for instance, that the growth of small enterprises is more sensitive to financial development than that of large firms. Finally, a similar approach is followed also by the work of de Serres et al. (2006) in which the authors interact industry-specific measures of external financial dependence with a country-specific indicator of financial development. Following Rajan and Zingales' approach, they find that more developed financial systems increased firms' value-added growth and labour productivity growth in OECD economies in the nineties.

A different branch of microeconometric literature focuses on disentangling the finance-to-growth nexus not by looking at firms' reliance on external funds, but on the ability of firms to better capture growth opportunities thanks to the access to extra funding for investments. Put differently, this branch of literature underlines that the finance-to-growth channel is based on faster capital reallocation to industries with good growth opportunities. This is the case, for instance, of Fisman and Love (2004) who show that financially developed countries are characterized by faster value added growth in the sectors which grow faster in the United States. This would imply that there is a natural reallocation of resources towards industries with better global growth opportunities (as captured by the industry median of real sales growth between 1980 and 1990 in the United States). What emerges from this analysis, therefore, is that financial development may better align industry growth opportunities with actual growth. A further example of this branch of literature is represented by the work of Ciccone and Papaioannou (2006) who show that finance increases the growth of countries by reallocating capital more quickly to industries where investment opportunities arise. Using industry-level data from 28 manufacturing industries in 67 countries in the 1980s, they show that industries with better global investment opportunities grow faster in countries with greater financial development. The financial markets of these countries are indeed able to attract and manage the capital necessary to satisfy the high demand of the sectors that experience faster technical progress[3].

A final way of modelling the finance-growth link at the micro level is investigating how financial development impacts on firm entry and survival. Considering the first aspect (firm entry), Berger, Hasan and Klapper (2004) use a large data set which includes financial data on over 3 million firms in 20 countries located in Western and Eastern Europe, and find a strong differential effect of financial development on entry in external-finance-dependent sectors. Using private credit to GDP or stock market development as measures of financial development, their analysis suggests that entry is higher in more financially intensive industries (i.e. those that do more R&D) in countries that feature higher financial development. These findings are also supported by those of Beck et al. (2008) who, employing a cross-country cross-industry approach, show that

[3]Bekaert et al. (2007) seem to partially contradict the previous two papers. Using a different measure of growth opportunities (constructed by combining the country's pattern of industrial specialization with indicators of global industry growth opportunities) and an industry-level dataset containing 50 countries, they show that financial market openness (e.g., the liberalization of equity markets) is a more important determinant of the ability to exploit growth opportunities than financial development.

financial development exerts a disproportionately positive effect on small firms. To reach this conclusion, the authors first construct an industry-level size variable that measures the industrial reliance on small firms; next, they explore the effect of financial development on entry rates.

Turning to firms' survival rate, a recent work of Aghion, Fally and Scarpetta (2007) use firm-level data for 16 industrialized and emerging economies to analyze whether financial development promotes post-entry growth, even after controlling for the initial size at entry. Their results corroborate this hypothesis, especially for those sectors with higher dependence on external finance and with lower average size at entry. Similarly, using panel data on French manufacturing firms over the 1996 - 2004 period, Musso and Schiavo (2008) find that (i) an easier access to external funds lowers the probability that firms exit the market; (ii) access to external financial resources has a positive effect on firms' survival rate; and (iii) financial constraints are related with productivity growth in the short run.

Instrumental variables for financial development

A different strand of literature has focused on identifying possible instrumental variables for financial development. Legal and accounting standards have been used to construct such instruments. The cornerstone of this literature is represented by the work of La Porta et al. (1997), who examine legal rules covering protection of corporate shareholders and creditors, the origin of these rules, and the quality of their enforcement in 49 countries. Their analyses suggest that the legal and regulatory system play a critical role in influencing the ability of the financial system to provide high-quality financial services. They classify countries according to their legal origins, identifying four main legal systems: English, French, German, and Scandinavian. These origins of the legal system are particularly relevant: they strongly influence the legal and regulatory environment governing financial sector transactions, therefore explaining cross-country differences in financial intermediary development.

Since legal origin is treated as an exogenous variable, it can be used as an instrumental variable in finance-growth regressions. This is the approach followed by Levine, Loayza and Beck (2000) who use this instrumental variable to extract the exogenous component of financial intermediary development. Their findings show that, using legal origin dummy variables as instrumental variables, legal and regulatory changes that strengthen creditor rights, contract enforcement, and accounting practices boost financial intermediary development with positive repercussions on economic growth.

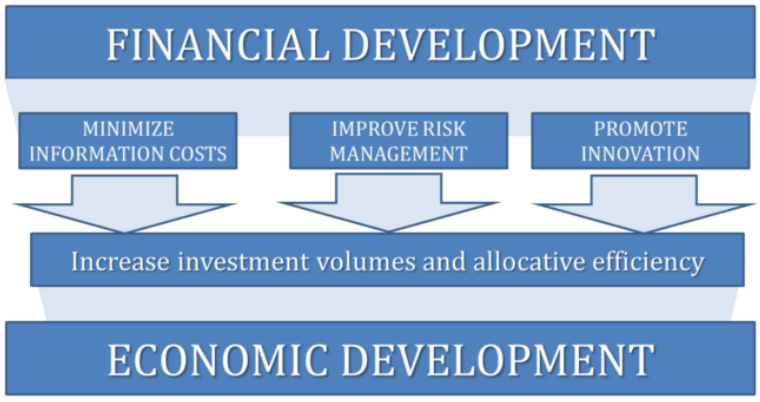
Similarly, Levine (1999) examines the relationship between the legal system and banking development, and demonstrates that using the legal environment to measure the exogenous component of banking development, this indicator is robustly associated with per capita growth, physical capital accumulation, and productivity growth. Demirgüç-Kunt and Maksimovic (1998) also investigate how differences in legal and financial systems

affect firms' use of external financing to fund growth. Using a sample of 30 developing and developed countries, they show that the proportion of firms that grow at rates exceeding this predicted rate in each country is associated with specific features of a country's legal and financial systems. Their findings not only reveal that well-developed legal systems result in better firms' growth performance, but also that financial development may indirectly increase dependence on external financing by reducing firms' profits.

3 Channels of interaction between financial development and growth

Figure 4 summarizes the various theoretical arguments for why there could be a positive link between financial development and economic growth. The financial system can promote growth by boosting the volume of savings and investments or by improving the efficiency in the allocation of savings across investment plans. The financial sector can achieve such effects by: i) reducing the costs of information; ii) improving the management of risk; and iii) fostering innovation. This section provides a detailed review of both theoretical and empirical findings, disentangling the key mechanisms through which financial development can affect growth.

Figure 4: Financial development and its effects on economic growth



Source: authors' elaboration

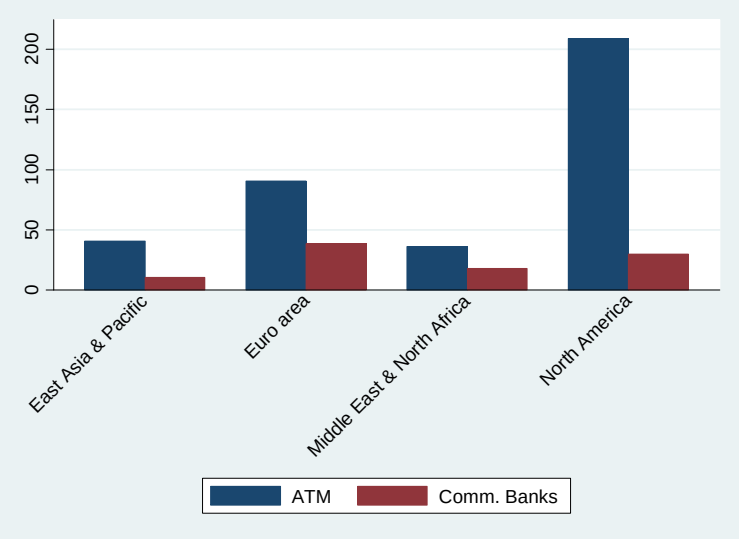
3.1 Investment volumes or allocative efficiency?

The financial system can boost the volume of savings (that in a closed economy equal investments) or improve the allocation of pooled savings across investment projects.

Easing the pooling of savings

The financial system pools together the savings generated in the household sector. In the banking sector, this task is primarily performed by banks' local branches, that, being close to savers, are able to create stable relationships with savers based on trust and on the repeated provision of financial services. Figure 5 show the number of commercial bank branches and automated teller machines (per 100,000 adults) in developed and developing economies.

Figure 5: Commercial bank branches (per 100,000 adults) and Automated teller machines (ATMs) (per 100,000 adults)



Source: World Bank, 2012

An increase in savings leads to output growth by allowing an increase in investment. To put in McKinnon's words (1973): there is a widespread agreement that flows of saving and investment should be voluntary and significantly decentralized in an open capital market in order to reach faster economic growth. This view is also supported by Gurley and Shaw (1960), who demonstrate that the financial sector promotes savings and finally results into an increase in output growth. The process of transforming savings into investments can involve several difficulties, such as transaction and information costs for pooling households' savings (Levine,2005). If the financial system helps mitigate these frictions, the pooling of resources becomes easier[4].

A closer look at the overall effect of financial sector development on the volume of savings reveals an ambiguous relationship. Hassan, Sanchez and Yu (2011) show empirically that a more developed domestic financial sector in developing countries may significantly contribute to an increase in savings. However, using a sample of OECD countries and developing economies in the 1970s and 1980s, Jappelli and Pagano (1994)

[4]Sirri and Tufano (1995) explain that without a pooling of wealth to fund enterprises, firm size would be constrained by the wealth under the control of a single household.

demonstrate that borrowing constraints can positively affect savings. Their study, supported also by the empirical findings of De Gregorio (1996), relies on the idea that in the absence of developed financial markets and institutions, while individuals are unable to borrow, they are induced to increase their precautionary savings in order to face unexpected consumption needs in the future. Therefore, to the extent that financial development reduces borrowing constraints, saving ratios could be lowered[5].

Easing the allocation of savings to productive investments

Besides affecting the volume of savings, the financial system eases the allocation of pooled savings to profitable investment projects. Smith (1937) stresses that financial arrangements lower transaction costs through an efficient management of resources, resulting in greater specialization and in faster technological improvement. Greenwood and Jovanovic (1990) develop a model in which both economic development and financial development are endogenous. They argue that better financial institutions lower the cost of transferring savings to investment projects, increase yields, and speed up the growth process. Greenwood and Smith (1997) examine the role of banks and stock markets and conclude that these help entrepreneurs identify investment opportunities. Bencivenga, Smith and Starr (1996) show that, as the liquidity of financial assets increases in a country, resources are better allocated from an intertemporal point of view: the transformation of short-term savings into long-term investments permits the financing of projects with longer time cycles, which are more likely to generate sustained growth. This view is shared by Levine (1991), who shows that financial development raises the ratio of savings devoted to long-run investments and reduces the likelihood of premature liquidation of profitable investment projects.

In Khan (2001), the reduction in the cost of financial contracts implies a rise in the return on debt, a decline in the spread between borrowing and lending rates, and ultimately a reduction in the premium commanded by producers with access to investment loans. This virtuous cycle leads to an increase in the efficiency of financial intermediaries, raising the return on investments. A similar argument is put forward by Trew (2008), who develops a growth model where the microeconomic frictions stem from the difficulty of entrepreneurs to access credit. He demonstrates that, while the efficiency-growth link always exists, the financial depth-growth link may not. Matching growth rates with loan deposit spreads and with measures of bank profitability, he shows that the numerical implications of his model are broadly in line with data only for the efficiency-growth channel.

[5]Nevertheless, both De Gregorio (1996) and Bencivenga and Smith (1993) stress that, in the presence of credit constraints, agents will be unable to borrow in case of income drops. This will induce them to hold their savings in the form of highly liquid and low productive assets, which, in turn, could have negative effects on growth.

Empirical findings

De Gregorio and Guidotti (1995) find empirically that the efficiency effect is the main channel through which financial development promotes growth: according to their estimates, a 10% increase in credit speeds up growth by 0.18% via efficiency gains and 0.07% via higher investment levels. This result is also consistent with the empirical findings of King and Levine (1993). Their study estimates that if the financial sector expands by 10%, income increases more rapidly by 0.34 percentage points. Their analysis also concludes that more than 70% of this effect is attributable to higher efficiency induced by a more developed financial sector. Rajan and Zingales (1998) study a large sample of countries over the 1980s and observe that industrial sectors that are relatively more in need of external finance develop disproportionately faster in countries with more developed financial markets. They argue that access to credit gives firms more opportunities to search for profitable investment projects. This result is consistent with an earlier study of Demirguc-Kunt and Maksimovic (1995) who, using micro-data at the firm level, estimate that the growth rates of firms with access to the credit market would not be sustained only by internal resources. Moreover, analyzing panel data for 65 countries, 28 industries, and 33 years, Wurgler (2000) demonstrates that better financial markets are associated with a better allocation of capital: relative to countries with small financial markets, financially developed countries boost investments in growing industries and cut them in declining ones. Therefore, the key advantage of financially developed countries is not the higher investment rate, but the better allocation of resources to profitable investment projects[6]. This point is reminiscent of Bagehot (1873) argument that one of the reasons for England's good economic performance was an efficient capital allocation.

3.2 Minimizing the cost of information

The financial system can foster growth because it produces information on borrowers, helping overcome information asymmetries between lenders and borrowers.

Ex-ante production of information

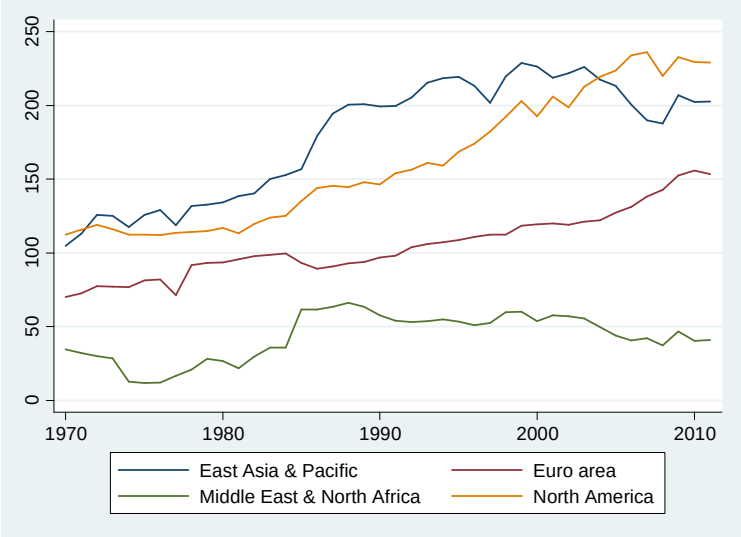
To explore this argument, Boyd and Smith (1992) develop a model of adverse selection in which verification of output is costly. They show that financial intermediaries emerge because they have a comparative advantage in information acquisition. By reducing credit rationing and interest rate differentials, financial intermediaries ultimately create the conditions for economic growth. This model captures the fact that there are relevant costs for evaluating projects that could induce suboptimal levels of investment. For instance, it is usually difficult for households to collect information on investment opportunities, and the quality of the information

[6]Recently, increasing attention has also been devoted to the dynamic process through which credit is reallocated across firms (see, e.g., Herrera, Kolar and Minetti (2011)).

they obtain may not be good enough to finance projects. As a result, projects that are potentially highly profitable could be left idle.

The function of financial intermediaries as information producers is also well described in Boyd, Prescott and Smith (1988). Boyd et al. argue that asymmetric information in investment contracts results into an adverse selection problem. In a situation in which information is poor, bad-type agents mimic good-type ones, by promising to engage in projects of similar quality and profitability. In this equilibrium, the number of good projects financed is lower than the optimum, and some bad-type projects are evaluated as good. The authors show that an alternative solution is the formation of financial intermediaries, that is, coalitions of agents that evaluate projects and invest only in those estimated to be of high value[7]. Boyd et al. show that if the coalition ends up funding some bad-type investments, because of lack of good-types projects, there will be no waste of resources in their evaluation. Thus, the ex-ante information produced by the intermediary coalition alleviates adverse selection problems.

Figure 6: Domestic credit provided by the banking sector (% of GDP)



Source: World Bank, 2012

While Boyd et al. have in mind financial intermediaries as banks that produce information and sell debt contracts to firms, other authors show that the same reasoning could be applied to other types of financial intermediaries that sell the information they produce. In Bhattacharya and Pfleiderer (1985), the financial intermediary is run by a portfolio manager who has greater ability than savers to obtain and understand signals about risky assets. The manager, however, does not invest on behalf of the saver, but his role is only to transmit (by selling) the information to his principal. A more articulated version of the same idea is put forward by Allen (1990), who characterizes the conditions under which information is merely sold to savers

[7]See also Araujo and Minetti (2007 and 2011) for models where financial intermediaries help produce information.

and the conditions under which the buyers of information act as intermediaries and resell information.

In Greenwood and Jovanovic (1990) financial intermediaries arise endogenously to facilitate trades. Intermediaries increase the expected rate of return on investments through a research-type process during which they produce information on the most profitable uses of funds. As in Townsend (1978), the authors assume that organizational structures are costly, thus the institutional setting of financial intermediaries is designed to minimize the costs of collecting and processing information. By allowing the migration of funds to investments with high return, the development of the financial infrastructure promotes economic growth[8].

Ex-post production of information

The activities just described are linked to the role of financial intermediaries as information producers at a pre-contractual (ex-ante) stage. However, another crucial role of financial intermediaries is the monitoring of investment projects that they carry out at the post-contractual stage. In Diamond (1984), since monitoring is costly, it is efficient to delegate it to a specialized agent, namely a bank. According to the author, borrowers have to be monitored so as to prevent moral hazard ex post. In fact, since lenders do not have sufficient information on the output of investment projects, lending contracts cannot be contingent on output. However, if a lender gathers information on production, the information asymmetry can be overcome. In a similar way, Blackburn and Hung (1998) focus on moral hazard in lending contracts: firms have the incentive to claim that their projects have failed in order to avoid repaying their loans to lenders. The authors show that a solution to this problem is represented by incentive-compatible loan contracts, which are enforced through a process of costly monitoring. However, as this process entails fixed costs, the development of an advanced financial sector reduces the unit cost of the monitoring process, thus increasing the rate of growth of the economy.

It thus emerges that financial intermediaries have a critical role in producing ex-ante and ex-post information. However, despite representing a (partial) solution to information asymmetry problems, this function does not necessarily achieve the most efficient outcome. In fact, there could be an inefficient duplication of information production costs if multiple agents end up producing the same information[9]. The most efficient solution would be that a small number of agents produce enough information and then sell it to uninformed agents. Clearly, this solution can lead to a further problem of reliability of the information produced ("who monitors the monitor?"). Hirshleifer (1971) stresses that it may be impossible for an information producer

[8] Similarly, Bencivenga and Smith (1993) develop a model in which all investment projects are financed through credit and examine the consequences of informational frictions on economic growth. Due to adverse selection in credit markets, in turn resulting from the difficulty of distinguishing between high- and low-quality investments, lenders engage in credit rationing, depressing growth.

[9] A mechanism through which financial institutions such as banks can share information and avoid duplication of information production are credit registers and bureaus (see, e.g., Doblas-Madrid and Minetti (2013), for empirical evidence).

to credibly ensure that he has produced valuable information. Leland and Pyle (1977) show that financial intermediaries can overcome this reliability problem by investing their wealth in the assets about which they produce information. The authors develop a model to analyse conflicts of interest between managers and creditors, based on the assumption that entrepreneurs know the true characteristics and the performance of the investment project for which they require financing, while lenders do not have access to such information. Due to this conflict, the cost of monitoring activities by creditors would be very high and the interest rate applied on loans would be higher than the optimal. The authors show that financial markets can overcome this problem by inducing entrepreneurs of good quality to retain a large fraction of own capital in companies to signal their quality (see also Campbell and Kracaw (1980) for a similar result).

Khan (2001) develops a dynamic general equilibrium model to study whether financial development reduces the costs of information asymmetries and thus results in higher economic growth. The starting assumption is that it is costly for lenders to verify production and to discern risky projects. In this situation financial intermediaries arise that reduce the costly verification of production when borrowers are unable to repay loans. The financial sector not only lets the most advanced producers benefit from higher returns due to lower information costs, but also it creates incentives for other producers to undertake the technological changes needed to access investment loans, which in turn reduces financing costs and promotes growth.

The importance of relationship lending

Relationship lending deserves special attention when investigating the role of financial intermediaries as information producers. A more developed financial intermediary sector can to produce better information through long and tight lending relationship. Boot (2000) stresses two core elements upon which relationship lending is based: i) the engagement of lenders in multiple types of interactions with borrowers; and ii) the repetition over time of such interactions, which reduces the cost of obtaining proprietary information on borrowers.

Bhattacharya and Thakor (1993) show that, through customer relations, banks are able to acquire private information on firms to overcome situations of asymmetric distribution of information that prevents firms' access to financial markets. In addition, Boot and Thakor (2000) show that the establishment of these types of relations involves lasting benefits for businesses in terms of a greater amount of credit offered and/or better access to credit, as reflected in the interest rate charged and the guarantees required.

In this perspective, the key variable appears to be the length of credit relationships. Boot and Thakor (1994), for instance, show that the possibility of carrying out repeated transactions is an efficient method to amortize the costs of screening activities. These gains, however, could potentially hide some negative effects, as demonstrated by Sharpe (1990). In fact, the previous models are based upon the exclusivity of

the bank-customer relationship: this exposes the debtor to the risk of being informationally captured by the lender, which can exploit an informational monopoly power and impose higher interest rates ex post. This detrimental effect is also present in Boot and Thakor (2000) who illustrate how the lock-in effect can distort both banks' and firms' incentives, resulting in sub-optimal allocation of capital and/or worse growth decisions of entrepreneurs.

Empirical studies confirm the arguments of the models just discussed, although with some surprising twists. Berlin and Mester (1999) use a data set of 600.000 small business loans over 12 years and do not find strong evidence in support of a particular role of relationship lending. Their finding contrasts, however, with those of other empirical studies. Petersen and Rajan (1995) show that credit-constrained firms (in their analysis, small enterprises) are more likely to be financed when creditors can better internalize the benefits of assisting firms, i.e. when lending relationships are stable (thanks also to a more concentrated credit market). Elsas and Krahnen (1998) show that relationship lenders are able to provide liquidity insurance to troubled firms in situations of unexpected deterioration of borrower ratings. Moreover, D'Auria, Foglia and Reedtz (1999) find evidence of lower borrowing costs for Italian firms that have well established bank relationships.

Does relationship lending stimulate growth? Weinstein and Yafeh (1998) and Miarka (2000) analyze a large sample of small and large Japanese enterprises in the periods 1977-1986 and 1985-1998 and find that, although close ties to a bank improve firms' access to capital, this relationship is not necessarily accompanied by higher growth rates. Gambini and Zazzaro (2013) find that that growth rate of Italian small enterprises is negatively affected by the maintenance of long-lasting ties with a bank, while the growth performance of other firms increases with the length of the relationship.

3.4 Improving the management of risk

According to the literature, market-based financial systems are especially good at ameliorating the management of risk in financial relations. Levine (2005) argues that, while bank-based systems can provide low-cost services to deal with standard risk management, market-based systems can increase the flexibility of these services, offering more products and tools for managing capital. This function is essential, as improvements in the management of risk can positively affect the rate of growth of the economy. Levine (2005) identifies three types of risk that could be better managed by a developed financial sector: cross-sectional risk, liquidity risk, and intertemporal risk.

Cross-sectional risk

A more developed financial system is able to efficiently combine and manage both high- and low-risk projects. This permits to achieve risk diversification, which is crucial for channelling savings to investments with

high return and high risk. Acemoglu and Zilibotti (1997) develop a model in which minimum investment requirements imply that agents cannot always insure themselves against the risk involved in investing in high-return projects. They show that, by letting agents hold a diversified portfolio of investments, the financial sector is the only institution able to reallocate funds from agents who prefer safe returns (namely, current account holders) to risky projects with high returns and high level of initial capital. Clearly, without such a diversification, high-return/high-risk projects would not be financed, with a consequent negative effect on economic growth.

This ability of financial institutions to induce a portfolio shift towards projects with higher expected returns was also stressed by Gurley and Shaw (1955) who argued that the primary function of the financial sector in promoting growth is the transformation of funds from large groups of different agents into diversified debt for investors. Obstfeld (1994) develops an endogenous growth model in which greater diversification reduces savings if relative risk aversion exceeds one (with negative effects on the level of investment), but this effect is outweighed by a portfolio shift towards risky assets, so that overall economic growth increases. A counterargument, however, comes from Devereux and Smith (1994) who show that the welfare of a country may be lower with a developed financial system that allows risk sharing opportunities. The authors find that growth rates are lower in an equilibrium with full diversification, as this reduces the equilibrium saving rate, depressing growth. Therefore, the welfare gains from risk sharing have to be compared with the losses from a reduced growth rate: the authors assess that, for reasonable parameter values, the losses can dominate and welfare can be lower.

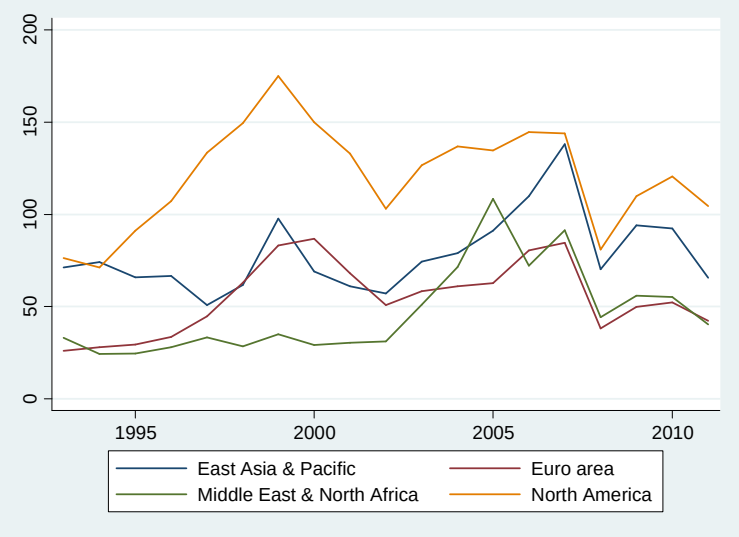
Liquidity risk

Turning to liquidity risk, a major contribution to the analysis is offered by Levine and Zervos (1998). These authors show that the initial level of stock market liquidity is positively and significantly correlated with economic growth in a sample of 42 countries over the period 1976-1993. For instance, a one-standard-deviation increase in the initial stock market liquidity is estimated to increase the per capita GDP growth by 0.8% per year and by 15 percentage points over the 18 years span. These empirical findings are consistent with the predictions of the theoretical literature. Bencivenga and Smith (1991) show that, by mitigating liquidity risk, the financial sector can boost investments in high-returns and illiquid investments, thus accelerating growth. Indeed, thanks to liquid capital markets, savers can finance projects with high productivity and at the same time they can hold liquid assets (equity, bonds, etc.) that can be quickly and easily sold if they need access to their savings. In this framework, banks face a predictable demand for liquidity resulting from the law of large numbers and can, therefore, allocate funds more efficiently than single individuals.

Building on Diamond and Dybvig (1983), Levine (1991) constructs an endogenous growth model in which

a stock market emerges that allocates risk in the economy (Figure 7 shows the stock market capitalization in different regions of the world; Figure 8 shows the value of stocks traded in the same areas). Levine shows that the stock market alters the steady state growth rate by allowing agents to diversify their portfolios in case of liquidity shocks. A more developed financial system, in fact, mitigates liquidity risk by letting entrepreneurs hit by liquidity shocks sell their shares to other investors. This way, capital is not prematurely liquidated to satisfy short-run liquidity needs and the accumulation of capital in the economy speeds up, resulting in greater economic growth. This function, however, is not exclusive of stock markets: Diamond (1991) shows that when there are large barriers to the development of a system of equity trading, the banking sector naturally takes a liquidity-enhancing role in the economy, replicating the same equilibrium allocation of capital that arises with liquid equity markets.

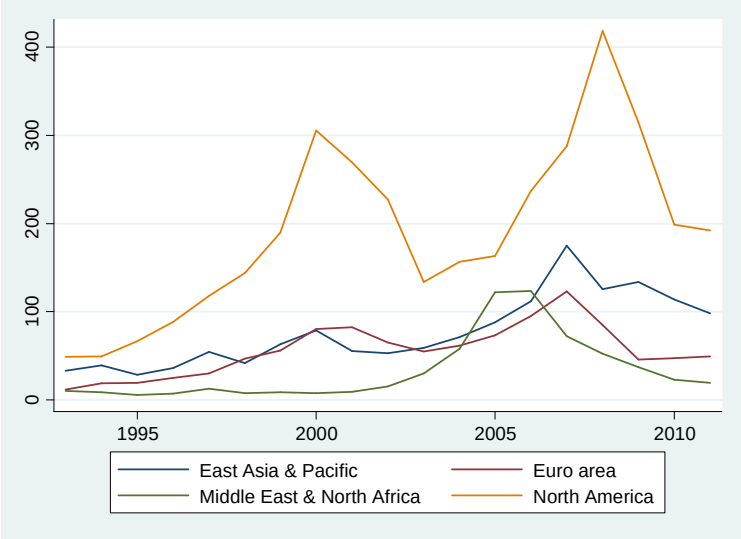
Figure 7: Market capitalization of listed companies (% of GDP)



Source: World Bank, 2012

To be clear, not all studies agree that liquid stock markets positively affect the rate of growth of the economy, and this could support the development of a bank-based financial system. For instance, Bhide (1993) shows that highly liquid stock markets can let investors diversify cheaply, but at the same time can weaken the internal monitoring system of financial intermediaries, by reducing the costs of exit of "unhappy stockholders". This can end up in a worse allocation of resources compared to a bank-based system where breaking credit relationships entails high costs and hence monitoring incentives are stronger. On top of these problems, an excessive increase in the liquidity of financial markets can also expose the economy to problems of instability when the economy is hit by aggregate shocks. This point has been already discussed in Section 1, with particular reference to the recent analysis of Brunnermeier and Pedersen (2009).

Figure 8: Stocks traded, total value (% of GDP)



Source: World Bank, 2012

Intertemporal risk

The last type of risk to be considered is intertemporal risk. Greenwood and Smith (1997) underline that the provision of liquidity by financial markets limits the exposure of savers to idiosyncratic risk and prevents the costly premature liquidation of long-term investments. Allen and Gale (1997) develop an overlapping generations model in which more developed financial intermediaries allow to channel a higher fraction of savings to long-run investment projects. These offer returns that are relatively low in booms and relatively high in recessions and thus favour diversification of risk across generations, eliminating the inefficiencies due to lack of inter-temporal smoothing. This result also suggests that the financial sector can have a remarkable effect on the development of innovative activities that have high growth potential in the long run. We address this point in the next section.

3.4 Easing innovation processes

Schumpeter (1961) showed that financial institutions are important for economic activity because they evaluate and finance entrepreneurs engaging in research and development (R&D). The role of financial institutions in solving information problems and managing risk have been discussed above. What we have not yet examined, however, is how these functions could promote innovation.

A complex theoretical relationship

Innovation is a trial-and-error process, in which it may be initially necessary to finance numerous unexpected opportunities, about which little is known ex ante, but that could have high future returns (Dosi, 1990). Therefore, due to the uncertainty associated with R&D activities, a more developed financial system can be essential to ensure the necessary screening mechanism, thus promoting innovation and growth. Xu and Huang (1999) argue that, since the uncertainty associated with R&D projects can only be solved when a project is carried out, ex-post selection is more effective than ex-ante selection. The authors show that, when financial institutions are sufficiently developed and multi-banking financing arrangements are set up (in which projects are co-financed by different actors), it is possible to develop a screening mechanism that discards bad projects, even in cases in which the refinancing of such projects could be profitable ex post. This prediction is consistent with the cited works of Rajan and Zingales (1998), as the industries that require most external financing are primarily those more innovative, and of Wurgler (2000), as the most innovative industries are also those likely to grow faster.

However, the improvement in the information about R&D projects is just one perspective of the analysis. Examining the role of risk, Petersen and Rajan (1995) reach opposite conclusions. Building a model in which concentrated banking sectors allow for intertemporal risk sharing, they show that only a concentrated banking sector (i.e., one in which entrepreneurial projects are financed by only one bank) is able to guarantee low cost of funding in the early stages of firm development. Moreover, Carpenter, Lazonick and O'Sullivan (2003) find that investments are rarely financed externally in innovative sectors such as the optical network industry.

King and Levine (1993) stress the role of financial intermediaries both as evaluators of potential innovators and providers of insurance for innovators. Thanks to the cross-sectional diversification obtained by intermediaries, the economy is able to promote investments in growth-enhancing innovative activities that feature high level of risk and thus are not "naturally" financed by risk-averse agents. Morales (2003), instead, applies a different approach based on the growth model of Aghion and Howitt (1998), and considers capital accumulation and R&D activities as complementary sources of growth. He builds a model in which the financial sector affects the financing of R&D activities. He demonstrates that financial activity does have an important role in reducing the incidence of moral hazard in research, increasing the level of monitoring and the probability of success of research projects. However, this impact of the financial sector on research productivity causes two opposite effects on growth. On the one hand, financial development fosters research projects with positive spillovers on other sectors of the economy, resulting in higher productivity in the whole economy. On the other hand, the increased R&D productivity raises the probability that an incumbent

producer is replaced by an innovator, thus reducing the incentives to accumulate capital.

Block (2002) takes a critical approach towards all the above views. He stresses that often firms do not raise funds to allocate them to specific innovative projects, but the majority of funds are given to companies that only subsequently allocate the resources to particular innovative investments. For this reason, one cannot neglect that a key role in the link between financial development and innovation is played by the organizational and decisions processes within firms. Mayer (1996) develops a model of ownership structure in which economies with more concentrated stakeholders encourage long-term commitment and this allows to allocate internal resources towards R&D projects. Considering a sample of 14 OECD countries, Carlin and Mayer (2003) show that there is no relation between concentration of ownership and R&D, which suggests that ownership concentration provides the commitment needed to encourage basic investment but not more advanced training of skills. Using microeconomic data on a large sample of Italian manufacturers, Minetti, Murro and Paiella (2011) find instead that an increase in ownership concentration tends to reduce firms' innovation efforts, especially at the R&D stage.

Assessing the pros and cons of market-based and bank-based financial systems in promoting innovation, Stiglitz (1985) underscores that a very liquid market-based system could lead to an equilibrium in which investors have no incentive to undertake pioneering projects, as the information about innovations could quickly spread to competitors. By contrast, bank-based systems could create more stable relationships and convince entrepreneurs to invest in innovation. Boot, Greenbaum and Thakor (1993) show that the reputation in securing the information provided by innovators could be higher in the case of a bank-based system, thus increasing the resources devoted to R&D projects. However, Carlin and Mayer (2003) contend that, being characterized by more dispersed ownership, market-based systems can be associated with R&D projects of higher risk, while bank-based systems, where ownership is more concentrated, are oriented towards longer-term investments with a more imitative nature.

Empirical findings

The literature that tests the role of financial markets in the innovation process is recent, but already rich. A first concern in defining a successful empirical strategy is to rule out the possibility that the causality goes from innovation to financial development. In fact, a possible explanation of the existence of a relationship between these two variables is that only those economies with good innovation prospects develop financial markets that are able to provide the funds necessary to support innovation.

The second concern is linked to the fact that it is not necessarily demonstrated that financing constraints should matter for R&D activity. As argued by Himmelberg and Petersen (1994), R&D investment seems to be often financed by internally generated cash flow in advanced economies. The standard approach for

testing this prediction is examining the cash flow sensitivity of investment: despite its large application in many studies, this approach has not delivered a definitive answer. Providing a comprehensive summary of the literature on this issue, Hall and Lerner (2009) conclude that this still remains an open question. However, analysing a large sample of European firms, Brown, Fazzari and Petersen (2009) show that financing constraints affect the R&D activity of firms.

A third issue is whether the evidence suggests that market-based financial systems are preferable or not to bank-based systems for promoting innovation. Some empirical evidence that R&D-intensive firms make relatively little use of debt finance is provided by Aghion et al. (2005) who, using data on publicly traded U.K. firms, find that businesses with positive but low R&D use more debt finance than businesses that report no R&D, but the use of debt finance falls with R&D intensity among firms that report R&D. Yet, other studies show that bank-based financial systems can have a key role in supporting innovation. As demonstrated by Benfratello, Schiantarelli and Sembenelli (2008) in the analysis of over 6,000 Italian enterprises during the 1990s, a higher capillarity of the banking sector (measured as the density of the network of bank branches in Italian provinces) is capable of generating significant effects on the innovative processes of firms, increasing the likelihood of introducing a process (product) innovation by about 6% (4.5%) in case the density goes from 30 to 50 branches per 100 inhabitants. This positive effect of banking development is also reflected in the amount of resources that companies devote to R&D. Studying more than 4,000 Italian businesses in the early 2000s, Herrera and Minetti (2007) show that the length of the credit relationships between banks and firms also increases the probability of innovation. The authors point out that this effect is particularly significant in the decision of a company to introduce product innovations (rather than process ones). A subsequent analysis of Minetti (2011) demonstrates that banks are particularly effective at fostering incremental innovations, i.e. innovations that do not drastically change the production processes of firms. He argues that this result is perhaps linked to banks' limited knowledge of radically new technologies.

Finally, two recent empirical studies confirm the innovation-financial development nexus. Using a large data set including 34 developed and emerging countries and using the patenting rate as a proxy of the innovation activity of a country, Hsu et al. (2011) show that, while the development of equity markets encourages innovation, credit market development impedes innovation. This is particularly true in emerging countries, and in countries with low quality of the legal system and with weak creditor protection. In the same vein, Ayyagari, Demirguc-Kunt and Maksimovic (2012) analyze over 19,000 firms across 47 developing economies and find that a firm's access to finance is an important determinant of the extent of innovation it undertakes. Moreover, financing from foreign banks appears to be associated with higher levels of innovation compared to financing from domestic banks.

4 Conclusions

This paper has reviewed the link between the development of the financial structure and economic growth. For reasons of space we have not touched on some important areas of research. One such area is the role played by inequality in the relationship between finance and growth. Difficulties in accessing financial markets can not only have adverse consequences on average income levels but also increase income, wealth, and human capital inequality. In a pioneering work, Benabou (1966) posed the question of why two countries that start from a similar macroeconomic situation, such as Philippines and South Korea in the post-war period, have divergent development trajectories. He conjectured that the Philippines were penalized by a more unequal distribution of wealth and an underdeveloped financial system. The idea is that when financial markets are inefficient, the returns across investment projects are not equalized. The greater the level of inequality, the larger the return differentials, and the bigger the loss in potential aggregate output. In addition, because in developing countries there is a good degree of learning-by-doing in production, and because production stimulates the assimilation of foreign technologies, the static loss of GDP translates into slower long-run growth.

Financial constraints can also have detrimental effects on investments in education. Households with limited access to finance invest relatively less in human capital than they would do in a world with educational credit. This mechanism was first examined by Galor and Zeira (1993) where education is an indivisible investment, but generates greater private and social returns than physical capital (which, however, can be increased by small amounts). Lack of credit would induce low-income households to overinvest in physical capital. As a result income inequality increases from one generation to the next, and the economy's growth rate, which depends on the rate of accumulation of human capital, is smaller than it would be in a world with perfect credit markets. It is a fact, however, that the government takes an active role in financing education directly and indirectly. Arguably, this is the reason the Gini coefficients for education are lower than those for income and wealth (Thomas et al., 2001). Several advanced economies have witnessed an increase in income and wealth inequality in the last two decades or so. In addition, some of these economies have also experienced growth rates lower than their historical trend. The current debate on the reforms of the financial sector following the Great Recession will necessarily have to take into account the complex linkages among finance, growth and inequality.

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