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Reassessing the Literature on the Relationship Between Financial Structure and Economic Growth

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Abstract: This paper surveys the literature, particularly the empirical literature, that examines the association between financial structure and economic growth. The studies are divided into two groups depending on their research focus and research design. Whereas both strands of literature contribute to our understanding of the relationship between financial structure and growth and may also inform each other, the fundamental difference in their research questions means that they should be treated separately rather than together. Despite this difference, the two strands of literature share a common weakness: i.e. they overlook the interactions between banks and stock markets, which may lead to biased estimations.

Keywords: banks, economic growth, financial structure, interactions, stock markets

JEL Code: E51, G21, O16, O47

1 Introduction

The financial sector has been dubbed “the brain of the economy” (Mishkin 2006: 25) in view of its essential role in allocating capital. Without an efficient financial sector, it is hard or even impossible to transfer idle funds to more efficient uses; new ideas, innovative products, and productive investments would therefore be abandoned, and society would in turn be trapped in the status quo. It is therefore not surprising to find that historically and comparatively, economic prosperity has always been accompanied by financial development (Rajan and Zingales 2003; Rousseau and Sylla 2003). Greenwood et al. (2013) further show that financial development can explain approximately 23% of cross-country dispersion in

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output. Whereas the positive effects of financial development on economic performance have been questioned since the 2008 financial crisis, the literature as a whole seems to support the beneficial role of financial development in the process of economic growth (Arestis et al. 2015; Popov 2018; Valickova et al. 2015).¹

We may be convinced by the literature and therefore agree that financial development does indeed matter for economic growth; however, there are still other unsolved questions. For example, is financial structure relevant in understanding economic progress? More specifically, does it make a difference to have a bank-based financial system versus a market-based one? If so, which system is better in terms of achieving economic prosperity? Economists have debated the comparative importance of these two systems for decades (Allen and Gale 2000; Demirgüç-Kunt and Levine 2001; Fohlin 2012). However, to date, no consensus has been reached at either the theoretical or the empirical level. Allen et al. (2018: 56) therefore admit that “the question of how financial structure characteristics affect economic development is not yet fully understood”.

It is hence necessary to survey the literature to help us understand the status quo of the research, particularly the challenges faced by researchers in terms of indicator selection, methodology employment, result robustness, etc., as well as the potential direction of future research. There are already high-quality literature reviews in the field of financial structure, such as those of Levine (2005) and Allen et al. (2018). However, Levine’s (2005) work was published 16 years ago and therefore does not cover the more recent advances; Allen et al.’s (2018) survey, despite its recency and comprehensiveness, fails to examine certain important dimensions of the research on financial structure, such as the interactions between the banking sector and stock markets. In this study, we fill the gap left by the previous surveys.

More specifically, we identify two strands of literature and survey them separately. The first group of literature follows the tradition of Beck et al. (2001) and Levine (2002), using certain indicators to measure the comparative weight of

¹ After conducting a meta-analysis of the literature, Arestis et al. (2015: 560) conclude that “the results suggest the existence of a statistically significant and economically meaningful positive genuine effect from financial development to economic growth”. Similarly, Valickova et al. (2015: 522) use a meta-analysis method and confirm that “the literature as a whole documents a moderate, but statistically significant, positive link between financial development and economic growth”. Popov (2018: 95) also states that “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”. However, Carré and L’œillet (2018) claim that there is a paradigm shift in the aftermath of the 2008 financial crisis, with a growing body of literature highlighting that the relationship between finance and growth tend to be variable, nonlinear, or nonsignificant. See also Xu and Gui (2021), who offer a review of the more recent literature.

banks and stock markets in a financial system and then exploring whether and to what extent this comparative weight matters for understanding economic growth. The second body of literature, without referring to these relative indicators, aims to directly estimate the contributions of one financial sector to economic growth versus those of the other. Both of these bodies of literature have contributed to our understanding of the connection between financial structure and economic growth; unfortunately, the point that they contribute from different perspectives and that their research outputs therefore cannot be compared directly appears to have attracted insufficient attention from researchers in this field. Classifying these two bodies of work is the first contribution of this study.

The second contribution of this study is to highlight a missing piece of the picture, i.e. the interactions between banks and stock markets. Despite their differences, the aforementioned two strands of literature share the same weakness: i.e. they overlook these interactions. As we discuss in this study, the evidence suggests that there are indeed complicated and dynamic interactions between banks and stock markets, which in turn affect their contributions to economic growth. A failure to take such interactions into consideration in empirical research may lead to seriously biased estimation results. The real effects of certain financial sectors on the economy may be overestimated or underestimated, depending on the nature of the interactions. Future studies are therefore strongly suggested to take the interactions between different components of the financial system seriously.

The rest of the paper is organized as follows. Section 2 examines the literature that uses the relative structure indicators and therefore focuses on the role of the relative weight of different financial sectors. Section 3 surveys the literature that directly estimates the contribution of banks to the economy in comparison to that of stock markets. Section 4 discusses the interactions between banks and stock markets and the impacts of such interactions on economic growth. Section 5 concludes.

2 Studies Using the Relative Indicators²

Before we proceed, it is necessary to briefly discuss the meaning and measures of financial structure. In the literature, financial structure is usually defined by the

² Here, we focus on cross-country studies only and therefore leave out single-country studies that use the relative indicators, such as Liu and Zhang (2020). In addition, it is worth noting that there are studies that explore the relative importance of banks versus financial markets by developing financial structure indicators (or standards) to classify financial systems in a different way from Beck et al. (2001) and Levine (2002). See, for example, Cuadro-Sáez and Herrero (2008), Allard and Blavy (2011), and Langfield and Pagano (2016).

relative weight (in terms of size, activities, and efficiency) of financial markets (particularly stock markets) versus financial intermediaries (particularly banks) in a country's financial system (Beck et al. 2001; Levine 2002). Whereas both banks and stock markets can be relied on to perform the basic function of a financial system, i.e. channeling funds from surplus units with no or little profitable investment opportunities to agents who have such opportunities but suffer from a deficit of funds, they channel funds in quite different ways. Banks typically act as an intermediary, taking deposits from savers and lending them out to borrowers in the form of loans, whereas stock (and bond) markets serve as a platform where equity (and debt) securities are issued and traded. Certainly, in most countries, the financial system combines both banks and financial markets; nevertheless, financial structure, i.e. the comparative importance of banks versus financial markets in financing the economy, varies across countries.

Based on this perspective, every country can be classified as having either a bank-based financial system or a market-based system. For example, Germany and Japan are usually cited as typical cases of the former, while the US and the UK are regarded as prototypes of the latter. In the former countries, there are “high levels of bank finance, equity holding by banks, long-term relationships, close monitoring and active corporate governance by banks”, while in the latter countries, “market-oriented financial systems support large, active securities markets, and firms use market-based financing” (Allen et al. 2018: 31). Certainly, it needs to be cautioned that the classification in practice is not unambiguous: “In theory, every country has one type of financial system, which falls into one of the distinct categories ... in reality, there is no clear-cut distinction between financial systems, and the classifications empirically fit only roughly” (Allen et al. 2018: 32).

A collection of indicators that can be used to proxy for financial structure have been developed by Beck et al. (2001) and Levine (2002). They construct four indicators.³ The first one, *structure-activity*, is a measure of the activity of stock markets relative to that of banks and equals the logarithm of the total value traded ratio (the value of domestic equities traded on domestic exchanges divided by GDP) divided by the bank credit ratio (the value of deposit money bank credits to the private sector as a share of GDP). The second one, *structure-size*, is a measure of the size of stock markets relative to that of banks and equals the logarithm of the market capitalization ratio (the value of domestic equities listed on domestic exchanges divided by GDP) divided by the bank credit ratio. The third one, *structure efficiency*, is a measure of the efficiency of stock markets

³ The fifth indicator, which measures regulatory restrictions on commercial bank activities, has rarely been used in subsequent studies and is therefore ignored in this survey.

relative to that of banks and equals the logarithm of the total value traded ratio (or turnover ratio, which equals the value of stock transactions relative to market capitalization) times overhead costs (or interest rate margins) of the banking system relative to banking system assets. Finally, these authors develop a conglomerate indicator, *structure-aggregate*, which is the first principal component of the aforementioned three indicators. These indicators (Levine indicators hereafter) can therefore be relied upon to measure the relative activity, size, efficiency, and aggregate development of stock markets versus those of banks in different countries, with larger values indicating a more market-based financial system. These indicators have subsequently been used in the literature that will be the focus of this section.

By contrast, there are other studies that explore the comparative contributions of banks and stock markets to economic growth without referring to the Levine indicators. Typically, these studies add banking development indicators and stock market development indicators into the regression equation simultaneously, and the results can therefore be interpreted as the effects of banking development on economic growth after stock market development is controlled for (and vice versa), regardless of the relative weight of the banking sector (or stock markets) in the financial system. This strand of literature is surveyed in Section 3.

As we have discussed, financial structure indicators were first introduced by Beck et al. (2001) and Levine (2002). These two papers use the same indicators and same methods (OLS and IV estimations), cover the same sample countries for the same period, and reach the same conclusions. They find that for 48 countries over the 1980–1995 period, when their financial structure indicators and aggregate financial development indicators (bank activity times stock market activity, bank size times stock market size, bank efficiency times stock market efficiency, and the first principal component of activity, size, and efficiency) are included in the regression equation jointly, financial development indicators are positively and significantly related to economic growth, whereas financial structure indicators never enter the growth regression significantly. Levine (2002: 398) therefore concludes that “the results indicate that although overall financial development is robustly linked with economic growth, there is no support for either the bank-based or the market-based view”. In other words, financial structure is irrelevant in understanding economic growth.

The irrelevance argument is challenged by subsequent studies. Pinno and Serletis (2007) find that once parameter heterogeneity is allowed for, financial structure is relevant: economic growth is promoted by market-based financial systems in developed countries (but is supported by bank-based financial systems in developing countries). Luintel et al. (2008) and Arestis et al. (2010)

similarly argue that estimates may be biased if cross-country parameter heterogeneity is ignored. They apply time-series and dynamic heterogeneous panel methods to overcome the problems of cross-country heterogeneity and unbalanced cross-country growth paths and find that financial structure determines output levels (not growth rates) in the majority of their sample countries.

The conclusion of Pinno and Serletis (2007) implies that the financial structure-economic growth nexus is dependent on an economy's income level, which is supported by other studies. For example, Luintel et al. (2016) report that the relationship between financial structure and output level changes with the stage of economic development. More specifically, a market-based financial system is positively and significantly associated with per capita income only in high-income countries, whereas aggregate financial development benefits middle- and low-income countries. In addition to development stage, institutional environment is also shown to be relevant. Ergungor (2008) reports that whether and to what extent financial structure influences economic growth depend on features of the judicial system: countries that have inflexible judicial systems grow faster if they have bank-oriented financial systems. Yeh et al. (2013) find that the interactions between financial structure indicators and income level as well as rule of law are significantly related to economic growth, which implies that both income level and legal environments intervene in the financial structure-economic growth nexus. They also report that a market-based financial system promotes economic growth in the long run at the cost of inducing growth volatility.

In a more recent study, Chu (2020) demonstrates a more complicated relationship between financial structure and economic growth. She introduces the interaction between financial structure and aggregate financial development and the interaction between financial structure and an indicator of whether aggregate financial development is balanced. She also considers the potential nonlinear relationship between financial structure and economic growth. Her findings indicate that a market-based financial system promotes economic growth in the advanced stage of financial development while damaging economic growth in an unbalanced financial environment (with excessive stock market vis-à-vis banking sector development). In addition, there is an inverted U-shaped relationship between financial structure (activity indicator) and economic growth.

In summary, despite their usefulness in characterizing a financial system as bank- or market-based, the Levine indicators are actually not widely used in the economic growth literature.⁴ Even in this small group of works, it is difficult to detect a consensus on the role of financial structure in economic growth. These

⁴ Certainly, the Levine indicators have been applied to studies exploring other topics related to financial structure. In that sense, they are still widely used in the economics literature as a whole.

studies use different methodologies, cover different sample countries, introduce different control variables, and even employ different dependent variables (GDP level vs. GDP growth). In addition, except for Chu (2020), none of these studies consider the potential nonlinearity in the connection between finance and economy, although this nonlinearity has been repeatedly confirmed by the recent literature examining the connection between aggregate financial development and economic growth (Xu and Gui 2021). These studies also fail to consider the interactions between the banking sector and stock markets, which will be discussed in Section 4. When the nonlinearity and the interactions between banks and stock markets are taken into consideration, whether and to what extent the results presented by the aforementioned studies are robust remain to be seen.

The foundation of these studies, the Levine indicators, is certainly not flawless. They have certain weaknesses (Cuadro-Sáez and Herrero 2008). First, these indicators are insufficient to cover the whole financial system, as financing by foreign investors and the domestic bond market is excluded. Second, being the natural logarithm of a ratio, the indicators are neither bounded nor linear. The indicators equal infinity or minus infinity when the size of one of the two financial system components is zero or approaches zero. Third, an increase in stock market development relative to the banking sector has a different impact on the indicator depending on the initial size of the markets. Cuadro-Sáez and Herrero (2008) construct a new indicator that can be used to measure whether the development of a financial system is balanced (between banks and stock markets) and find that a more balanced financial system is more favorable for economic growth. Unfortunately, this indicator has been overlooked by subsequent studies, and therefore, its usefulness has not been tested systematically. Developing better indicators that can address the problems inherent in the original Levine indicators and that therefore can be used to define, characterize and classify financial systems in different countries more effectively is of great necessity.

3 Studies Not Using the Relative Indicators

There are many more studies that explore the relative contributions of banks and stock markets in promoting economic growth without referring to the Levine indicators. Most of these studies jointly incorporate banking development indicators and stock market development indicators into the regression equation, and the results should therefore be interpreted as measuring the absolute rather than relative effects of one part of a financial system (after the influence of the other part of the financial system is controlled for). The coefficient estimates of bank

development on economic growth can be further compared to those of stock market development, and their comparative merits are therefore determined.

Levine and Zervos (1998) is among the first studies⁵ to systematically examine the contributions of banks versus those of stock markets to economic growth. The authors use four indicators to measure stock market development (*size*, that is, the value of listed domestic shares on domestic exchanges divided by GDP; *liquidity*, the value of the trades of domestic shares on domestic exchanges divided by the value of listed domestic shares and the value of the trades of domestic shares on domestic exchanges divided by GDP; *international integration measures*, computed by the capital asset pricing model and international arbitrage pricing theory; and *volatility*, the 12-month rolling standard deviation estimate based on market returns) and one bank development measure (the value of loans made by commercial banks and other deposit-taking banks to the private sector divided by GDP). Based on a sample covering 47 countries for the 1976–1993 period, they find that both the initial level of bank development and that of stock market liquidity have a statistically significant relationship with future values of output growth and that the main channel linking financial development with output growth runs through productivity growth rather than capital stock growth. They also report that the economic effects of stock market liquidity are comparable with those of bank development (a one-standard-deviation increase in initial stock market liquidity (bank development) increased per capita growth by 0.8 (0.7)% points per year over the 1976–1993 period).

Levine and Zervos's (1998) conclusion is supported by certain studies. For example, Rousseau and Wachtel (2000) find that both bank development and stock market development Granger-cause the output level, and the magnitude of their results in terms of annual output growth is similar. Beck and Levine (2004) apply a system-GMM estimation and again report that both bank development and stock market development indicators enter the growth regressions significantly. Durusu-Ciftci et al. (2017) similarly find that both bank development and stock market development have positive long-run effects on the steady-state level of GDP per capita (but the contribution of bank development is substantially greater). Shen et al. (2018) report that stock market indicators exhibit a positive effect on the real per capita GDP level regardless of outliers, whereas the influence of the banking sector on GDP changes from negative to positive when outliers are controlled for. They therefore argue that the negative relationship between

⁵ Before Levine and Zervos (1998), there were studies exclusively examining the effects of banks on economic growth (such as King and Levine (1993)) or the influence of stock markets on economic growth (such as Levine and Zervos (1996)). The exception is Atje and Jovanovic's (1993) work analyzing the role of both banks and stock markets in a simple cross-country OLS regression.

banking sector development and economic growth demonstrated by the literature (see below) is caused by the existence of outliers.

The positive effects of stock markets on economic growth are further confirmed by some other studies, which, however, fail to find a beneficial role of banks or even report a negative association between bank development and economic prosperity.⁶ Thumrongvit et al. (2013) find that whereas the stock market indicator is positively associated with economic growth, the banking sector measure shows no significant effect. Peia and Roszbach (2015) find that in advanced economies, stock market development generally causes the GDP level, while the causality between bank development and GDP goes in the reverse direction. Kim et al. (2012) report that whereas stock market development is favorable to growth (particularly in high-income, low-inflation, and nonagricultural countries), banking sector development is detrimental to output growth. Haiss et al. (2016) similarly demonstrate that while the stock market variable has a positive effect on economic growth (when no lags are included in the equation), all banking sector indicators (private credit, domestic credit, and liquid liabilities) and the bond market development indicator exert a negative impact on growth.

However, a larger body of literature refutes a simple linear (positive or negative) relationship between banks or stock markets and economic growth; rather, these studies demonstrate that the connection tends to be nonlinear, heterogeneous across countries, and context dependent. Shen and Lee (2006) find that an inverse U-shaped relationship exists for bank development and growth as well as stock market development and growth. Shen and Lee's (2006) conclusion is confirmed by Gambacorta et al. (2014) and Swamy and Dharani (2019, 2020) but challenged by Shen et al. (2011), who identify that while there are nonlinear relationships between both components of the financial system and economic growth, the shape of nonlinearity for banks is different from that for stock markets. Moosa (2018) also reports that while a nonlinear association exists between the banking sector indicator and growth (an inverted U-shaped curve for high-income OECD countries and upper middle-income countries and a U-shaped curve for high-income non-OECD countries and low middle-income countries), no such nonlinearity is observed for the stock market indicator. Benczúr et al. (2019) find that after they control for stock market capitalization and debt market indicators, bank credit has a nonlinear, hump-shaped impact on economic growth (but they do not examine whether the stock market indicator has a nonlinear effect). By contrast, Cave et al. (2020) report that a nonlinear

⁶ There are also studies, such as Yu et al. (2012), reporting that the positive effects on economic growth come from banks rather than from stock markets.

connection only exists between stock market development and economic growth, while there is a linearly negative relationship between bank development and economic growth.

The relationship between these two components of the financial system and economic growth is proven to be not only nonlinear but also heterogeneous across countries, regions, and time periods. Kim et al. (2010) report that while both stock market development and banking sector development damage economic growth (relative to that of the US) in low-income countries, stock market development promotes relative economic growth in high-income countries⁷ (on which banks have no effects). Cheng et al. (2011) find that the effects of both banks and stock markets on the output level are contingent on the level of country risk and time horizon (long run vs. short run). The importance of a country's income level and the time period of analysis in mediating the effects of banks and stock markets on economic growth is further confirmed by other studies, such as Cheng et al. (2014), Barajas et al. (2016), Seven and Yetkiner (2016), Hou and Cheng (2017), and Fufa and Kim (2018). In addition to income level and time period, institutional quality and financial crises have also been shown to intervene in the relationship between financial structure and economic growth (Asteriou and Spanos 2019; Compton and Giedeman 2011; Slesman et al. 2019).

It is difficult to draw a general conclusion from such a diversified literature, which applies different methodologies, covers different sample countries for different time periods, and employs different indicators. Nevertheless, despite the variety of results and the complications caused by nonlinearity and heterogeneity, it appears that the evidence as a whole indicates that stock market development is comparatively more favorable for economic growth, particularly for high-income countries. By contrast, the beneficial effects of bank development are limited to low-income countries and environments characterized by a modest level of financial development, a finding that is compatible with the recent literature showing the detrimental consequences of “too much finance (credit)” (Arcand et al. 2015; Xu and Gui 2021).

Unfortunately, this strand of literature, despite its important contributions, deviates from the original focus of the financial structure literature, namely, to explore the comparative performance (in terms of economic growth) of a bank-based system (where banks and stock markets coexist but banks dominate the

7 There might be differences even within the group of high-income countries. For example, Lee (2012) conducts a time series analysis in a small sample (six countries), and shows that stock markets play a more important role in financing growth in Japan, the UK, and the US, while banks exert a stronger impact in France, Germany, and Korea.

financing process and therefore are proxied by *relatively* larger bank development indicators) and a market-based system (where banks and stock markets coexist but stock markets play a more important role and therefore are proxied by *relatively* larger stock market development indicators), rather than to directly compare the economic effects of stock markets per se to those of banks per se. The results of these two strands of literature therefore cannot be compared directly. In other words, a positive association between stock market (bank) development and economic growth cannot be automatically interpreted as evidence supporting the superiority of a market- (bank-) based system. For example, if both banks and stock markets promote economic growth and the positive effects of banks dominate those of stock markets, then a bank-based system outperforms a market-based system in terms of economic growth even though stock markets per se are beneficial for economic growth. The aforementioned nonlinearity and heterogeneity issues certainly make it more difficult to bring the two strands of literature together.

The situation is even more complicated if we further consider the interactions between the banking sector and stock markets, as we will discuss in the next section. Assume that there is a complementary relationship between stock markets and banks and that stock markets and banks have opposite effects (stock markets positive and banks negative) on economic growth. In that case, stock markets affect the economy both directly and indirectly; they promote economic growth directly but damage economic growth indirectly through their effects on bank development. There would then be an overestimation of the positive effects of stock markets on economic growth if their (negative) indirect impacts (via banks) are not taken into consideration, and the results would certainly be biased.

4 Interactions Between Banks and Stock Markets

In the early theoretical literature, banks and financial markets are usually seen as substitutes, with the former only growing at the expense of the latter and vice versa (Baliga and Polak 2004; Boot and Thakor 1997; Chakraborty and Ray 2007; Dewatripont and Maskin 1995; Greenwood and Smith 1997). In these theoretical frameworks, firm size, investment technologies, monitoring cost, income distribution, etc., determine which financial sector emerges and dominates. However, more recent theoretical models argue that the relationship between banks and financial markets is actually more complicated than its portrayal in earlier studies; in addition to competition (substitution), the interactions may take the form of complementarity and coevolution (Boot and Thakor 2012; Song and Thakor 2010, 2013).

There are two channels through which banks and markets may be linked in a codependent manner (Song and Thakor 2010, 2013). First, bank development boosts market development through securitization. Securitization means that a bank certifies a borrower's credit quality via credit analysis and then the financial market finances the borrower. Improvements in banks' credit analysis technology, as a result of development in the banking sector, enhance market investors' confidence in a securitized borrower's credit quality. This, in turn, encourages more informed trading in the market and hence leads to a more active and efficient financial market. Second, banks need to raise capital from financial markets. With the development of the financial market, the costs of information acquisition and processing are reduced, the number of informed traders increases, and pricing efficiency in the financial market is improved, all of which result in a lowering of the cost of equity capital for banks. Advances in the financial market therefore enable banks to expand their lending scope and lend to riskier borrowers who were previously excluded from credit availability.

In addition to securitization and capital raising, banks and financial markets may interact in other ways. For example, Hellmann et al. (2008) report that banks occasionally participate in the venture capital market, which is an integral part of the capital market. Boot and Thakor (2012) argue that the development of financial markets may lead to a diminished role for the central bank in providing liquidity to individual banks as a lender of last resort. Finally, as highlighted by Hardie et al. (2013), in recent years, banks have gradually transformed from a traditional banking model to a market-based banking model that is more involved in securitization and shadow banking, more dependent on wholesale market funding, and more reliant on market-based loan pricing (mark to market).

The existence of a link between banks and stock markets is confirmed by empirical studies, but the specific feature of the link is debated. Demirgüç-Kunt and Levine (1996: 316) find that there is a strong positive correlation between stock market development and financial intermediary development and conclude that the two “go hand in hand”. This conclusion is supported by certain subsequent studies. For example, Kim and Rousseau (2012) show that the expansion in a traditional measure of financial intermediation (the difference between broad money (M2) and narrow money (M1)) promotes stock market development (in terms of size and liquidity). Pradhan et al. (2017) present evidence showing bidirectional causality between bank development and the stock market.⁸

⁸ In addition to the cross-country studies surveyed here, there are also single-country studies reporting a complementary relationship between banks and stock markets. See, for example, Sylla (1998), Arize et al. (2018), Toh et al. (2019), and Ugolini (2019).

Other studies show that the interactions between these two financial sectors are more complicated. First, the interaction has been shown to be context-dependent. Demirgüç-Kunt and Maksimovic (1996) report that the association between stock markets and banks changes with the stage of stock market development (complementary in the developing stage but competitive in the developed state). In a time series study that covers five developed countries (France, Germany, Japan, the UK, and the US), Arestis et al. (2001) show that the direction of causality in the relationship between banks and stock markets changes from one country to another. Cheng et al. (2011) find that the relationship between the banking sector and stock markets is dependent on the time period (long run vs. short run) and country grouping (low-risk countries vs. high-risk countries). Allen et al. (2012) report that the impacts of stock market indicators on banking sector measures change between normal and crisis regimes.⁹

Second, the influence between banks and the stock market may be asymmetric. Wu et al. (2010) conduct an impulse response analysis showing that a bank development shock increases stock market development but that a stock market development shock decreases bank development. Kim and Lin (2013) similarly report that increased stock market liquidity stimulates credit expansion, whereas bank credit expansion improves stock market liquidity. Ngo and Le (2019) find that banking efficiency contributes to stock market development, whereas stock market development is harmful to banking efficiency. The negative impact of stock market development on bank development is further confirmed by Lin (2020), who reports that households' demand for retail deposits decreases during stock market booms, which induces a contraction in bank lending and a decrease in real activity in bank-dependent sectors.

Deidda and Fattouh (2008) is the first study to examine the effects of the interaction between banks and stock markets on economic growth. They find that while both the banking sector indicator and the stock market indicator per se are positively associated with economic growth, their interaction term has a significantly negative impact on growth, which implies that the influence of banking development on growth becomes less positive as the level of stock market development increases (and vice versa). Owen and Temesvary (2014) similarly report that in countries with less developed stock markets, bank finance has a more

⁹ Levine et al. (2016) find that the adverse consequences of banking crises for equity issuances, firm profitability, employment, and investment efficiency are smaller in countries with stronger shareholder protection laws. They argue that the findings are consistent with the "spare tire view", which suggests that stock markets (supported by shareholder protection laws) may act as an alternative source of external financing for firms, easing the ramifications of banking crises for the economy.

positive effect on growth, which suggests that bank finance and stock market finance may be substitutes in promoting economic growth. By contrast, Botev et al. (2019) find an asymmetric interaction: the positive effects of bank credit on the economy are reinforced by more developed stock markets, whereas no such strengthening effects can be found to run from bank credit to stock markets.

In summary, there are intricate interactions between the banking sector and stock markets, which in turn complicate the connection between financial structure and the economy. The contributions of one financial sector to economic growth may be reinforced or weakened (or even neutralized in certain scenarios) by the other sector, depending on the nature of their interactions. Failure to take such interactions into consideration in empirical studies inevitably leads to biased estimations. Unfortunately, most of the empirical works seem to have overlooked this issue, and whether and to what extent their results remain robust after the interaction effect is controlled for is an open question.

5 Conclusion

Whether financial structure matters for understanding economic growth is a long-debated question in the literature, and so far, no consensus has been achieved. In this study, we survey the literature by first distinguishing two strands. The first one follows the tradition of Beck et al. (2001) and Levine (2002), relying on the indicators measuring the magnitude of each financial sector in the financial system relative to the other and then exploring the contributions of the relative magnitude to economic growth. The second strand of literature, by contrast, directly examines the impacts of one financial sector on economic growth after controlling for the effects of the other sector. Both directions of research are valuable and productive; however, their research outputs cannot be compared directly, and it is therefore more appropriate to treat them separately rather than pool them together.

We further discuss an important dimension of the financial structure issue, i.e. the interactions between the banking sector and stock markets. The banking sector and stock markets not only influence the economy but also affect each other. They may compete (substitute) or cooperate (complement) with each other, and one sector's (positive or negative) effects on the economy may therefore be weakened or strengthened, depending on the nature of the interrelationship. Unfortunately, this interrelationship appears to have been overlooked by most of the empirical studies exploring the connection between financial structure and economic growth, and it may be argued that their estimations may be biased to a certain extent by this oversight. Future studies are strongly recommended to take the interaction issue more seriously.

Appendix

Table 1: Studies using the Levine indicators.

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Beck et al. (2001)	Ordinary least squares (OLS) and instrumental variable (IV) estimations	Real per capita GDP growth	Levine indicators (four); financial development indicators	Financial development affects economic growth, whereas financial structure does not	48 countries, 1980–1995
Levine (2002)	OLS and IV estimations	Real per capita GDP growth	Levine indicators (four); financial development indicators	Financial development affects economic growth, whereas financial structure does not	48 countries, 1980–1995
Pinno and Serletis (2007)	Automatic classification program; OLS estimation	Real per capita GDP growth	Levine indicators (four); financial development indicators; certain interaction terms	Financial structure is relevant when parameter heterogeneity is allowed for	Data from Levine (2002)
Luintel et al. (2008)	Fully modified OLS (FMOLS) estimation	Real per capita GDP	Levine indicators (three); financial development indicators	Financial structure (and financial development) significantly explains output levels in most countries	14 countries, 1978–2005
Arestis et al. (2010)	Vector autoregression (VAR) and FMOLS estimations	Real per capita GDP	Financial structure (total value of domestic equities listed in domestic exchange/GDP divided by total lending by deposit-taking institutions/GDP)	Financial structure significantly affects output level in five of six countries	Six countries, 30–39 years

Table 1: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Luintel et al. (2016)	Dynamic ordinary least squares (DOLS) estimation	Real per capita GDP	Levine indicators (three); financial development indicators	Market-based financial systems benefit high-income countries, whereas aggregate financial development benefits middle- and low-income countries	69 countries, 1989–2011
Ergungor (2008)	Two-stage least squares (2SLS) with IV estimation	Real per capita GDP growth	Levine indicators (two) and their interaction with judicial flexibility indicators; financial development indicators	Relationship between financial structure and growth is dependent on judicial environment	46 countries, 1980–1995
Yeh et al. (2013)	Pooled mean group (PMG) and mean group (MG) estimations	Real per capita GDP growth; growth volatility	Levine indicators (three) and their interaction with real per capita GDP as well as rule of law	A market-based financial system leads to both growth and growth volatility and is beneficial when income level is low and rule of law is strong	40 countries, 1960–2009
Chu (2020)	System-generalized method of moments (GMM) estimation	Real per capita GDP growth	Levine indicators (three, slightly modified); balancedness indicator	Influence of financial structure depends on stage of financial development and balancedness of financial system. There exists a nonlinearity in the connection	99 countries, 1971–2015

Table 2: Studies not using the Levine indicators.

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Levine and Zervos (1998)	OLS and IV estimations	Real per capita GDP growth; capital stock growth; productivity growth; savings	Stock market development (size-market capitalization/GDP; liquidity-value traded/GDP and turnover ratio; international integration, and volatility); bank development (private credit by banks/GDP)	Both bank development and stock market liquidity influence growth, and the main channel is productivity growth	47 countries, 1976–1993
Rousseau and Wachtel (2000)	2SLS with IV estimation; GMM estimation of panel VAR models	Real per capita GDP; real per capita GDP growth	Stock market development (size-market capitalization/GDP; liquidity-value traded/GDP); bank development (M3/GDP)	Both bank development and stock market development Granger-cause output level	47 countries, 1980–1995
Beck and Levine (2004)	OLS and system GMM estimations	Real per capita GDP growth	Stock market development (liquidity-turnover ratio); bank development (private credit by banks/GDP)	Both bank development and stock market development indicators are significant in growth regressions	40 countries, 1976–1998
Durusu-Ciftci et al. (2017)	Augmented mean group (AMG) and common-correlated effects (CCE) estimations	Steady-state level of GDP per capita	Stock market development (liquidity-value traded/GDP); bank development (private credit by banks/GDP)	Both banking sector and stock markets have positive effects on GDP level	40 countries, 1989–2011
Shen et al. (2018)	Least square dummy variable correction (LSDVC) and least trimmed squares (LTC) estimations	Real per capita GDP	Stock market development (size-market capitalization/GDP; liquidity-value traded/GDP and turnover ratio); bank development (private credit by banks/GDP and liquid liabilities/GDP)	Stock markets affect GDP positively, whereas influence of banking sector depends on outliers	48 countries, 1988–2014

Table 2: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Thumrongvit et al. (2013)	System-GMM estimation	Real per capita GDP growth	Stock market development (liquidity-turnover ratio); bank development (private credit by banks/GDP); bond market development	Stock markets promote economic growth, but banking sector has no effect	38 countries, 1989–2010
Peia and Roszbach (2015)	VAR Granger causality tests	Real per capita GDP	Stock market development (size-market capitalization/GDP); bank development (private credit by banks/GDP)	Stock market development causes GDP level, while bank development is determined by GDP level	22 countries, 1973–2011
Kim et al. (2012)	Identification through heteroskedasticity (IH) fixed effects estimation	Real per capita GDP growth	Stock market development (liquidity-value traded/GDP); bank development (private credit by banks/GDP)	Stock market development benefits economic growth, while banking sector development is harmful	63 countries, 1960–2007
Haiss et al. (2016)	Pooled ordinary least squares (OLS) and feasible generalized least squares (FGLS) estimations	Real per capita GDP growth	Stock market development (size-market capitalization/GDP); bank development (private credit by banks/GDP or domestic credit/GDP); liquid liabilities/GDP; bond outstanding/GDP; aggregate financial development	All banking sector indicators negatively influence economic growth, while the stock market variable exerts a positive effect	26 countries, 1990–2009

Table 2: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Shen and Lee (2006)	OLS and fixed effect estimation	Real per capita GDP growth	Stock market development (size-market capitalization/GDP, liquidity-value traded/GDP and turnover ratio); bank development (private credit by banks/GDP, liquid liabilities/GDP, interest rate spread)	Both bank development indicators and stock market development indicators show a nonlinear association with economic growth	48 countries, 1976–2001
Gambacorta et al. (2014)	GMM estimation	Real per capita GDP growth	Stock market development (liquidity-turnover ratio); bank development (bank credit/GDP)	Increase in both bank and stock market activity is associated with higher growth, but only up to a certain point	41 countries, 1989–2011
Swamy and Dharani (2019)	System-GMM estimation, Granger causality test, panel threshold estimation	Real GDP growth and real per capita GDP growth	Stock market development (size-market capitalization/GDP); bank development (private credit by banks/GDP, domestic credit/GDP, private credit by financial sector/GDP)	Both banks and stock markets are associated with economic growth in a nonlinear manner	24 countries, 1983–2013
Swamy and Dharani (2020)	Driscoll and Kraay (1998) covariance matrix estimation, system-GMM estimation, Granger causality test, panel threshold estimation	Real GDP growth and real per capita GDP growth	Stock market development (size-market capitalization/GDP); bank development (private credit by banks/GDP, domestic credit/GDP, private credit by financial sector/GDP)	Both banks and stock markets are associated with economic growth in a nonlinear manner	G-7 economies, 1983–2013

Table 2: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Shen et al. (2011)	OLS and flexible nonlinear estimation	Real per capita GDP growth	Stock market development (size-market capitalization/GDP; liquidity-value traded/GDP and turnover ratio); bank development (private credit by banks/GDP, liquid liabilities/GDP)	There is an inverted U-shaped relationship between banking sector and economic growth and a V-shaped association between stock markets and economic growth	46 countries, 1976–2005
Moosa (2018)	FMOLS estimation	GDP growth	Stock market development (value of publicly traded shares/GDP); bank development (credit/GDP)	A nonlinear relationship exists between credit indicator and growth only	92 countries, 2001–2014
Benczúr et al. (2019)	Anderson and Hsiao IV estimation	Real per capita GDP growth	Stock market development (size-market capitalization/GDP); bank development (private credit by banks/GDP, credit to households/GDP, credit to nonfinancial corporations/GDP); debt securities indicators; aggregate financial development	After controls for other components of financial system (stock markets and bond markets) are included, bank credit has a nonlinear impact on economic growth	9–23 countries, 1990–2014
Cave et al. (2020)	System-GMM estimation	Real per capita GDP growth	A multiple-indicators multiple-causes (MIMIC) model is used to construct bank development and stock market development indicators instead of observed indicators of financial development	Effect of stock market development on economic growth is positive up to a threshold, after which it becomes negative	101 countries, 1990–2014

Table 2: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Kim et al. (2010)	2SLS with IV and GMM estimations	Average growth rate of per capita GDP relative to that of the US	Stock market development (size-market capitalization/GDP, liquidity-value traded/GDP and turnover ratio); bank development (private credit by banks/GDP)	Banks and stock markets have similar effects on relative growth in low-income countries but exert different impacts in high-income countries	61 countries, 1960–1985
Cheng et al. (2011)	Error correction-based panel cointegration test	Real output	Stock market development (size-market capitalization/GDP); bank development (private credit by banks/GDP)	Level of country risk and time horizon (long run vs. short run) are relevant in understanding financial structure-growth nexus	28 countries, 1976–2003
Lee (2012)	Granger causality test	Real per capita GDP growth	Stock market development (growth in market capitalization and market capitalization/GDP); bank development (growth in banking sector assets and banking sector assets/GDP)	Stock markets play a more important role in financing growth in Japan, UK, and US, while banks exert a stronger impact in France, Germany, and Korea	Six countries, different sample periods for each country
Cheng et al. (2014)	PMG estimation	Real GDP	Stock market development (size-market capitalization/GDP, liquidity-value traded/GDP and turnover ratio); bank development (liquid liabilities/GDP)	Banks and stock markets have distinct short- and long-run impacts on GDP level at various stages of country development	30 countries, 1976–2005

Table 2: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Barajas et al. (2016)	System-GMM estimation	Real per capita GDP growth	Stock market development (liquidity-turnover ratio); bank development (private credit by banks/GDP)	Growth effects of bank credit are lower for certain regions and countries, while impacts of stock market liquidity are free of heterogeneity	146 countries, 1975–2005
Seven and Yetkiner (2016)	OLS, within-group fixed effect, and system-GMM estimations	Real per capita GDP growth	Stock market development (size-market capitalization/GDP, liquidity-value traded/GDP and turnover ratio); bank development (liquidity liabilities/GDP, bank assets/GDP, private credit by banks/GDP, bank deposits/GDP, bank assets/(bank assets + central bank assets), financial system deposits/GDP); three summary measures based on principal component analysis (one for stock market development, one for bank development, and one for overall financial development)	Bank development has a positive (negative) impact on growth in low- and middle- (high-) income countries; stock market development and economic growth are positively associated in both middle- and high-income countries	146 countries, 1991–2011

Table 2: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Hou and Cheng (2017)	OLS, GMM, and PMG estimations	Real per capita GDP growth	Stock market development (liquidity-turnover ratio); bank development (private credit by banks/GDP); life insurance market indicator	In short run, regardless of intermediating factors, bank credit has a positive effect on economic growth, while impact of stock market liquidity is insignificant. In long run, bank credit contributes to growth only in countries with low financial development, and stock market liquidity benefits growth only in low-income countries	31 countries, 1981–2008
Fufa and Kim (2018)	OLS and difference- and system-GMM estimations	Real per capita GDP growth	Stock market development (size-market capitalization/GDP, liquidity-value traded/GDP and turnover ratio); bank development (liquidity liabilities/GDP, private credit by banks/GDP, private credit by all financial institutions/GDP)	Stock market liquidity enhances economic growth in both high- and middle-income countries, while bank credit boosts growth in middle-income countries and damages growth in high-income countries	40 countries, 1989–2012
Compton and Giedeman (2011)	OLS, IV, and system-GMM estimations	Real per capita GDP growth	Stock market development (size-market capitalization/GDP, liquidity-turnover ratio);	Effect of banks on growth is larger when institutional quality is weak and	90 countries, 1970–2004

Table 2: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Slesman et al. (2019)	Dynamic panel threshold estimation	Real per capita GDP	bank development (liquidity liabilities/GDP, private credit by banks/GDP)	diminishes as institutional quality improves; impact of stock markets appears to be independent of institutional quality	77 countries, 1976–2010
			Stock market development (size-market capitalization/GDP, liquidity-value traded/GDP); bank development (liquidity liabilities/GDP, bank assets/GDP; private credit by banks/GDP, private credit by all financial institutions/GDP)	Both bank credit and stock market liquidity promote economic growth only in environments with high institutional quality	
Asteriou and Spanos (2019)	Fixed effects estimation	Real per capita GDP growth	Stock market development (size-market capitalization/GDP, liquidity-turnover ratio); bank development (liquidity liabilities/GDP, bank assets/ (bank assets + central bank assets))	Effects of both bank development and stock market development on economic growth go from positive before financial crisis to negative after financial crisis	26 countries, 1990–2016

Table 3: Interactions between banks and stock markets.

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Demirgüç-Kunt and Levine (1996)	Correlation analysis		Stock market development (size-market capitalization/GDP, liquidity-value traded/GDP and turnover ratio, concentration, volatility, asset pricing, regulatory and institutional indicators); bank development (liquid liabilities/GDP, quasi-liquid liabilities/GDP, private credit by banks/GDP, total claims of banks/GDP, spread); nonbank financial institution indicators; aggregate bank development and stock market indicators	Stock market size and liquidity are correlated with most bank development indicators; aggregate bank development indicator and aggregate stock market development indicator are correlated	44 countries, 1986–1993
Kim and Rousseau (2012)	VAR and vector error correction model (VECM) estimation	Market capitalization/GDP and value traded/GDP; M2-M1; GDP; investment	Stock market development (size-market capitalization/GDP, liquidity-value traded/GDP); bank development (M2-M1); GDP; investment	Expansion of financial intermediation leads to greater capitalization and liquidity in stock markets	Four countries, 1995–2010
Pradhan et al. (2017)	VECM, FMOLS, and DOLS estimations, Granger causality tests	Stock market development, bank development, bond market indicators, insurance market indicators, GDP growth	Stock market development (size-market capitalization/GDP, liquidity-value traded/GDP and turnover ratio, number of listed companies per 10 k population, and an aggregate indicator); bank development (broad money supply/GDP, domestic credit by banks/GDP, domestic credit by	There is evidence of bidirectional causality between bank development and stock market development	17 countries, 1991–2011

Table 3: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Demirgüç-Kunt and Maksimovic (1996)	OLS estimation	Firms' capital structure (short-term debt/total equity, long-term debt/total equity, and total debt/total equity)	financial sector/GDP, private credit by banks/GDP, and an aggregate indicator; bond market indicators; insurance market indicators, real per capita GDP growth Stock market development (size-market capitalization/GDP, liquidity-value traded/GDP and turnover ratio, securities misplacing indicator); bank development (liquid liabilities/GDP, private credit by banks/GDP, bank assets/GDP); assets of all intermediaries/GDP; aggregate bank development and stock market indicators	In economies with developed stock markets, stock market development leads to substitution of equity financing for debt financing; in economies with developing stock markets, stock market development allows firms to increase their borrowing	30 countries, 1980–1991
Arestis et al. (2001)	VAR estimation	Real GDP, stock market development, bank development	Stock market development (size-market capitalization/GDP, volatility); bank development (domestic credit/GDP), real GDP	Both banks and stock markets contribute to growth in France, Germany, and Japan, while impact of financial development in UK and US is weak; direction of causality between banks and stock markets changes from one country to another	Five countries, 24–29 years

Table 3: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Cheng et al. (2011)	Error correction-based panel cointegration test	Private credit, stock market capitalization	Stock market development (size-market capitalization/GDP); bank development (private credit by banks/GDP)	Banks and stock markets substitute for each other in low-risk countries, while in high-risk countries, they are substitutes in the short run and complements in the long run	28 countries, 1976–2003
Allen, Gu, and Kowalewski (2012)	OLS with fixed effects estimation	Bank development (private credit by banks/GDP, private credit by all financial institutions/GDP, bank assets/GDP)	Stock market development (size-market capitalization, liquidity-value traded/GDP and turnover ratio, number of listed companies per 10 k population, raised capital/GDP); bank concentration, bond market development	Stock market indicators have a positive effect on banking sector before banking crises, a negative impact during crises, and again a positive influence after crises	69 countries, 1970–2009
Wu et al. (2010)	PMG estimation; impulse response analysis	Real GDP	Stock market development (size-market capitalization/GDP, turnover ratio); bank development (liquid liabilities/GDP, bank assets/(bank assets + central bank assets))	Different indicators of bank and stock market development have different long-run and short-run effects on output; a bank development shock has positive impacts on equity development, but an equity development shock has negative impacts on bank development	13 countries, 1976–2005

Table 3: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Kim and Lin (2013)	IH fixed effects estimation	Turnover ratio, private credit, GDP growth	Stock market development (turnover ratio); bank development (private credit by banks/GDP); per capita GDP growth	Bank indicator enters stock market regression positively while stock market indicator enters bank regression with a negative coefficient	96 countries, 1976–1998
Ngo and Le (2019)	GMM estimation	Stock market capitalization; bank efficiency	Bank efficiency (estimated from data development analysis); stock market development (size-market capitalization/GDP)	Banking efficiency has a significantly positive effect on stock market capitalization, whereas stock market capitalization has a negative effect on banking efficiency	86 countries, 2006–2011
Lin (2020)	OLS, fixed effects, and IV estimations	Bank deposit growth, bank loan growth, county-level employment growth	Stock returns, stock market participation, and their interaction term	Stock market booms are associated with slower bank deposit growth, reduced loan growth, and slower employment growth	The US, 1994–2014
Deidda and Fattouh (2008)	OLS and IV estimations	Real per capita GDP growth	Stock market development (turnover ratio); bank development (private credit by banks/GDP); an interaction term between stock market development and bank development	While banking sector indicator and stock market indicator per se both have a positive effect on economic growth, their interaction term is significantly negative	100 countries, 1980–1995
Owen and Temesvary (2014)	Finite mixture model estimation	Real per capita GDP growth	Total credit/GDP; domestic lending; foreign lending; stock market capitalization/GDP	In countries with less developed stock markets, bank finance has a more positive effect on growth	82 countries, 1995–2010

Table 3: (continued)

Paper	Method	Dependent variable	Explanatory variable	Key results	Sample coverage
Botev et al. (2019)	DOLS and first difference-GMM estimations	Per capita income	Stock market development (size-market capitalization/GDP); bank development (domestic credit/GDP, private credit by banks/GDP, bank branches per capita)	Positive effects of bank credit on economy are reinforced by more developed stock markets, but not vice versa	100 countries, from mid-1990s to 2012

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