IMT Institute for Advanced Studies, Lucca

Lucca, Italy

The Role of Finance in Economic Development, Income Inequality and Poverty Reduction

PhD Program in Economics, Markets, and Institutions

XXVIII Cycle

By

Ünal Seven

2016

The dissertation of Ünal Seven is approved.

Program Coordinator: Prof. Andrea Vindigni, IMT Lucca

Supervisor: Assoc. Prof. Massimo Riccaboni, IMT Lucca

Co-Supervisor: Asst. Prof. Massimiliano Onorato, IMT Lucca

Co-Supervisor: Assoc. Prof. Ceyhun Elgin, Bogazici University

The dissertation of Ünal Seven has been reviewed by:

,

,

IMT Institute for Advanced Studies, Lucca

2016

To my family

Contents

List of Figures

List of Tables

Acknowledgements

Chapter 2 is the reproduction of the paper Financial Intermediation and Economic Growth: Does Income Matter?, co-authored with Hakan Yetkiner, forthcoming, *Economic Systems* (Elsevier);

Chapter 4 is based on the paper titled "Does Stock Market and Bank Development Reduce Inequality and Poverty? Evidence from Emerging Countries", co-authored with Yener Coskun, under review in *Emerging Markets Review* (Elsevier).

> *"If we do not know who we are, how can our activities be proper? If we are mistaken about our identity, we will also be mistaken about our activities. Simply knowing that we are not these material bodies is not sufficient; we must act according to the conviction that we are spiritual."*
>
> *Raja-vidya*: The King of Knowledge

Whenever I read this quote from *Bhagavadgita* I feel so ambitious at life and work. If we do not know what is what, we cannot behave or act properly. I hope I know who I am. I hope I am not mistaken about my identity, my activities and my work. And I believe that the achievement of a such Ph.D degree is a result of a big effort though it is not an exception. I am indebted to many people who have been the source of support, patience, motivation, enthusiasm, and immense knowledge.

First of all, I would like to express my deepest appreciation to my supervisor **Prof. Massimo Riccaboni** for the care, under-

standing, help, and support that he provided to me during the past three years.

I am grateful to my co-advisor **Prof. Ceyhun Elgin** for the support, comments and contributions to the different chapters of this thesis. He gave me the chance of spending four months of my visiting period in the beautiful city of Ístanbul.

I am really grateful to my co-advisor **Prof. Massimiliano Onorato**, who has been supporting me since the beginning. He played a key role in finalizing this dissertation. I also want to thank **Prof. Hakan Yetkiner** and **Dr. Yener Coskun** for their helpful comments, collaborations and supports.

I also want to acknowledge all the insightful and useful comments from **Prof. Andrea Vindigni** and **Dr. Alessandro Belmonte**. I am indebted to both of them for their help for the third chapter of this dissertation.

I owe my deepest gratitude to my family who have been shown me unconditional love and support for this achievement.

Last but not least I would like to thank all the beautiful people and good friends I have met at IMT, that made my permanence in Lucca much more interesting and fun:

(in *random* order)

Ílkay Öksüz, Laurence Sean Connell, Marina Andric, Alice Kate Lambert, Ajay Kumar Sampathirao, Laura Demeter, Emi Ferra, Davide Boschetto, George Davidescu, Luca Trapin, Justin Raggi, Sahizer Samuk, Yesim Tonga and so many others...

And in general many thanks to all the IMT community for the good time I had in Lucca.

Vita

March 02, 1988 Born, Erzurum, Turkey

Education

2005-2010 *Bachelor Degree in Mathematics*
Final mark: 81,6/100
Dokuz Eylül University, Ízmir, Turkey

2010-2012 *Master of Science in Finance*
Final mark: 93/100
Izmir University of Economics
Ízmir, Turkey

2014-2015 *Visiting Pre-Doctoral Fellow*
Department of Economics
Bogazici University, Istanbul, Turkey

Work Experience

2010-2013 *Teaching Assistant*
Izmir University of Economics
Department of International Trade and Finance
Ízmir, Turkey

2014-2015 *Research Analyst*
Turkish Capital Markets Association
Research and Statistics Department
Ístanbul, Turkey

Publications

1. Seven, Ü. and Yetkiner, H. (Forthcoming) *Financial Intermediation and Economic Growth: Does Income Matter?* Economic Systems.
2. Seven, Ü., Aydogan, B. and Vardar, G. (2014) *The Competitive Conditions of the Banking Industry in the Post-Crisis Period: Analysis of Turkish Banks*. Íktisat Ísletme ve Finans, vol. 29(339), pp. 49-68.
3. Seven, Ü. and Tutek, H. (2014) *The Application of the Catastrophe Theory to the Ístanbul Stock Exchange Crash of 2008*. Íktisat Ísletme ve Finans, vol. 28(330), pp. 41-60.
4. Seven, Ü. Erol, C., Okan, B. and Tunc, S. (2013) *The Impact of Financial Restructuring after 2001 Turkey Crisis on the Risk Determinants of Turkish Commercial Bank Stocks*. International Journal of Economic Perspectives, vol. 7(4), pp. 94-103.

Invited Seminars and Presentations

1. "Does Financial Development in Stock Markets and Banks Reduce Inequality and Poverty? Evidence from Emerging Countries". World Congress of Comparative Economics, Roma Tre University, Rome, Italy, 2015.
2. "Testing for Bubbles in Turkish Housing Markets: A Comparison of Alternative Methods". European Real Estate Society (ERES), Istanbul Technical University, Istanbul, Turkey, 2015.
3. "Financial Development, Inequality and Poverty: Evidence from Emerging Countries". Occasional CEE Seminar, Center for Economics and Econometrics, Bogazici University, Istanbul, Turkey, 2014.
4. "Does Financial Development in Stock Markets and Banks Reduce Inequality and Poverty? Evidence from Emerging Countries". International Conference on Economics of Turkish Economic Association, Antalya, Turkey, 2014.
5. "Does Stock Market and Bank Development Reduce Inequality and Poverty? Evidence from Emerging Countries". EconWorld, Prague, Czech Republic, 2014.
6. "Stock Markets, Banks, and Economic Growth: Does the Relationship Differ Across Income Levels?". EconWorld, Prague, Czech Republic, 2014.

Honors and Awards

1. *Erasmus Scholarship*, by the Government of Italy, 2015-2016.
2. *Fellowship for Visiting Period Abroad*, by the Italian Ministry of Education, University and Research, 2014-2015.
3. *Full Ph.D. Scholarship*, by the Italian Ministry of Education, University and Research & the Fondazione Cassa di Risparmio di Lucca, 2013-2016.
4. *Full Ph.D. Scholarship*, by Izmir University of Economics, 2012-2013.
5. *CFA Investment Research Challenge Winner*, CFA Institute, Turkey, 2012.
6. *CFA Investment Research Challenge EMEA Regional Finalist*, CFA Institute, UK, 2012.
7. *Honor Student*, Master of Science in Finance, Izmir University of Economics, Turkey, 2012.
8. *Full Scholarship*, Master of Science in Finance, Izmir University of Economics, Turkey, 2010.
9. *Honor Student*, Bachelor of Science in Mathematics, Dokuz Eylul University, Turkey, 2010.

Abstract

The financial sector is seen as performing critical functions in facilitating economic growth and, both directly through broadening access to finance and indirectly through growth, contributing to reductions in inequality and poverty by mobilizing savings, facilitating payments and trade of goods and services, and promoting efficient allocation of resources. This dissertation analyses the role of finance in economic development, income inequality and poverty reduction by differentiating between banks and stock markets. It also studies the impacts of the two components of the financial sector, from both theoretical and empirical points of view. The second chapter examines the impact of financial development on economic growth across income levels by providing empirical analyses for a large panel of countries. The third chapter studies the role of finance in income inequality by building an occupational choice model under financial market imperfections and providing empirical analyses for the relationship between financial development and income inequality. The fourth chapter analyses the link between banks, stock markets and poverty reduction by providing empirical analyses for a panel of emerging countries.

Chapter 1

Introduction

Financial systems and intermediaries perform critical functions in domestic and global economies. The main role of the financial markets and institutions in all economies is to improve the efficiency of capital allocation, mobilize savings, lead to more capital formation, manage risks, and facilitate transactions. When financial markets and institutions work well, they provide opportunities for all market participants to take advantage of effective investment by diverting funds to more productive use, hence boosting economic growth. It may be expected that this framework would also reduce income inequality and poverty. On the other hand, if financial markets do not work well, opportunities for growth are missed and inequalities persist. In the case of the existence of financial market imperfections, the least wealthy and the smallest enterprises may be the most affected by information asymmetries, contract enforcement costs, lack of collateral, and transaction costs, namely a lack of finance. As a result, financially constrained entrepreneurs need to rely on their own limited personal wealth or internal resources to invest in their own projects, and thus remain in poverty, perpetuating inequality in the country. Certainly, the question of whether deeper financial markets lead to more economic growth but also less income inequality and poverty becomes important mainly because the great divergence between rich and poor countries as a whole and the very poorest countries

as a whole has continued beyond the end of the twentieth century. My research focuses on these issues in a systematic framework by providing theoretical and empirical results. On the theoretical side, I analyse in a simple model how the interaction between financial development and entrepreneurial talent determines the distribution of income. On the empirical side, I study the impacts of financial development on economic growth, income inequality and poverty by providing panel data analyses. Below I briefly elaborate on the three chapters that study the role of financial development in economic development, income inequality and poverty.

The second chapter studies the relationship between financial development and economic growth. Although a vast theoretical and empirical literature on the relationship between the development of the financial sector and economic growth suggests that the financial system may promote long-run economic growth, there is no general consensus about the role of either stock markets or banks on economic growth. Theory provides conflicting predictions about the relationship between stock markets, banks, and economic growth. In this chapter, I analyse the simultaneous and separate impacts of banks and stock markets on economic development across different income levels using a comprehensive dataset and modern econometrics techniques. In addition, to address the difficulties with measuring the level of financial development and to capture a more complete picture of financial systems, I construct composite indexes that represent the overall development in stock markets and the banking sector by employing principal component analysis. The econometric analyses suggest that banking development has a positive effect on economic growth in low- and middle-income countries, but negative in high-income countries. However, I also find that stock markets contribute to economic growth in both middle- and high-income countries. Moreover, the results show that the estimated coefficients mostly lose their significances when I test the simultaneous effect of banks and stock markets, suggesting that one should consider both separate and simultaneous effects of banks and stock markets to have satisfactory results.

The third chapter focuses on the impact of financial development on

income inequality. Since the results of the second chapter suggest that well-functioning financial systems may help boost economic growth, it is worthwhile to investigate whether they also reduce income inequality. To do that, I firstly build a simple occupational choice model with heterogeneous agents to better understand the mechanism of the effects of financial development on the level of income inequality. In the model, individuals choose between being an entrepreneur, being self-employed, or being a worker depending on their initial wealth and talent. I define the level of financial development as the amount of collateral required to get credit from the financial sector. In that respect, a decline in the amount of collateral (namely, relaxing credit constraints) reduces income inequality as individuals with relatively low wealth become more likely to obtain credit, set up firms and receive higher incomes than the workers'; that is, relatively poor individuals can be entrepreneurs thanks to financial development. On the other hand, if the amount of wealth required as collateral increases, then wealthy individuals become even wealthier by running firms and obtaining higher income, resulting in increasing income inequality. In the equilibrium of this setting, only talented individuals with a certain level of wealth choose to become entrepreneurs. Hence, the development of a financial system increases the earning opportunities for the talented poor by decreasing the amount of collateral. The model suggests that as the financial system develops, namely that the amount of collateral required decreases, some poor individuals with relatively high talent can become entrepreneurs, resulting in an increasing share of entrepreneurs and increasing average talent of entrepreneurs. In other words, the level of financial development affects income inequality to the extent it affects the equilibrium number of entrepreneurs and average entrepreneurial talent, and an increase in the level of financial development induces more individuals to become entrepreneurs, resulting in less income inequality. Secondly, I empirically test the impact of financial development on income inequality by using a cross-country panel data set of developed and developing countries, taking into account the role of individuals' talent in reducing inequality. I use the theory to quantify the importance of financial development

and individuals' talent for cross-country income inequality differences. A central ingredient in the analysis is the observed achievement levels (talent) constructed from the Program of International Student Assessment (PISA) scores. Heuristically speaking, none of the empirical studies in the literature has ever tried to link the theory to the empirics. This is indeed very surprising, if not disappointing, as there are extensively developed occupational choice and income inequality approaches under financial frictions. Hence, integrating theory with empirics, albeit in a very simple manner, is the very important motivation of the third chapter. The empirical results suggest that an increase in the level of financial development leads to a decrease in the net Gini coefficient. Moreover, the results also suggest that there is a negative and statistically significant relationship between individuals' talent and income inequality. A key policy conclusion is that more democratized access to credit markets reduces income inequality. Moreover, redistributive social policies and institutional improvements in finance would also be effective in reducing inequality.

The objective of the fourth chapter is to examine whether bank and stock market development contribute towards poverty reduction in emerging countries. Economists have long debated whether financial sector development can bring direct benefits to the poor. One strand of literature stresses that capital market imperfections and lending constraints that limit access to finance may affect poverty during economic development. Although it is known that absolute poverty has been reduced over the last two decades, the exact impact of financial sector development on poverty reduction has not been well defined in empirical studies. Using dynamic panel data methods with a comprehensive dataset for the period 1987-2011, I first assess the relationship between banks, stock markets and poverty indicators. Then, I examine the effect of overall financial development, including banks and stock markets, on poverty reduction. In other words, the fourth chapter empirically investigates whether improved access to banking or stock market opportunities is the main channel through which financial development contributes to a reduction in poverty. By developing new proxies for measuring both bank and

stock market developments, I find that although financial development promotes economic growth, this does not necessarily benefit those on low-incomes in emerging countries. Moreover, contrary to the conventional findings, the results suggest that neither banks nor stock markets play a significant role in poverty reduction.

Chapter 2

Financial Development and Economic Growth: Does Income Matter?

2.1 Introduction

The main role of the financial markets and institutions in all economies is to improve the efficiency of capital allocation and encourage savings, hence boosting growth, leading to further capital formation, the mobilization of savings, the management of risks, and the facilitation of transactions. The financial system may achieve this role through either credit markets or equity markets, or both. There is considerable country specific variation in the elements of the financial sector possible for channelling resources from savers to investment opportunities.[1] Although a vast theoretical and empirical literature on the relationship between financial sector development and economic growth suggest that finan-

[1] In modern economies, the process is conducted by a wide range of market-oriented institutions. While the process is conducted by a few elements of financial sector in planned economies, a single institution, especially the banking sector, plays an important role in the emerging market economies (Bonin and Wachtel, 2003).

cial system may promote long-run economic growth[2], there is no general consensus about the role of either stock markets or banks on economic growth. Theory provides conflicting predictions about the relationship between stock markets, banks, and economic growth. Many researchers are becoming increasingly convinced that well-functioning financial systems can boost economic growth by ameliorating information and transaction costs (Bencivanga et al., 1995; King and Levine, 1993a; Beck and Levine, 2004). However, some models show that higher returns from enhancing resource allocation may lower saving rates. If there are sufficiently large externalities associated with saving and investment, then financial development slows long-run growth rate (Bencivanga and Smith, 1991; Naceur and Ghazouani, 2007).

Although the existing literature provides substantial and wide-ranging evidences on the role of the financial system in shaping economic development, there are serious shortcomings associated with the functioning of the financial system (Cihak et al., 2012). Firstly, researchers have no direct measures to determine the degree to which financial systems are successful in achieving their main role, mentioned above. Financial proxies used in the empirical literature are currently mostly relied on measures of the size of the banking sector and stock markets due mainly to their availability across countries and time. However, the existing measures are far from meeting is the requirements for cross-country studies, especially for less wealthy countries. Secondly, in addition to the problem of high correlation between the existing measures, there is no uniform argument as to which variables are most appropriate for measuring financial development. Focusing on a single indicator of financial institutions and markets is unlikely to capture all features of a financial system, justifying the construction of index measures that represent the separate or simultaneous development in the banking sector and stock markets.

This chapter aims to investigate the dynamic impacts of stock markets and banks on economic growth. This study makes several contributions. Firstly, this study fills an important gap in the literature by si-

[2]Levine (2005) presents a survey of theories on the issue and lists the possible channels through which financial system may influence economic growth.

multaneously analysing the impacts of both stock markets and banks on economic development across different income levels using a comprehensive dataset and modern econometrics techniques. In addition to the benefits of updated and a comprehensive data, up to 146 countries and 21 years in some regressions, a further innovation is the separate and simultaneous effects of banking and stock markets. This is important because although there exists a broad literature on the finance-growth nexus, conventional literature has not considered the role of stock markets. The second contribution of this study is the incorporation of both banking and stock market indicators to examine the long-run relationship among both markets and economic growth using principal component analysis to construct broad indexes that capture various dimensions of the financial sector. The use of principal component analysis to build a composite index of financial development is one of the most important aspects of this study. Since financial intermediation, especially in developing and developed countries, is generally more sophisticated and has more dimensions, building this index helps us to capture a more complete picture of financial development.[3] Moreover, researchers do not have direct measures of the degree to which a financial system, as a whole, performs its key functions, and there is no uniform argument as to which proxies are most appropriate for measuring financial development. Due to the lack of sufficient data across countries, and the differences among economies, a comprehensive index or principal component better represents "what is broadly meant by financial development". In this respect, principal component analysis (PCA) is utilized in this chapter to construct satisfactory and reliable indicators of bank and stock market developments. Thirdly, this study considers a panel from a range of high-, middle-, and low-income countries, in accordance with the World Bank classification, to investigate whether the relationship between financial development and economic growth differs across income levels. Although there is a

[3]In addition, using only one banking & stock market development indicator may not be closely related to the complete information of financial services. On the other hand, if I had used more than one indicators of financial development in the analyses, I could have faced with the multicollinearity problem since financial development variables are highly correlated as shown in part (2.3.3).

large body of literature that investigates the linkage between financial development and economic growth in advanced economies, far less is known about the finance-growth nexus in developing and the least developed countries. Furthermore, some researchers have shown that the effects of finance on economic growth may vary according to the country's income level.[4] Finally, this study also aims to address the difficult problem of measuring the depth of financial system.[5] To the best of my knowledge, no systematic empirical research exists that addressing the question of how to construct an index as a single measure representing the overall development of financial system. The study of Ang and McKibbin (2007) can be termed as one of the first steps in this direction, but unlike their study, I take into account both the influence of stock market development and also the dynamic impacts of stock markets and banks on economic growth.

Methodologically, I first divide the sample into three different income groups; high-, middle-, and low-income. Next, I employ principal component analysis to construct the index measures for bank & stock market development, rather than using widely used and highly correlated group of variables. Then, I construct a panel with data averaged over three year non-overlapping intervals from 1991 to 2011 to smooth out short-term fluctuations in growth rates. The empirical part of this study employs the System Generalized-Method-of-Moments (GMM) approach developed by Arellano and Bond (1991) and Blundell and Bond (1998). In order to increase the explanatory power of financial development on economic growth, I use secondary school enrolment rate, government consumption share in Gross Domestic Product (GDP), inflation rate, and trade as a ratio of GDP as control variables. The robust results show that banks have a positive effect on economic growth in low- and middle-income countries, but negative in high-income countries. I find that stock mar-

[4]See Rioja and Valev (2004) and Aghion et al. (2005), among others.

[5]There is no directly measurable or reliable data available to measure the extent and efficiency of financial intermediation although the existing measures have been improved over the last ten years (Ang and McKibbin, 2007). Moreover, Levine (2003) mentions the problem of choosing a proxy for measuring financial development and the differences among economies in terms of the availability of financial intermediation.

kets, however, contribute to economic growth in both middle- and high-income countries. Moreover, the results also show that the estimated coefficients mostly lose their significances when I test the simultaneous effect of banks and stock markets, suggesting that one should consider both separate and simultaneous effects of banks and stock markets to have satisfactory results.

The organization of the chapter is as follows. Section 2 reviews the broad literature of the research field. Section 3 introduces the data and the methodology. This section also explains the construction of the summary measures for bank development and stock market development. Section 4 is reserved for empirical analysis. Section 5 includes concluding remarks and policy implications of financial development.

2.2 Literature Review

The literature on economic theory emphasizes that the comparative importance of banks and equity markets for economic activity changes during the process of economic development, during which markets becoming increasingly important for economic activity (Demirgüç-Kunt et al., 2012). Moreover, the recent global financial crisis, which was mainly triggered by high default rates of sub-prime mortgages, shows that a close interaction between bank and equity markets influences economic growth. The historically low levels of interest rates, the securitization process, adverse selection problems, and moral hazard incentives combined brought a close relationship between banking sector and capital markets during the early years of 2000s.[6] More specifically, as the slowing of economic growth through crises can be attributed to the financial system, it is crucial to examine the simultaneous impact of stock markets and banks on economic growth.

The early theoretical and empirical literature focused on the role of capital and labour resources, and the use of technology as the sources of growth. The role of finance in the growth process was ignored in

[6]See Wu et al. (2010).

the majority of the early literature. In the 1970s, a widespread movement toward financial development and growth nexus emerged, notably with the early work by Goldsmith (1969), McKinnon (1973) and Shaw (1973).[7] Since then, especially after 1990s, there have been various studies designed to investigate the relationship between financial development and economic growth. A large body of research that concentrates on the link between financial development and growth has shown that a well-functioning and market-oriented financial sector contributes to improved economic outcomes (King and Levine, 1993a; Demirgüç-Kunt and Levine, 2008; Rousseau and Wachtel, 2000). In particular, this literature has shown that financial depth is associated with higher rates of economic growth. In the early 1990s, King and Levine (1993a)[8], developing the work of Goldsmith (1969), studied economic growth over a 30-year horizon by enlarging the sample to 80 countries, and systematically controlling for many possible determinants of economic growth, such as initial income, black market premium, government spending, openness to trade, educational attainment, inflation, and political instability. They found a robust, positive, and statistically significant relationship between growth indicators and bank development, as measured by the total liquid liabilities of financial intermediaries over GDP. However, there were two drawbacks: they focused only on the banking sector, and neglected to address the causality issue.

In addition to King and Levine (1993a), numerous other efforts provide theoretical and empirical evidence to investigate the relationship between financial development and economic growth. Pagano (1993) argues that financial intermediation impacts economic growth by influencing saving rate, i.e., the fraction of savings channelled into investments.

[7]Goldsmith (1969) finds that the size of the financial system positively contributes to economic growth using a comparative approach with data for 35 countries for the period 1860-1963. McKinnon (1973) and Shaw (1973) stress the crucial role of public policies in the mobilization of savings that aims to finance investment and they suggest that there is a relationship between financial development and savings and investment rates.

[8]King and Levine (1993) assume the role of the financial system in the evaluation of projects and diversification of the risk associated with innovation in their endogenous growth model. Their analysis suggests that financial sector plays an important role in the acceleration of economic growth through its impact on innovation.

Levine et al. (2000) use instrumental variable techniques to address the endogeneity issue between financial development and economic growth in a panel data setting. They find that the exogenous component of financial intermediary development is positively associated with economic growth. Beck and Levine (2004) apply GMM techniques developed for dynamic panels, and find that both stock markets and banks are positively correlated with economic growth after controlling for the simultaneity bias and omitted variables effects. Rousseau and Wachtel (2000) use the difference panel estimator, developed by Arellano and Bond (1991) and Holtz-Eakin et al. (1988), showing that both bank and stock market development explain subsequent growth.[9]

One interesting research focus is the identification of the combined impacts of banks and stock markets on economic growth. This is because the failure to consider the impact of stock market development makes it more difficult to accurately assess whether the positive relationship between bank development and growth holds when controlling for stock market development and overall financial development matters for the growth (Beck and Levine, 2004). The study of Levine and Zervos (1998) is known to be foremost in which they investigate the relationship between stock markets and banks on economic growth using cross-country growth regressions.[10] Levine and Zervos (1998) find that initial measures of stock market liquidity and banking development are positively correlated with economic growth after controlling for the other possible growth determinants and the Solow-Swan convergence effect. As a measure of bank development, they use the ratio of bank credit to the private sector divided by GDP. To measure the stock market development, they use market capitalization relative to GDP, the value of trades relative to

[9]Time series techniques have also been applied to the finance-growth nexus. For example, Arestis et al. (2001) use quarterly data on a sample of developing countries and find that although both banks and stock markets may be able to promote economic growth, the impact of banking sector development is more powerful. See also Demetriades and Hussein (1996), Rousseau and Wachtel (2000), and Bekaert et al. (2005).

[10]Atje and Jovanovic (1993) also asses the role of stock markets on economic growth. They find that the stock market is a predictor of economic growth, whereas there is no significant relationship between banking sector development and economic growth. See, Levine (2001) and Bekaert et al. (2005) for more empirical evidence on the stock market, bank, and growth relationship.

GDP, and market liquidity which is measured by the value of trades relative to market capitalization. However, they neglected to control for country-fixed effects and simultaneity bias.

A contradicting view to this well-supported argument that financial development has positive effect on economic growth is given by models, which emphasize that finance does not in fact cause economic growth. Robinson (1952), for example, argues that finance exerts no causal impact on growth. Instead, financial development follows economic growth as a result of higher demand for financial services. Lucas (1988) states that the role of finance is over-stressed in the growth literature. Naceur and Ghazouani (2007) show that there is no significant relationship between banking sector and stock markets development levels and economic growth in their study on 11 MENA countries. Arcand et al. (2012), using the private credit to GDP ratio as an indicator of financial depth, arguing that countries with a small or medium sized financial system benefit from increased financial depth. However, they show that the effect of the size of the financial system vanishes as the proportion of financial system reaches 80-100 percentage of GDP. There is also currently no consensus on the separate effects of stock markets and banks on economic growth. Harris (1997), using the instrumental variables method, finds no critical role for stock markets in easing information frictions. Stiglitz (1985) and Bhide (1993) argue that stock markets do not have the same potential to improve resource allocation as banks.[11] More recently, Cecchetti and Kharroubi (2012) study the impact of size and growth of the financial system on productivity growth and economic level based on a sample of developed and emerging economies. Their findings suggest that higher level of financial activity is not always better.[12] Beck (2011) finds that, although the aggregate growth impact of banking depth is no different for resource-based economies, both private credit and stock market activity tend to be weaker. The debates among economists over the relationship between financial sector development and growth make

[11] See also Boyd and Prescott (1986) and Arestis et al. (2001).

[12] Moreover, Arcand et al. (2012) find that as depth increases to very high levels, the impact of banking depth on growth becomes progressively weaker.

this a research area relevant to empirical studies as well as theoretical work.

Research provides conflicting results not only regarding the effect of overall financial development or the separate impacts of stock market development and bank development on growth, but also for the effects of finance on growth across income levels. In the literature, most of the studies focus on high-income or developed countries whereas very few focus on developing countries. Mainly due to problems with data availability across countries, there are a limited number of empirical studies that investigate the impact of finance on economic growth across regions, income levels, and types of economy. Demirguc-Kunt et al. (2001) and Demirgüç-Kunt et al. (2012) show that both bank and stock market become more developed as countries develop economically. Aghion et al. (2005) use a cross-section of 71 countries over the period 1960-1995 and find that countries close to the efficient frontier do not benefit from financial development. Rioja and Valev (2004) study the effects of financial development on the sources of growth using a sample of 74 countries, divided into three regions, over the period 1961-1995. Although finding no statistically significant relationship between financial depth and economic growth in less developed economies, they observe a strong positive influence on productivity growth in more developed countries. The studies distinguishing between high-, middle-, and low-income countries generally emphasize that the relationship between financial development and growth is weaker or even negative for high-income countries. Hassan et al. (2011) use 168 countries in the period of 1980-2007, and they group countries into several sub samples. They find a statistically significant negative relationship between domestic credit to the private sector and economic growth for high-income countries while they find a positive and statistically significant relationship between domestic credit to private sector and growth in East Asia & Pacific and Latin America & Caribbean. Moreover, Barajas et al. (2013) use a data set for 150 countries and apply dynamic panel techniques to investigate whether the impact of financial deepening on economic growth varies across countries. Finding that the relationship between finance

and growth is heterogeneous across regions, income levels and between oil and non-oil exporters, they argue that this heterogeneity is primarily because of the level of banking depth rather than stock market activity. Rioja and Valev (2014) find that stock markets have not contributed to growth in low-income countries, while banks have a sizeable positive effect on capital accumulation. They also show a positive relationship between stock market development and growth in high-income countries. Similarly, Lin et al. (2009) show theoretically that the structure of the financial system depends on the country's stage of development. It can be concluded, therefore, that the effects of finance on economic growth may vary according to the country's income level.

2.3 Data and Methodology

2.3.1 The Sample

I use an updated country sample, with up to 146 countries included in some regressions, for the period 1991-2011. Since this study mainly focuses on the impacts of financial development on economic growth, I choose the countries for the panel according to data availability on financial sector development indicators. I require that a country should have data for at least four non-overlapping time points to be included in any estimated systems. This leaves 146 countries for banking sector analyses and 80 countries for stock market analyses. I follow the World Bank classifications, which categorize all World Bank member economies and all other economies with population of more than 30,000 into four income groups. However, I divide the sample countries into three income groups by combining the upper- and lower-middle income countries into one category, middle income.[13]

The sample comprises 45 high-income countries (high-income OECD and non-OECD countries), 77 middle-income countries (upper-middle income and lower-middle income countries) and 24 low-income coun-

[13]See Table A.1 in Appendix A for the list of countries and their respective income classification.

tries. The sample is restricted to the period 1991-2011 on the basis of availability of the data, especially on stock market development. The sample period also covers an era of financial liberalization and development in many countries, as well as money growth and an increasing volume of investment. I compute three-year period averages for all variables in the model. I do so for two main reasons. First, the variables of interest may be subject to business cycle variations. Averaging data over a period is used to smooth out business cycle variations in growth rates. Second, the System GMM model was designed to work with data having fewer time points and greater numbers of individuals. Taking three-year averages yields a maximum of seven time points for any country in the sample, which would then satisfy the time requirement of the econometric model.[14]

2.3.2 Measures of Financial Development

The selection of key variables to measure financial development and differences among economies in terms of availability of financial intermediation are the major problems in an empirical study of finance-growth nexus. Due to the diversity of financial services provided by financial systems, the construction of financial development indicators is a difficult task. One should consider the different aspects of financial development rather than the traditional intermediation activities in order to capture a complete picture. In this respect, I use both bank-based and market-based financial proxies to capture the development of financial system. Although the empirical literature has used several indicators in order to measure financial depth, there are currently no direct measures of the degree to which financial system performs its basic functions such as mobilization of savings, allocation of resources to productive uses, fa-

[14]I have seven non-overlapping periods (1991-1993, 1994-1996, 1997-1999, 2000-2002, 2003-2005, 2006-2008, and 2009-2011). Generally speaking, the empirical literature uses three or five year averages. For instance, Hassan et al. (2011) use three-year average growth rates whereas Levine et al. (2000) use non-overlapping five-year average data in their GMM specifications. Since the data becomes stationary, I prefer to use three-year averages in order to have more time points. Moreover, averaging data over a time period solves missing data problem and becomes popular in dynamic growth model.

cilitating transactions and risk management, and exerting corporate control.

In an attempt to construct a reliable indicator by taking the relevant financial proxies into account, for stock market development and bank development, I employ principal component analysis by following Ang and McKibbin (2007).[15] I use logarithm of liquid liabilities to GDP (*liquid*), logarithm of deposit money bank assets to GDP (*assets*), logarithm of private credit by deposit money banks to GDP (*private*), logarithm of bank deposits to GDP (*deposits*), logarithm of deposit money bank assets to deposit money bank assets and central bank assets (*central*), and logarithm of financial system deposits to GDP (*finsys*) as the proxies for bank development.[16] To measure stock market development, I use logarithm of stock market capitalization to GDP (*mktcap*), logarithm of total value traded to GDP (*traded*), and logarithm of stock market turnover ratio (*turnover*).[17] Each of these variables is adding extra information to better measurement of financial development. For example, liquid liabilities to GDP ratio is used to measure the ability of the banking system to channel funds from savers to borrowers. A higher liquidity ratio means higher intensity in the banking system. Bank credit to the private sector reflects the extent of efficient resource allocation since the private sector is able to utilize funds in a more efficient and productive manner as compared to the public sector. The ratio of deposit money bank assets to deposit money bank assets and central bank assets measures the relative importance of a specific type of financial institution, i.e., the deposit money banks. The basic idea underlying this ratio is that deposit money banks make more efficient use of funds than central banks. Moreover, stock market capitalization is the product of share price and the number

[15] Ang and McKibbin (2007) did not take into account the stock market indicators to get summary index of financial development. They only used banking sector indicators of financial development.

[16] Private credit to GDP ratio is one of the most widely used indicators of financial development (King and Levine, 1993a; Levine et al., 2000; Rioja and Valev, 2004). Liquid liabilities to GDP ratio is used by Goldsmith (1969) and King and Levine (1993) as the size of the financial sector in relation to GDP.

[17] See Levine and Zervos (1998), Beck and Levine (2004), Demetriades and Rousseau (2011), and Demirgüç-Kunt et al. (2012), among others.

of shares outstanding for all stocks traded on the principal exchange(s) of a given country. It measures the overall size of stock markets and reflects the importance of financing through equity issues in the capital mobilization and resource allocation process. The ratio of total value traded to GDP measures the stock market activity, and contains components of both size and liquidity, higher values of which reflect the confidence of both individual and portfolio investors, of stock markets. Stock market turnover ratio is the ratio of total value traded to market capitalization, and it is a measure of share liquidity. It measures how active or liquid the stock market is relative to its size. Changes in the degree of turnover reflect short-term fluctuations associated with the business cycle.

Using these variables, I develop three summary measures, one for bank development (*bank-aggregate*), one for stock market development (*market-aggregate*), and the last one for the overall financial development (*finance-aggregate*), including stock markets and banks. Each measure employs the principal component analysis that deals with the problems of over-parametrization and multi-collinearity.[18] Theoretically, these new indexes for stock market development and bank development are able to capture most of the information from the original dataset, which consists of nine overall financial development measures.

To assess the strength of the independent link between stock markets, banks and economic growth, I control for other potential determinants of economic growth in the regression. I use standard control variables that are widely used by majority of the growth literature, starting with Barro (1989) specification (see, for example, Levine and Zervos, 1998; Rioja and Valev, 2004; Beck and Levine, 2004; Rousseau and Wachtel, 2000). First, I include logarithm of real initial GDP per capita to control for convergence effects, which states that countries that are initially poorer are expected to grow faster; several studies suggest that per capita income might be a good indicator for general development (see, for example, La Porta et al., 1997; Beck and Levine, 2004). Second, a secondary school enrolment rate (*education*) is used to control for human capital accumula-

[18] Principal component analysis has been used to reduce a large set of correlated variables into a smaller set of uncorrelated variables. See, Stock and Watson (2002).

tion. Barro (1991) uses the elementary school enrolment rate to measure the initial stock of human capital in a growth study. In other studies, the inflation rate (*inflation*) and the ratio of government consumption to GDP (*government*) are used to measure the macroeconomic stability (see Scully, 1989; Beck et al., 2000). In this study, a further measure, the ratio of trade to GDP (*trade*), is used to capture the degree of openness of an economy. These various control variables, expressed as natural logarithms (with the exception of the inflation rate, which enters the equation as the log of 1 plus the inflation rate), have the effect of increasing the explanatory power of financial development on economic growth. For all variables, I calculate 3-year average values from the yearly time series of these indicators. The sources and short definitions of the financial development indicators and control variables are provided in Table A.2 in Appendix A.

2.3.3 Summary Statistics, Correlations and Principal Components

The dependent variable is economic growth, measured by the real GDP per capita growth (at constant 2005 US$). Table 2.1 provides summary statistics for the nine financial development indicators, dependent variable and four control variables. There are considerable variations in financial development variables across countries. For example, private credit to GDP ratio ranges from a low of 0.11% in Armenia to a high of 272% in Cyprus. Liquid liabilities to GDP ratio and turnover also show significant variation. The liquidity to GDP ratio varies from 380% (Luxembourg) to 0.24% (Armenia), and the turnover ratio ranges from 448% (Kyrgyzstan) to 0.02% (Swaziland).

The sample correlations are given in Table A.3 in Appendix A. In general, the correlation coefficients are excessively high, which suggests that the financial development indicators may contain common information and may lead to multicollinearity and over-parametrization problems (Ang and McKibbin, 2007). To deal with these problems, I use principal component analysis (PCA), which is the optimal linear scheme for reduc-

Table 2.1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Growth	873	.066444	.1090644	-.6219241	.914685
Private	984	43.22258	41.67111	.1152023	272.735
Liquid	982	54.16641	46.16431	.2478361	380.4252
Central	955	84.46751	17.73942	15.67734	99.99907
Assets	983	52.67902	46.03872	.1252552	298.4128
Deposits	980	46.2819	44.46518	.1859279	376.2705
Finsys	982	46.58204	44.47733	.1859279	376.2705
Mktcap	623	47.1353	56.81037	.0124085	486.1752
Traded	615	28.72085	57.18208	.0014755	675.9176
Turnover	614	46.50081	57.74979	.0198378	448.5403
Inflation	1018	48.48239	385.2324	-8.232694	9288.871
Education	867	73.75177	31.89412	5.16489	155.5195
Trade	1012	87.69934	52.11233	14.9024	428.1443
Government	988	15.72042	5.847509	2.554207	42.89479

Note: The table presents the summary statistics about the variables used in the econometric analysis for the 146 countries during the period 1991-2011. The data are extracted from the World Bank and IMF's International Financial Statistics. All variables are in percentage form (except growth) and represent the three-year averages. Max., Min. and Std. Dev. denote maximum, minimum, and standard deviation, respectively.

ing a large set of correlated variables into a smaller set of uncorrelated variables.[19] However, due to the lack of data availability across time and countries, the sample has some missing values. Although PCA has attractive features, a challenge is presented by the incomplete data set, in which some of data points are missing. To solve this problem, some interpolation methods have been used to complete the missing data, such as replacing the missing values with the mean or an extreme value, a common strategy in multivariate statistics. In the sample, a significant portion of the measurement matrix is known, while up to 10 percent of the information is missing for certain variables, such as *traded*, *central* and *deposit*. To test the effect of missing values, I restrict the sample to 57 countries with no missing data for any of the financial development indicators. When I perform PCA with the restricted sample, I see that there is no significant difference between the principal components of the restricted and unrestricted samples.

Table A.4 presents the results of the extraction of PCA for banking development. The financial development indicator for banking corresponds to the first principal component, which is the only one with an eigenvalue greater than 1, and which explains about 86% of the varia-

[19]See Appendix A.2 for the detailed description of the principal component analysis.

tion in the dependent variable. The remaining principal components are not considered since their marginal contributions are relatively small (for instance, while the second principal component explains 10% of the variation of the dependent variable, the third principal component explains only 3%).

Table A.5 presents the results obtained from PCA of stock market development indicators. In this case, I extract again the first principal component, which is able to capture 80% of the information from the original dataset. The first component is computed as a linear combination of the three standard measures of stock market development with weights given by the first eigenvector.

As one can see from the second part of the Tables A.4 & A.5, all banking development indicators except deposit money bank assets over deposit money bank assets plus central bank assets contribute almost equally to the first principal component, while stock market development indicators contribute differently, with "traded ratio" has the highest correlation among other two, to the first principal component. The correlations between the selected variables and first principal component indicate that it is difficult to see which mechanisms are driving the results of banking development, while it is clearer that total value traded to GDP ratio is the driving indicator for measuring stock market development.

2.3.4 Methodology

This study aims to examine the relationship between stock market development, bank development, and economic growth, and to investigate whether this relationship differs across income levels. A large number of studies use cross sectional analysis for estimating the growth regression (Barro, 1989; King and Levine, 1993; Rousseau and Wachtel, 2000) and use the Fixed Effects (FE) regression models to control the country specific effect. However, neither cross-sectional or FE models does not take into account the issue of endogeneity present in the growth equation (Caselli et al., 1996). The financial development variables may be endogenous because of feedback from growth to finance, or because of

the common effects of omitted variables on both growth and finance (Aghion et al., 2005). To deal with the problem of country specific effects and the problem of endogeneity, I use generalized method of moments introduced by Holtz-Eakin et al. (1988), Arellano and Bond (1991), and Arellano and Bover (1995) and popularized in the finance-growth literature by Levine et al. (2000) and Beck and Levine (2004). I employ the System GMM method, though I also present the OLS and Within Group results for reasons of completeness. I prefer to use the one-step GMM estimators with standard errors that are not only asymptotically robust to heteroskedasticity, but have also been found to be more reliable for finite sample inference.[20]

The standard panel data estimates methods such as FE and First Differences (FD) allow for unrestricted correlation between unobserved heterogeneity, and past, present and future values of the right hand side variable. In order to achieve consistency they require that all regressors are strictly exogenous. This assumption is clearly violated in the case of the lagged dependent variable, since the error term cannot be orthogonal to the lagged values of the dependent variable. Hence, under sequential exogeneity, the OLS, Within Group (FE) and FD estimators are all inconsistent for the fixed number of years. The System GMM has three main advantages compared to the OLS and Within Group estimators. First, this method provides consistent and efficient parameter estimates in a regression in which independent variables are not strictly exogenous, that correlated with past and current realizations of the error, and that heteroskedasticity and autocorrelation within individuals exist (Roodman, 2009b). The second advantage is that the System GMM estimator overcomes the endogeneity problem, as it instruments the endogenous variables with variables thought to be uncorrelated with the fixed effects, while avoiding dynamic panel bias. Another advantage is that System GMM is very well suited to panel studies consisting of few time points

[20] In principle, researchers should use the two-step estimates as they are the efficient GMM estimates. However, in finite sample, it has been shown that the two-step variance-covariance matrix is biased downward, so that leads to over-rejecting. Therefore, the common practice has been to use the one-step estimates with a robust variance-covariance matrix. Moreover, see Blundell and Bond (1998) and Hoeffler (2002).

but many individuals (small "t", large "N") (Roodman, 2009a).

The availability of panel data offers some important advantages. It allows to the detection of effects that would not be possible with simple cross-section or time series data, and also allows us to control for individual heterogeneity. In a dynamic panel data model, I will be able to account for unobserved country specific effects and allow for the endogeneity of one or more of the regressors. In panel data, variables vary along two dimensions (time and individuals). This usually leads to an increase in the efficiency of the estimates with respect to a series of cross sections with the same number of observations. Hence, the System GMM estimation method is more suited to this panel study, which consists of 146 individuals but only seven time points. Due to these advantages, I select the System GMM estimation method, proposed by Arellano and Bover (1995) and Blundell and Bond (1998).

The System GMM estimator combines the standard set of equations in first-differences with suitably lagged levels as instruments, with an additional set of equations in levels with suitably lagged first-differences as instruments.[21] The consistency of the System GMM estimator depends on the assumptions that there should be no serial correlation in the error term and the instruments should not be correlated with the error term. The issues are addressed through two tests: the Arellano-Bond test for serial correlations, which examines the first and the second order autocorrelated disturbances in the first differences equation, and Hansen (1982) test of over-identifying restrictions for the validity of the instruments.[22] If both of these tests are satisfied, then the coefficient estimates are consistent. Moreover, I use "collapsed instruments", a technique implemented in Stata by Roodman to limit the proliferation of instruments, which can weaken the usefulness of the Hansen test (Gantman and Dabós, 2012).

I can write the traditional cross-country growth regression as follows:

$$\ln [y_{i,t}] - \ln [y_{i,t-1}] = \gamma_0 + \gamma_1 \ln [y_{i,t-1}] + \gamma_2 \ln [X_{i,t}] + \gamma_3 \ln [Z_{i,t}] + c_i + \mu_t + \epsilon_{i,t} \tag{2.1}$$

[21] See Appendix A.3 for brief summary of the System GMM Estimator.

[22] Additionally, the number of cross sections should be larger than the number of instruments to overcome over-fitting bias (Roodman, 2009a).

where $\ln[y_{i,t}]$ is the logarithm of real per capita GDP averaged over a series of three year periods, $\ln[y_{i,t-1}]$ is the logarithm of per capita GDP at the beginning of each of these periods, X represents the set of explanatory variables of stock market development and bank development. The focus of the studies is on estimating γ_2, which indicates the effects of bank development and stock market development on economic growth. The convergence effect is denoted by γ_1, as lagged income, $y_{i,t-1}$ (or initial GDP) is expected to have a negative effect on economic growth. $Z_{i,t}$ is the set of control variables includes secondary school enrolment rate, government consumption share in GDP, real interest rate, trade as a ratio of GDP, and the inflation rate, all of which are widely used in the finance-growth literature. Furthermore, c_i captures the existence of other determinants of a country's steady state that are not already controlled for by $X_{i,t}$ and $Z_{i,t}$, and μ_t is the time dummy variable in period t to capture common shocks affecting all countries simultaneously. Finally, $\epsilon_{i,t}$ is the error term, a white noise error with mean zero, and the subscripts t and i denote the time period and the country indices, respectively.

In short, I use the method of dynamic panels, which deals with the problem of omitted unobserved variables by taking first differences, and also tackles the issues of endogeneity and reverse causality by using lagged realizations of the explanatory variables as instruments in a GMM specification. I run the following model for investigating the relationship between banks, stock markets, and economic growth:

$$\ln[y_{i,t}] = \beta_0 + \beta_1 \ln[y_{i,t-1}] + \beta_2 \ln[X_{i,t}] + \beta_3 \ln[Z_{i,t}] + c_i + \mu_t + \epsilon_{i,t} \quad (2.2)$$

where $\beta_1 = 1 + \gamma_1$.

2.4 Empirical Results

The regression specification builds on the approach to growth equations introduced by Barro (1989). My specifications include the convergence effect (log of the initial real GDP per capita), financial development indicators, the human capital investment variable, the export plus import to GDP ratio, the government consumption to GDP ratio and the inflation

rate. The econometrics package used is Stata 12 and the module used for the System GMM is *xtabond2*. I report the OLS, Within Group (FE) and one-step System GMM estimates (recall that I present the OLS and Within Group only for reasons of completeness; otherwise these estimators are not efficient). All regressions include time dummies, which I find to be jointly significant in almost every regression, to account for time-specific effects. In order to conserve space, the coefficients on the time dummies are not reported in the tables. In all runs, I assume that control variables are exogenous and financial development indicators are endogenous in the sense of being correlated with shocks to GDP per capita in both the current and previous periods.

Two tests were applied to determine the validity of the instruments used in the System GMM estimates. First, I use Hansen test of over-identifying restrictions, which analyses the sample analogue of the moment conditions to test the overall validity of the instruments used in the estimation process. Second, I use the autoregressive (AR) test to see whether the error term is serially correlated in both the difference regression and the system difference level regression. The AR test has a null hypothesis that there is no autocorrelation. The tests for AR (1) process in first differences rejects the null hypothesis since $\Delta\epsilon_{i,t} = \epsilon_{i,t} - \epsilon_{i,t-1}$ and, $\Delta\epsilon_{i,t-1} = \epsilon_{i,t-1} - \epsilon_{i,t-2}$, that is, both have $\epsilon_{i,t-1}$. However, the test for AR (2) and the second order serially correlation of error term will violate the System GMM assumptions. The number of instruments should also be less than or equal to the number of groups to have valid instruments.

2.4.1 Bank Development and Economic Growth

The results of the OLS, Within Group and one-step System GMM estimators for the relationship between banking sector development and economic growth are shown in Tables 2.2-2.4. Specifically, I examine heterogeneity in this relationship across income levels. I run various regressions to establish how banking affects economic growth in low-, middle-, and high-income countries; however, only the most convenient results are presented.

Table 2.2 presents the summary results of the OLS, FE and System GMM estimates for banking development in low-income countries. The OLS and FE results do not suggest statistically significant results for the banking measure. However, the banking measure is statistically significant at conventional 5% level when I apply the one-step System GMM. Since it is well known that the OLS and FE estimates are biased and inconsistent, I focus only on the System GMM results. The results indicate that the variable of interest, *bank-aggregate*, is significantly correlated with economic growth in low-income countries. This finding is consistent with the general expectation, which suggests that banks are the primary suppliers of funding for capital accumulation in low-income countries. Among the other explanatory variables, only *trade* is statistically significant, at 10% level.

Table 2.2: Bank Development and Economic Growth: Low-Income Economies

Variable	**OLS**	**Within-Group (FE)**	**System GMM**
Constant	0.322	1.026	0.404
	(0.192)*	(0.527)*	(0.835)
Initial real GDP per capita	-0.033	-0.228	-0.004
	(0.028)***	(0.081)***	(0.152)***
Bank-aggregate	0.006	0.024	0.058
	(0.008)	(0.016)	(0.027)**
Education	0.016	0.015	0.011
	(0.013)	(0.049)	(0.024)
Trade	-0.040	0.095	-0.135
	(0.024)	(0.069)	(0.070)*
Government	0.005	-0.026	0.105
	(0.028)	(0.054)	(0.064)
Inflation	-0.008	-0.005	0.002
	(0.017)	(0.014)	(0.028)
Observations	111	111	111
R-squared	0.945	0.7810	
F-statistic	157.31***	24.96***	61.81***
Number of Groups			23
Number of Instruments			21
Hansen test p-value			0.607
Difference-in-Hansen test p-value			0.484
AR(1)			0.133
AR(2)			0.960

Note: The dependent variable is the three-year (non-overlapping) average of real per capita GDP growth for 1991-2011 for each country, which yields seven observations per country. Three-year averages for all of the independent variables are computed over the same as the dependent variable. Robust standard errors are given within parentheses. Definitions of variables are same as in Table A.2. Specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen test p-value and Difference in Hansen test p-value tests of over-identification test, AR(1) and AR(2) test of the error terms are also reported. Time dummies for seven time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

Table 2.3 presents the regression results for middle-income countries.

The results indicate a positive and statistically significant relationship between banking development and economic growth in middle-income countries. Comparing the results shown in Table 2.2 above with those from middle-income countries, the bank measure is statistically significant in the OLS, FE and System GMM specifications. The coefficient of *bank-aggregate* in low-income countries is 0.058 while it is 0.147 in middle-income countries, according to the System GMM results. Hence, banking development has a larger positive effect on growth in middle-income countries than low-income countries. Although *education* and *government* variables are statistically significant in FE estimates, they both appear insignificantly in the System GMM estimates.

Table 2.3: Bank Development and Economic Growth: Middle-Income Economies

Variable	OLS	Within-Group (FE)	System GMM
Constant	0.101	4.024	4.077
	(0.088)	(0.420)***	(1.544)***
Initial real GDP per capita	-0.024	-0.426	-0.516
	(0.006)***	(0.039)***	(0.188)**
Bank-aggregate	0.009	0.061	0.147
	(0.004)*	(0.007)***	(0.065)**
Education	0.027	-0.104	-0.020
	(0.013)**	(0.036)***	(0.068)
Trade	0.003	-0.022	-0.098
	(0.009)	(0.038)	(0.103)
Government	-0.017	-0.085	0.089
	(0.014)	(0.041)**	(0.128)
Inflation	0.003	-0.016	0.066
	(0.010)	(0.010)	(0.039)*
Observations	378	378	378
R-squared	0.9813	0.8529	
F-statistic	2880***	154.43***	22.17***
Number of Groups			74
Number of Instruments			22
Hansen test p-value			0.136
Difference-in-Hansen test p-value			0.184
AR(1)			0.655
AR(2)			0.990

Note: The dependent variable is the three-year (non-overlapping) average of real per capita GDP growth for 1991-2011 for each country, which yields seven observations per country. Three-year averages for all of the independent variables are computed over the same as the dependent variable. Robust standard errors are given within parentheses. Definitions of variables are same as in Table A.2. Specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen test p-value and Difference in Hansen test p-value tests of over-identification test, AR(1) and AR(2) test of the error terms are also reported. Time dummies for seven time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

In high-income countries, however, banking development has a negative effect on economic growth as shown in Table 2.4. The banking measure is statistically significant at 1% level and the coefficient of *bank-*

aggregate is -0.041 in the System GMM estimates. This is somewhat surprising given that the banking sector has grown remarkably over the last two decades, especially in high-income countries. There may be several explanations for this finding. Firstly, over the last two decades, banking sector in high-income countries has focused on consumer credit to households rather than enterprise credit. In several countries, such as Australia, Canada, Denmark, the Netherlands, and New Zealand, household credit has reached about 80% of the total credit provided by banking sector, mostly given as mortgage credit. Moreover, consumer credit has reached to more than 70 percent of GDP in several high-income countries such as the United States, New Zealand, and Ireland. The theoretical and most of the empirical finance-growth literature have assumed that the finance-growth linkage goes through enterprise credit. However, this assumption contradicts with the reality especially in high-income countries. This could be one of the explanations of the negative relationship between banking sector development and economic growth in high-income countries. Secondly, while the banking sector has grown in both size and range of activities in high-income countries, banks have also become more complex financial institutions, due to the introduction of new technologies. As competition from financial markets has increased, it becomes increasingly difficult to make higher profit and manage risk using traditional borrowing and lending activities (Allen and Santomero, 2001). As a result of this, the banking sector started to use derivatives and other similar techniques for risk management. In other words, banking sector has gradually extended its scope beyond the traditional activity of intermediation towards non-intermediation financial activities (Demirgüç-Kunt and Huizinga, 2010). This complexity may hinder the banking sector from its key task, which is to improve the efficiency of capital allocation and encourage savings, hence boosting economic growth. Moreover, due to the complexity in the banking sector, it is not an easy task to find a satisfactory measure of overall banking development (this is why I employ principal component analysis instead of using a single indicator of banking development). As a result, the relationship between banking development and growth might not be mea-

sured properly, especially in high-income countries. It is also possible that the strong links developed between banks and businesses over time have weakened after the development of stock markets in high-income countries. In economically developed countries, financial systems become more market based, generally leading to a decline in the relationship between economic activity and bank development (Demirgüç-Kunt et al., 2012), and thus encouraging firms to move away from bank loans towards issuing equity.

Table 2.4: Bank Development and Economic Growth: High-Income Economies

Variable	OLS	Within-Group (FE)	System GMM
Constant	0.568	1.704	2.490
	(0.248)**	(0.332)***	(0.803)***
Initial real GDP per capita	-0.039	-0.161	-0.178
	(0.018)***	(0.032)***	(0.049)***
Bank-aggregate	-0.030	-0.020	-0.041
	(0.009)***	(0.017)	(0.013)***
Education	0.008	-0.013	-0.199
	(0.007)	(0.033)	(0.211)
Trade	-0.026	-0.008	-0.025
	(0.012)**	(0.044)	(0.061)
Government	0.002	0.030	0.038
	(0.014)	(0.036)	(0.285)
Inflation	-0.014	-0.006	0.055
	(0.011)	(0.017)	(0.135)
Observations	173	173	173
R-squared	0.9866	0.9184	
F-statistic	1003.75***	125.92***	329.31**
Number of Groups			39
Number of Instruments			17
Hansen test p-value			0.364
Difference-in-Hansen test p-value			0.340
AR(1)			0.933
AR(2)			0.919

Note: The dependent variable is the three-year (non-overlapping) average of real per capita GDP growth for 1991-2011 for each country, which yields seven observations per country. Three-year averages for all of the independent variables are computed over the same as the dependent variable. Robust standard errors are given within parentheses. Definitions of variables are same as in Table A.2. Specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen test p-value and Difference in Hansen test p-value tests of over-identification test, AR(1) and AR(2) test of the error terms are also reported. Time dummies for seven time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

To sum up, the results indicate that while development in banking sector contributes subsequent economic growth in low- and middle-income countries, it has negative effect on growth in high-income countries. The coefficient of the log of initial GDP per capita as expected is negative and statistically significant, which implies higher level of GDP per capita growth rate for lower level of initial GDP given other variables. More-

over, the results indicate that most control variables have no significant effect on economic growth.

2.4.2 Stock Market Development and Economic Growth

I present the OLS, Within Group and one-step System GMM results for the relationship between stock market development and economic growth across income levels in Tables 2.5 and 2.6. The results show that coefficient of the measure of stock market development is positive in both middle- and high-income countries, which implies that development in stock markets contributes subsequent economic growth in both middle- and high-income countries.

Table 2.5: Stock Market Development and Economic Growth: Middle-Income Economies

Variable	OLS	Within-Group (FE)	System GMM
Constant	0.145	1.595	-0.777
	(0.083)*	(0.479)***	(0.776)
Initial real GDP per capita	-0.013	-0.189	-0.015
	(0.006)***	(0.058)***	(0.102)***
Market-aggregate	0.006	0.028	0.047
	(0.003)*	(0.006)***	(0.023)**
Education	0.023	0.004	-0.098
	(0.009)**	(0.026)	(0.094)
Trade	0.002	-0.002	-0.015
	(0.010)	(0.033)	(0.062)
Government	-0.001	0.0001	0.453
	(0.012)	(0.035)	(0.264)*
Inflation	-0.018	-0.008	0.104
	(0.009)*	(0.009)	(0.100)
Observations	200	200	200
R-squared	0.9925	0.9357	
F-statistic	2517.75***	258.58***	42.41***
Number of Groups			38
Number of Instruments			19
Hansen test p-value			0.960
Difference-in-Hansen test p-value			0.972
AR(1)			0.561
AR(2)			0.059

Note: The dependent variable is the three-year (non-overlapping) average of real per capita GDP growth for 1991-2011 for each country, which yields seven observations per country. Three-year averages for all of the independent variables are computed over the same as the dependent variable. Robust standard errors are given within parentheses. Definitions of variables are same as in Table A.2. Specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen test p-value and Difference in Hansen test p-value tests of over-identification test, AR(1) and AR(2) test of the error terms are also reported.Time dummies for seven time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

Table 2.5 provides results of the regressions for the impact of stock market development on economic growth in middle-income countries

using the OLS, Within Group and one-step System GMM. The results indicate a positive and significant relationship between stock market development and economic growth. The coefficient of *market-aggregate* is statistically significant at 10%, 1%, and 5% levels in the OLS, FE and one-step System GMM estimates, respectively. This finding is in line with the continued increase in attention to stock market development over the last 20-25 years, especially in developing countries.

Table 2.6: Stock Market Development and Economic Growth: High-Income Economies

Variable	OLS	Within-Group (FE)	System GMM
Constant	0.432	2.030	2.649
	(0.094)***	(0.432)***	(0.661)***
Initial real GDP per capita	-0.033	-0.189	-0.236
	(0.007)***	(0.045)***	(0.053)***
Market-aggregate	0.006	0.024	0.064
	(0.004)	(0.009)**	(0.031)**
Education	0.009	0.034	-0.004
	(0.004)**	(0.018)*	(0.031)
Trade	-0.007	-0.051	-0.047
	(0.007)	(0.033)	(0.036)
Government	-0.016	0.026	0.052
	(0.008)*	(0.019)	(0.048)
Inflation	0.001	-0.015	-0.061
	(0.004)	(0.007)*	(0.067)
Observations	178	178	178
R-squared	0.9945	0.9473	
F-statistic	2895.23***	158.13***	89.81***
Number of Groups			38
Number of Instruments			21
Hansen test p-value			0.674
Difference-in-Hansen test p-value			0.777
AR(1)			0.356
AR(2)			0.662

Note: The dependent variable is the three-year (non-overlapping) average of real per capita GDP growth for 1991-2011 for each country, which yields seven observations per country. Three-year averages for all of the independent variables are computed over the same as the dependent variable. Robust standard errors are given within parentheses. Definitions of variables are same as in Table A.2. Specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen test p-value and Difference in Hansen test p-value tests of over-identification test, AR(1) and AR(2) test of the error terms are also reported.Time dummies for seven time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

The results for the relationship between stock market development and economic growth in high-income countries are shown in Table 2.6. I find a positive and statistically significant effect of stock market development on growth. The coefficient of *market-aggregate* is 0.064 in high-income countries while it is 0.047 in middle-income countries. In other words, stock market development has a larger positive effect on growth in high-income compared to middle-income countries. This finding may

reflect the difference between market based financial systems in developed countries and bank based financial systems in developing countries.

To test the consistency of the System GMM estimator, I report p-value of Hansen test and p-value of AR(1) and AR(2) tests. As can be seen from the last columns of Tables 2.2-2.7, the econometric specifications, including over-identification and serial correlation issues, are valid for all regressions where Hansen-p test p-value and AR(2) test p-value are always above the 0.05 level, which supports the interpretation of the estimated coefficients as being free from endogeneity bias.

On average, the results indicate that stock markets are significant determinants of economic growth in middle- and high-income countries. However, the analyses present a negative and significant effect of banking development on growth in high-income countries, while the coefficients of the banking development measure are positive and significant both in low- and middle-income countries.

2.4.3 Financial Development and Economic Growth

As mentioned in the introduction, I aim to investigate the simultaneous and separate impacts of banks and stock markets on economic growth. In parts (2.4.1) and (2.4.2), I find that banking and stock markets may show different impacts on growth across income levels. To examine the simultaneous impact of banks and stock markets on growth, I use the full sample that consists of 146 countries for the period of 1991-2011. In addition to the worldwide-pooled regression, I also examine this relationship across income levels in order to see whether it is important to study finance-growth nexus by income groups as opposed to an aggregation of worldwide countries. All variables are averaged over the three-year (non-overlapping) period as described previously.

To construct a satisfactory measure of overall financial development in banking and stock market, I use nine financial development indicators[23] (six indicators for banking and three indicators for stock market) to

[23]The financial development variables are the ones that I use for bank development and

be employed in principal component analysis. I employ the same procedure as described in part (2.3.3). The first principal component explains 68% of the variation in the original data, and it is chosen to represent the overall financial development in the sample (see Table A.6).[24]

Table 2.7 presents the results of regressions. The worldwide-pooled regression shows that overall financial development, measured by the first principal component, is positively associated with economic growth as shown in Column 1 of Table 2.7. The coefficient of *finance-aggregate* is statistically significant at 5% level. This result suggests that when I consider the mix of developed and developing countries, the simultaneous effect of stock markets and banks on growth is positive and statistically significant, consistent with the results of several studies in the literature such as Beck and Levine (2004), Levine and Zervos (1998), and King and Levine (1993), among others. Columns 2, 3, and 4 of Table 2.7 present regression results for low-, middle-, and high-income countries, respectively. There is evidence that high-income countries as a group obtain negative growth from increasing level of financial development while there is no evidence of statistically significant relationship between financial development and growth for low- and middle-income countries. However, in Table 2.6, I find a positive and statistically significant relationship between stock market development and growth in high-income countries. Moreover, the results presented in Tables 2 and 3 show that banking development is positively and significantly associated with growth in low- and middle-income countries. Hence, as regards the different results from separate and simultaneous effects of banks and stock markets, I can say that most of the high/middle/low income countries, especially the ones in these samples, still have bank based financial systems, which is quite consistent with the related literature.

stock market development in the previous parts.

[24] Although PCA results suggest that first and second principal components should be taken (since second component has also an eigenvalue greater than 1 and its marginal contribution is 14 percent to the variance), the significance level and sign of the estimated coefficients did not change dramatically when I rerun the regressions with these two principal components. Hence, for the sake of clarity and interpretability of the regression results, I only present the results that obtained by using the first principal component as a measure of overall financial development.

Table 2.7: Financial Development and Economic Growth: Simultaneous Impact of Banks and Stock Markets on Growth

Variable	Full Sample	Low-Income	Middle-Income	High-Income
Constant	1.942	5.023	4.798	-0.067
	(1.105)*	(9.990)	(7.221)	(0.621)
Initial real GDP per capita	-0.110	-0.354	-0.754	0.034
	(0.092)***	(0.905)	(0.983)	(0.056)***
Finance-aggregate	0.087	0.036	0.066	-0.063
	(0.034)**	(0.108)	(0.134)	(0.029)**
Education	-0.009	0.031	-0.022	0.001
	(0.049)	(0.484)	(0.678)	(0.016)
Trade	-0.019	-0.420	0.007	-0.017
	(0.043)	(0.578)	(0.009)	(0.020)
Government	-0.086	0.146	0.279	-0.004
	(0.079)	(0.284)	(1.017)	(0.027)
Inflation	-0.248	-0.343	-0.057	-0.021
	(0.227)	(0.137)**	(0.791)	(0.022)
Observations	406	33	219	154
F-statistic	69.46***	14.94***	16.92***	143.13***
Number of Groups	92	8	48	36
Number of Instruments	21	14	14	21
Hansen test p-value	0.511	1.000	0.690	0.233
AR(1)	0.414	0.582	0.937	0.972
AR(2)	0.611	0.154	0.422	0.595

Note: The dependent variable is the three-year (non-overlapping) average of real per capita GDP growth for 1991-2011 for each country, which yields seven observations per country. Three-year averages for all of the independent variables are computed over the same as the dependent variable. Robust standard errors are given within parentheses. Definitions of variables are same as in Table A.2. Specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen test p-value and Difference in Hansen test p-value tests of over-identification test, AR(1) and AR(2) test of the error terms are also reported.Time dummies for seven time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

Combining the results in Table 2.2 to Table 2.7, one can say that it is not an easy task to properly test the impacts of banks and stock markets on economic growth. Moreover, the results show that one should take into account the varying impacts of financial development on growth across income levels; otherwise, the results would be misleading. In short, to examine the role of banks and stock markets in economic development, it would be better to consider the separate and simultaneous impacts of banks and stock markets, in addition to the effect of income level of a country. These contradicting results support the need for the further examinations of the impacts of both banks and stock markets on economic growth.

2.4.4 Robustness Tests

In order to increase confidence in our results, I perform various robustness tests. Firstly, I exclude the countries with more than two missing

data points over the analysed period from the sample and re-estimate the models using the modified data, which now consists of 40 high-income, 65 middle-income and 20 low-income countries. There is no substantive change in results when the countries with missing data are excluded.

Secondly, in place of *pc1*, I use other financial indicators, obtained by employing principal component analysis. I use the indicators of financial development most commonly found in the finance-growth literature: private credit to GDP ratio and stock market turnover ratio. I employ the System GMM estimator for low-, middle-, and high-income countries, and I see that the results do not change dramatically. I find a positive and statistically significant relationship between private credit to GDP ratio and growth in low- and middle-income countries while the relationship is negative for high-income countries as shown in Table A.7 in Appendix A. Moreover, Table A.8 in Appendix A shows that stock market turnover is positively and significantly associated with economic growth both in middle- and high-income countries. The robustness tests confirm the results I obtained with the financial development indices. In sum, the panel results are robust to a variety of sensitivity analyses.

2.5 Concluding Remarks and Policy Implications

Economists have long debated whether financial development promotes subsequent economic growth. Most studies conclude that on the whole, financial development plays a key role in promoting growth. However, some studies find a negative relationship between financial deepening and economic growth. In this chapter, I examine the role of financial development (stock markets & banks) in economic growth using comprehensive data for 146 countries over the period 1991-2011. I estimate the impact of financial development on long-run economic growth rate across three income levels; high-income, middle-income and low-income. I employ principal component analysis to construct satisfactory measures of financial development in banking and stock markets. Most empirical studies in the literature measure the level of financial development through a single measure, the total credit to the private sector from

banks and other financial institutions as a percentage of the GDP. However, due to the diversity of financial services provided by financial systems, the use of a single indicator for financial development could limit the relevance of the results. To overcome this problem, I construct index measures for banking development and stock market development using principal component analysis, which allows a large set of correlated variables to be reduced to a smaller set of uncorrelated variables.

This analysis focuses on the relationship between stock markets, banks and economic growth, in particular, how the relationships vary according to income level over a period of two decades. The results show that the coefficient of financial development index, both in stock market and banking, is significant in all regressions. For banking development, the results suggest that the relationship between banking development and growth is positive and significant in low- and middle-income countries. In contrast, the relationship is significant but negative in high-income countries. These statistically significant and robust results may not exactly fit the popular expectations, which may be predicted a positive effect of banking development on growth in high-income countries. However, the recent literature suggests that the effect of increased financial development on growth may decrease with the level of economic development in a country. The results of this study are consistent with the findings of Hassan et al. (2011), who find a negative and statistically significant relationship between banking development and growth.

The empirical results based on the System GMM estimates suggest that the relationship between stock market development and economic growth is positive and significant in both middle- and high-income countries. This result is consistent with Rioja and Valev (2014), who find stock markets contribute to growth in high-income countries. Nevertheless, the evidence related to stock market development in this analysis for middle-income and high-income countries suggest that stock market development has a greater effect on growth in high-income countries than middle-income countries. Moreover, consistent with Barro (1989), Bekaert et al. (2005), and Beck and Levine (2004), I find that a low level of initial GDP per capita is associated with a higher growth rate, given

other variables. In order to increase confidence in the results, I perform various robustness tests. The panel results of this study are robust to a variety of sensitivity analyses.

I conclude that the impact of financial development on economic growth varies across countries due to the heterogeneous nature of economic structures, financial markets, and so on. In other words, the results highlight the importance of studying the relationship between finance and growth by income groups as opposed to an aggregation of worldwide economies. These results are important not only because they provide us new evidence on the role of financial development in economic growth, but also because policy decisions are based on the policymakers' understanding of the ways in which finance contributes to economic growth in a particular type of an economy. The results suggest some policy implications. First, policymakers in middle- and low-income countries should establish financial reforms to provide the basis for greater financial deepening both in banking sector and stock markets. Second, when I use private credits to GDP ratio as a banking development measure in the regressions for robustness test, I find that private credits to GDP ratio is strongly associated with economic growth in middle-income countries. Hence, policymakers should reduce the impediments to credit expansion in these countries. Third, policymakers should also pursue actions to limit the size of banking sector in high-income countries whereas they should aim to improve the growth effect of stock market activities. Fourth, policymakers should focus on enterprise credit instead of lending to consumers, especially in high-income countries, since the proportion of consumer credit in total credit is relatively high for developed countries. Following such a course, these actions should result in benefits in terms of higher and more sustainable long-run economic growth.

However, there are few important points that need to be emphasized at this point. The analysis of the determinants of financial repression and political institutions is outside the scope of this study, but is an important and interesting issue for future research. This study focuses on a preliminary analysis of the role of financial development in economic growth, considering the income level of the countries.

Chapter 3

Finance and Income Inequality: Some Theory and More Evidence

3.1 Introduction

Inequality is a persistent phenomenon and a fundamental issue of concern. The issue of inequality is important in its own merits, but also because of its connections to economics, politics, and demographics. Keynes (1936) argued that "outstanding faults of the economic society in which we live are its failure to provide for full employment and its arbitrary and inequitable distribution of wealth and incomes". Increasing income and wealth inequalities feed the concerns of lack of opportunity and its counter socio-economic/political impacts (see Stiglitz, 2012). In this respect, Lucas (2002) considered the issue of inequality of distribution as being most pernicious to a healthy economy. However, improving living standards, the trend to consumerism (wider access to durable/non-durable consumption materials) and the positive effects of credit finance have minimal effect on the reality of inequality. Despite the fact that many countries, especially emerging countries, have experienced rapid economic growth over the past two decades, income inequality has been

on the rise, or, at best, stagnant, in most countries since the early 1980s.[1] The question of why the gap between rich and poor is growing despite rises in GDP still remains an important issue for the policymakers.

Unequal access to finance has long been recognized as a critical mechanism for generating persistent income inequality and slower economic growth. The capital market imperfections and lending constraints that limit access to finance may affect inequality during economic development. These imperfections may prevent those with low incomes from investing in human capital, health, and entrepreneurial activities. Even if there is development in the size/liquidity of the financial system (specifically involving banks/stock markets), this development may not help the less well off because of the lack of democratized access to financial services or products. In other words, if the access to financial services for the poor is limited compared to the rest of the population, financial development may not contribute to reducing inequality. Similarly, large amount of credit do not always correspond to broad use of financial services, as credit is often concentrated among the wealthiest people as well as among the largest firms.[2] In most countries, especially in emerging and low-income countries, access to credit is based on collateral and the assets (financial or non-financial) which have benefited from the development of the financial system are disproportionately owned by the rich. This may be one of the main sources of increasing income inequality in these countries. On the other hand, the post 1980 period marked the starting point of the liberalization era with a specific emphasis on the importance of financial markets, resulting in accelerated financial deepening. However, this also has not benefited all segments of the population equally. As Stiglitz (2015) suggests, if a favoured (mostly politically

[1] While global inequality has declined mainly thanks to the development spurt of China and India, inequality within individual countries has worsened in a remarkably consistent fashion in both the developed and developing countries over the last three decades.

[2] According to the latest data provided by the World Bank's Enterprise Surveys (see www.enterprisesurveys.org for the detailed description of the surveys), 51 percent of firms in high income OECD countries have access to bank loans or lines of credit while that percentage is 20 for Middle East & North Africa countries. Similarly, the percentage of firms identifying access to finance as major constraint is 41 in Sub-Saharan Africa compared to 17 percent in Eastern Europe & Central Asia.

connected individuals) few get access to credit, our system of credit creation may perversely create not only inequality at the top, but also at the bottom. Beside all the above, the exact impact of financial development on income inequality has not been well defined in either empirical studies or the theoretical literature by which contradicting predictions are provided. In that aspect, it is important to consider the link between financial sector development and income inequality in a systematic framework.

Financial development may impact income inequality through two channels; indirect effect through GDP growth, assuming that growth is good for the poor (for a survey of the main theoretical arguments, see Levine, 1997), and direct effect through relaxing the access barriers to the credit market. In this chapter, I focus only on the direct effect of financial development on inequality.

The aim of this chapter is twofold. First, it aims to analyse in a simple model how the interaction between financial development and entrepreneurial talent determines the distribution of income. Second, it aims to present robust empirical evidence for the relationship between financial development and income inequality, taking into account the role of individuals' talent in reducing inequality.

To do that, I first build an occupational choice model in which individuals choose between being an entrepreneur, being self-employed, or being a worker depending on their initial wealth and talent. In the model, there are two ways in which production can take place. It can take place either in firms that have an optimal amount of capital and labour to operate or in a one-man business which does not require capital and labour. Since running a firm requires a minimal capital investment in order to operate, individuals may finance their investments by renting capital from lenders. An entrepreneur uses his initial wealth as collateral in return for a loan to set up a firm and pay for working capital. He hires labour at the prevailing fixed wage, which he pays out of earned revenues, receiving the balance as profit. However, under financial imperfection such that individuals are faced with a borrowing constraint, it may be impossible for poor individuals to have access to finance. I

model financial frictions in the form of collateral constraints arising from imperfect enforceability of contracts. I define the level of financial development as the amount of collateral required to get credit from the financial sector.[3] The lack of collateral prevents some would-be entrepreneurs from realizing their projects. Similarly, wealthy borrowers crowd out talented poor ones because of financial imperfection, which is modelled by collateral constraints. A decline in the amount of collateral (namely, relaxing credit constraints) reduces income inequality as individuals with relatively low wealth become more likely to obtain credit, set up firms and receive higher incomes, that is, relatively poor individuals can be entrepreneurs thanks to financial development. In addition, relaxing credit constraints benefits the talented poor whereas wealthy but relatively untalented entrepreneurs may lose due to (i) falling chance of getting credit due to the growing number of credit applications (ii) decreasing market share of each entrepreneur in the economy, which results in reduced income inequality.[4] In this respect, financial development alleviates capital misallocation; a fraction of capital is reallocated from less talented but wealthy entrepreneurs to more talented but less wealthy individuals. On the other hand, if the amount of collateral increases, then wealthy individuals become even wealthier by running firms and obtaining higher income. This is because a high value of collateral only enables a very small number of individuals to become entrepreneurs, allowing them to invest more capital in production and make more profits, leading to higher income inequality. In the equilibrium of this setting, only talented individuals with a certain level of wealth choose to set up firms and become entrepreneurs. Untalented individuals, or those who are talented but wealth-constrained, choose to become self-employed or look for a job as

[3]The theoretical literature has used several measures of financial development. For instance, Banerjee and Newman (1993) and Townsend and Ueda (2006) used the size of credit participation cost whereas Lloyd-Ellis and Bernhardt (2000), Bianchi (2010), and Dabla-Norris et al. (2015) used the amount of collateral to measure the level of financial development.

[4]When the fraction of individuals who prefer to be entrepreneurs increases in the economy, the market share of each entrepreneur will decrease due to competition among entrepreneurs, prices will eventually fall, and so income and wealth inequality may start to decline. Moreover, as long as the number of entrepreneurs increases the labour demand increases, too.

employee in one of these firms. Hence, financial development increases the earning opportunities for the talented poor by decreasing the amount of collateral. As collateral increases, capital endowments play an important role in determining who will become entrepreneurs although it is individuals' talent that should be a decisive factor.[5] In other words, as financial systems develop, entrepreneurial talent becomes more important than individual's wealth in becoming entrepreneurs. Thus, financial development may induce the efficient matching between entrepreneurial talent and production technologies, resulting in less income inequality.

I then use the theory to quantify the importance of financial development and individuals' talent for cross-country income inequality differences. A central ingredient in the empirical analysis is the observed achievement levels (talent) constructed from the Program of International Student Assessment (PISA) scores in a sample of 46 countries. Heuristically speaking, none of the empirical studies in the literature has ever tried to link the theory to the empirics. This is indeed very surprising, if not disappointing, as there are extensively developed occupational choice and income inequality approaches under imperfect financial markets. Hence, integrating theory with empirics, albeit in a very simple manner, is the very important motivation of this chapter.

Empirically, using a cross-country panel data set of 46 developed and developing countries over the period 1998-2012, I provide a robust support in favour of the negative relationship between financial development and income inequality. To deal with the potential endogeneity (or reverse causality) between financial development and income inequality, and to address the problem of unobserved country specific effects in the data, I utilize the instrumental variable estimations in a panel data framework. In addition, I employ principal component analysis to construct satisfactory and reliable measures of financial development. The use of principal component analysis to build an aggregate index of financial development is one of the aspects of the empirical part of this study. Us-

[5] I assume in the model that while profits are verifiable talent cannot be observed by the lenders, indicating the existence of asymmetric information between lenders and borrowers. Hence, the lenders cannot decide whether to lend to applicants upon analysing their entrepreneurial talent.

ing only one financial development indicator may not be closely related to the complete information of financial services. On the other hand, if I had used more than one indicator of financial development in the econometric analyses, I could have faced the multicollinearity problem since financial development variables are highly correlated. Moreover, I control for the effect of individuals' talent on income inequality since the theoretical model presented in this chapter suggests that individuals' talent plays an important role in reducing inequality.

The remainder of the chapter is organized as follows. The next section provides a brief overview of the related literature. In the third section I build a simple theoretical framework which I want to utilize to account for the proposed relationship between financial development and inequality. In the fourth section I conduct an empirical analysis and establish a robust relationship between financial development and income inequality, even after controlling for various variables that might affect income inequality. Finally, I provide concluding remarks and policy implications in the last section.

3.2 Literature Review

A growing theoretical literature has studied the link between financial development and income inequality in models of occupational choice and financial frictions, though the current literature provides conflicting predictions. Several theoretical models suggest that financial system development can help to reduce income inequality as well as to boost economic growth, due to several positive externalities. For example, by improving the efficiency of capital allocation and relaxing the constraints of funding from financial markets, financial development may reduce income inequality through improving collateral use and credit histories (Galor and Zeira, 1993; Aghion and Bolton, 1997; Galor and Moav, 2004). The study of Banerjee and Newman (1993) is shown as a milestone in the theoretical literature of finance-inequality nexus that is built on the occupational choice models.[6] BN (1993) focus on how

[6]Henceforth, BN (1993).

the long-run distribution of wealth is related to technology parameters. They find that because of the non-convexities in the feasible technology choices of entrepreneurs, the long-run distributions of wealth may depend on initial conditions. Their model features one-period lived, risk-neutral agents who ex ante differ only in their initial wealth. They, however, did not take into account the efficiency of individuals, namely that individual's talent. BN (1993) underline that countries with larger financial market imperfections such as information asymmetries and transactions costs that limit access to finance are more exposed to income inequality. Aghion and Bolton (1997) use a similar framework as BN (1993) and find that as wealth accumulates, demand for credit declines and supply rises, so that interest rates fall and, although it may initially rise, wealth inequality eventually falls. They also did not consider the differences in entrepreneurial efficiency.[7] However, unlike theirs, my model considers not only the distribution of initial wealth but also the distribution of entrepreneurial skills.

Moreover, Lloyd-Ellis and Bernhardt (2000) extend the model of BN (1993) to characterize an equilibrium development process driven by the interaction between wealth, entrepreneurial talent and credit constraints. In their model, when efficient entrepreneurs are relatively abundant income inequality traces out a Kuznets curve. They suggest that the economy can reach equilibrium with an efficient structure of production or get stuck with a dual structure, depending on the distribution of entrepreneurial efficiency. However, Lloyd-Ellis and Bernhardt (2000) do not consider the interaction between entrepreneurial talent and production technology, that is, the output produced does not depend on entrepreneurial talent in their model. Similarly, Bianchi (2010) builds an occupational choice model in which he explores the role of financial development in promoting efficient allocation of talent. His model is

[7]Moreover, as an important contributor to the related literature, Greenwood and Jovanovic (1989) predict a non-linear effect of financial development on inequality, in which income inequality first increases and then decreases as higher levels of economic development are reached and larger segments of society can access the growing financial markets. Consequently, the model of Greenwood and Jovanovic (1989) predicts an inverted U-shaped relationship between financial development and income inequality.

closely related to that of Lloyd-Ellis and Bernhardt (2000), however, he focuses only on the economic development process rather than the distribution of income. He analyses the interaction between entrepreneurial talent, production technologies and credit constraints in shaping the process of economic development. He suggests that financial development promotes higher production and social mobility by relaxing credit constraints. Much more recently, Dabla-Norris et al. (2015) develop a microfounded general equilibrium model with heterogeneous agents to evaluate the policy impacts of relaxing financial constraints on GDP and income inequality. They focus on three dimensions of financial inclusion (access, depth, and efficiency), and suggest that alleviating different financial frictions have a differential impact across countries, with country specific characteristics playing a central role in determining the linkages among financial development, GDP, and income inequality.

The simple theoretical model presented in this chapter builds on this occupational choice framework, but with novel features. My model is most closely related to those of Lloyd-Ellis and Bernhardt (2000) and Bianchi (2010). A crucial distinction between my model and theirs is the linkage between probability of production success and entrepreneurial talent, though these studies did not consider the case of production failure in their production technologies. In my model, unlike in the existing literature, the probability of success is associated with an individual's talent such that the higher the talent, the higher the probability of success. This assumption strengthens the importance of individual talent for the presented model. Moreover, the fraction of the entrepreneurs who experience positive return (or zero return) is also linked to the entrepreneurial talent. Therefore, to the best of my knowledge, this study is the first to analyse financial development and inequality linkage by associating entrepreneurial talent with both productivity and success.

The question of whether deeper financial markets lead to less income inequality has also been examined throughout the empirical literature. By employing data for 40 developed and developing countries for the period 1947-1994, Li et al. (1998) find that financial development leads to less income inequality. Clarke et al. (2006) examine the relationship

between finance and income inequality for 83 developed and developing countries for the 1960-1995 period, and find that, in the long-run, inequality is less when financial development is greater, consistent with Galor and Zeira (1993) and Banerjee and Newman (1993). According to Beck et al. (2007), financial development disproportionately raises the income of the poorest quantile and reduces income inequality. Similarly, Deininger and Squire (1998), Dollar and Kraay (2002), White and Anderson (2001) and Ravallion (2001) have explained that finance has a positive effect on poverty reduction. Kappel (2010) finds that financial development can reduce both poverty and income inequality, but the effect of financial development on poverty in particular is not only significant in and of itself, but also clearly greater than the effect on income inequality. However, and interestingly, none of the existing studies took into account the role of individuals' talent in reducing income inequality. As I mentioned in the introduction, I use mean PISA scores of each country to control for the effect of individuals' talent on income inequality by including it as a control variable in the regressions.

In contrast, other studies predict that financial development may fail to reduce income inequality. Claessens and Perotti (2007) argue that in countries with historically high levels of inequality, distortion in the institutional environment produces unequal access to finance, and ultimately leads to unequal opportunities, which in turn reinforces any initial economic inequality. The authors believe that limited access to funding and financial services not only reflects economic constraints, but also barriers erected by insiders. Charlton (2008) argues that stock market liquidity does not directly benefit the poor in developing countries. Law et al. (2009) examine the role of bank and stock market developments on income inequality in Malaysia for the period 1980-2000, finding that developments in banks and stock markets are not significantly associated with income inequality. Discussions on this nexus have been connected with socio-economic/political settings in their broadest meanings, for each country. Acemoglu and Robinson (2013) attempt to theorize prosperity's link with inclusive economic and political institutions, suggesting that the latter can enforce property rights, create a level playing field, and

encourage investments in new technologies and skills and are therefore more conducive to economic growth than extractive economic institutions. Such institutions also pave the way for technology and education as the engines of prosperity. However, it has been long recognized that creating prosperity does not necessarily create equal distribution of income/wealth in a society. Stiglitz (2012) contends that the financial sector has contributed so powerfully to inequality in the US through several channels. The author underlines that while financial firms pursue their own benefits via several rent seeking channels, an inefficient regulation/supervision/enforcement framework and regulatory capture have also played roles, with consequences for distribution.

3.3 The Model

I study a simple model of occupational choice under financial imperfections in order to analyse how the interaction between financial development and entrepreneurial talent determines the distribution of income. Imperfection in financial markets is modelled with a collateral constraint on capital rental, and it applies equally to all individuals in the economy.

The economy is populated by a continuum of n individuals, who are heterogeneous in terms of initial wealth b and talent z. Wealth is drawn from a cumulative distribution function F with support on $\mathbb{R}_+$; talent from a cumulative distribution function G with support on the interval $[0, 1]$. These distributions are assumed to be statistically independent.

3.3.1 Individuals

In the model, each individual is endowed with one unit of labour, which can be used either to set up a firm, or to run a one-man business or to look for a job in one such firm, depending on individual's initial wealth[8] and talent. Individuals who set up a firm are called entrepreneurs, denoting their population share and utility with x_1 and π^e, respectively.

[8]The amount of initial wealth can also be considered as the initial capital of an individual.

Individuals who work as an employee in a firm are called workers, denoting their population share and utility with x_2 and w, respectively. Individuals who run a one-man business are called self-employed, denoting their population share with x_3. The self-employed individuals can only produce enough for their own consumption, so that the production in one-man businesses is inefficient.[9] To emphasize this I normalize such a quantity to δ, where $w \gg \delta > 0$, deviating from Bianchi (2010). Individuals are assumed to be risk-neutral and their expected utility equal to expected income.

Following Bianchi (2010), I assume that there is a single good in the economy which can be produced by firms and one-man businesses. The product market is described by a decreasing inverse demand function $p = P(Q)$, where Q is the total quantity of output demand and p is the price of the good. I assume that each firm in the economy has the same size in terms of capital and labour; it employs k unit of capital and l workers to produce. Each worker supplies one unit of labour, and the workers' wage is equal to w, which is fixed and exogenous, implying that the labour market may not clear. The credit market is competitive so that the price of capital r is fixed and given exogenously by the competitive credit market. Production becomes successful with probability θ and fails with probability $1 - \theta$ in which case the output is zero but the entrepreneur still has to pay for workers. Therefore, an aggregate θ fraction of the entrepreneurs experiences positive return while the $1 - \theta$ fraction of the entrepreneurs experiences zero return. To simplify the model, I assume that the entrepreneur loses all installed capital when production fails, and the capital fully depreciates for all firms (independent of production failure) at the end of the period. In addition, the output produced depends on the individual's talent. A firm run by an entrepreneur with

[9] To gain a better understanding of the role of self-employed individuals in the model, one can consider the example of a teacher, who applies for a job at a school but is not assigned one because he is either less talented or the demand for teachers is low, keeping in mind that he is not wealthy enough to set up a new school. Hence, he can run a one-man business and give private courses to a few numbers of students, becoming self-employed. However, giving private courses is less efficient since he would teach more students if he worked at a school. Evidently he requires no capital, no employees and his output does not depend on his entrepreneurial talent.

talent z produces according to a production function $f(z,k,l) = zf(k,l)$, which is assumed to be strictly increasing in all arguments, and strictly concave in capital and labour, with $f(0,k,l) = 0$. I normalize $f(k,l) = 1$ for the sake of the tractability and simplicity of the model. The expected profit function for an entrepreneur can be written as

$$E_\theta[\pi^e(\theta,z,w,r,p)] = \theta[pz - wl - rk] + (1-\theta)[-wl - rk], \tag{3.1}$$

where p denotes the price of the good, w denotes workers' wages, and r is the market interest rate.

I also assume, deviating from the existing theoretical literature on the finance-inequality nexus, that probability θ is a monotonically increasing function of the individual's talent z such that

$$0 \leq \theta = \theta(z) = z \leq 1, \tag{3.2}$$

where $0 \leq z \leq 1$.

Equation (3.2) shows that the probability of success increases as the level of talent increases, namely that the higher the talent is, the higher is the probability of success. This assumption strengthens the importance of individual talent for the model. Moreover, the fraction of the entrepreneurs who experience positive return (or zero return) is also linked to the entrepreneurial talent.

Inserting into (3.1) the probability function as defined in (3.2), the expected profit function of an entrepreneur can be represented by:

$$E_\theta[\pi^e(z,w,r,p)] = z[pz - wl - rk] + (1-z)[-wl - rk]. \tag{3.3}$$

As mentioned above, it is assumed in the model that each firm has the same size in terms of capital and labour. That is, the number of workers equals firms' demand such that

$$x_2 = lx_1. \tag{3.4}$$

Moreover, each individual is given one occupation, so

$$x_1 + x_2 + x_3 = 1. \tag{3.5}$$

Following Bianchi (2010), I also assume that each individual has the same probability of getting a job in case of excess supply. However, there cannot be excess labour demand in this economy. Since there are workers, self-employed individuals and entrepreneurs in the society, the number of entrepreneurs is always bounded above (such that $x_1 \leq \frac{1}{1+l}$ since $x_1 + x_2 + x_3 = 1$, or namely that $x_1 = 1 - x_2 - x_3$). This is because $x_1 + x_1 l + x_3 = 1$ implies that $x_1 = \frac{1-x_3}{1+l} \leq \frac{1}{1+l}$. Hence, labour demand cannot exceed $\frac{l}{1+l} \geq l x_1 = x_2$, and so the number of individuals who prefer to become workers is always more than or equal to the firms' demand.

On the other hand, the expected income of a non-entrepreneur (worker or self-employed) can be defined as

$$E_\theta[\pi^{n.e.}(.)] = \frac{x_2}{1-x_1} w + \frac{x_3}{1-x_1} \delta, \tag{3.6}$$

where "*n.e*" denotes the non-entrepreneur.[10]

Inserting (3.4) into (3.6) and using (3.5) give,

$$E_\theta[\pi^{n.e.}(x_1, w, \delta)] = \frac{x_1(wl - \delta l - \delta) + \delta}{1 - x_1}. \tag{3.7}$$

There is a bank, representing the financial sector, in the economy which intermediates economic activity for some set of individuals. The production of a particular entrepreneur fails or not is only known to the entrepreneur himself. If production fails, which depends on the entrepreneur's talent in the model, an entrepreneur could pay less than the borrowed amount due to limited liability. Since the lie cannot be discovered by the bank, an entrepreneur could claim that he had zero-return and he would enjoy private gains on his externally financed fraction of entrepreneurial output, indicating the possibility of moral hazard. Hence, the bank cannot observe individuals' talent as well as the exact amount of business profit, which is associated with entrepreneurial talent. However, the bank can observe the average talent of the agents in

[10]The expected income of a non-entrepreneur is equal to the utility of being worker w, weighted by the probability of being hired $\frac{x_2}{1-x_1}$ plus the utility of being self-employed, δ, weighted by the probability of being self-employed $\frac{x_3}{1-x_1}$.

the economy. Therefore, the bank has to estimate the risk of the potential capital diverting (or escaping the repayment obligation) and ask the entrepreneurs to post a certain amount of collateral in order to borrow. To be more specific, when production succeeds, entrepreneurs can repay the credit. However, if production fails, the required repayment can be covered by the value of collateral. In short, access to credit is based on collateral. However, one should keep in his mind that if banks could observe entrepreneurial talent, the market would function perfectly as only sufficiently talented individuals would get a loan and these individuals would never divert capital.

Hence, an individual with an initial wealth of b can ask for a loan of k in order to set up a firm. However, individuals only with sufficient wealth can get credit by providing a certain amount of collateral. Let the lower bound on wealth be $\underline{b}$ such that

$$b \geq \underline{b}. \tag{3.8}$$

The lower is $\underline{b}$, the lower is the amount of collateral required to get credit from the financial sector, and the higher is the financial development, and so the higher is the fraction of individuals who can consider setting up a firm. For the sake of simplicity and to focus on the main purpose of this study, let us take the equilibrium level of financial development as given exogenously and set it to the lower bound on wealth $\underline{b}$, which is defined by (3.8).[11] This assumption does not interfere with the main objective of this study since the presented model aims to explore the effect of financial development on income inequality to the extent its effects on the equilibrium number of entrepreneurs.

To sum up, I build a simple occupational choice model under imperfect financial markets, in which individuals choose between becoming entrepreneurs, self-employed or workers depending on their initial

[11]The equilibrium amount of collateral (namely that the equilibrium level of financial development) can be defined endogenously in the model by considering the role of capital diversion by which an individual may generate private non verifiable returns. However, the main object of this study is not the derivation of the optimal level of financial development, but the effect of financial development on the share of entrepreneurs, so on income inequality.

wealth and talent. In the economy, labor market and credit market may not clear such that w and r are fixed and given exogenously.

3.3.2 Equilibrium

In equilibrium, each individual, given his initial wealth and talent, chooses between being an entrepreneur, a worker or self-employed in order to maximize his expected utility. If the poor but talented individuals cannot borrow from the financial system due to the high amount of collateral required, they apply for a job as employee and enjoy w, and, if they are not assigned one, they become self-employed and enjoy $\delta > 0$. On the other hand, if they are able to obtain credit, they can set up a firm and enjoy an expected income of π^e. The amount of collateral is more likely to exclude poor individuals as well as entrepreneurs with low level of wealth from accessing to financial services. As long as some entrepreneurs are excluded from production technologies, the overall output will decrease, the prices will eventually go up, business profits of the entrepreneurs will increase, and so income and wealth inequality may start to rise. As financial system develops more individuals can get access to credit and set up firm, the labour demand will increase, some self-employed individuals will become workers, and hence, income inequality will decrease.

A (b, z) type of individual will choose to become an entrepreneur if and only if his expected profit as an entrepreneur, $E_\theta[\pi^e(z, w, r, p)]$, is greater than the expected income of a non-entrepreneur (worker or self-employed), $E_\theta[\pi^{n.e.}(x_1, w, \delta)]$, given that $b \geq \underline{b}$.

If the financial sector works perfectly such that $\underline{b} = 0$, then initial wealth does not play an important role in becoming entrepreneurs, where sufficiently talented individuals can become entrepreneurs. However, in the case of financial imperfections, namely that $\underline{b} > 0$, to be an entrepreneur requires initial wealth $b \geq \underline{b}$ and talent $z \geq \underline{z}$, where $\underline{z}$ is the minimum talent level for entrepreneurs. Intuitively, individuals of a given talent $z \geq \underline{z}$ choose to become entrepreneurs only if they are wealthy enough to post the required amount of collateral for getting

credit. Similarly, individuals of a given wealth level $b \geq \underline{b}$ prefer to become entrepreneurs only if their talent is high enough. In that aspect, in the case of perfect financial markets, occupational choice depends only on an individual's talent but not on his wealth. That is, talented but poor individuals are more likely to become entrepreneurs and operate their businesses once obtaining credit from the financial sector becomes easier.

In order to characterize such equilibrium, let's consider two cases for individual i:

1) If $b_i \geq \underline{b}$, then two options emerge for each individual;

   a. If $E_\theta[\pi^e(z, w, r, p)] \geq E_\theta[\pi^{n.e.}(x_1, w, \delta)]$, then individual i prefers to be an entrepreneur.

   b. If $E_\theta[\pi^e(z, w, r, p)] < E_\theta[\pi^{n.e.}(x_1, w, \delta)]$, then individual i prefers to be a non-entrepreneur. He applies for a job as employee, and, if he is not assigned one, he becomes self-employed.

2) If $b_i < \underline{b}$, individual i cannot afford to set up a firm. Since $w \gg \delta$ irrespective of z, individual i applies for a job as employee, and, if he is not assigned one, he becomes self-employed.

The occupational choice of an individual in the case of $b_i < \underline{b}$ is trivial. However, a more interesting case concerns when $b_i \geq \underline{b}$. Given his talent z, an individual can be an entrepreneur if and only if

$$z[pz - wl - rk] + (1 - z)[-wl - rk] \geq \frac{x_2}{1 - x_1} w + \frac{x_3}{1 - x_1} \delta, \qquad (3.9)$$

where the left hand side (LHS) is the expected profit of an entrepreneur while the right hand side (RHS) is the expected income of a non-entrepreneur. Equation (3.9) implicitly defines a lower bound on the talent of entrepreneurs.

Proposition 1 *Individuals of a given wealth level $b \geq \underline{b}$ choose to become entrepreneurs only if their ability is high enough. So, the minimal level of talent for an entrepreneur, $\underline{z}$, can be defined as*

$$\underline{z}(x_1, w, r, p, \delta) = [\frac{x_1(-\delta l - \delta - rk) + \delta + wl + rk}{p(1 - x_1)}]^{1/2}. \qquad (3.10)$$

Proof: An individual, given his wealth $b \geq \underline{b}$, prefers to become an entrepreneur if and only if

$$z[pz - wl - rk] + (1 - z)[-wl - rk] \geq \frac{x_2}{1 - x_1} w + \frac{x_3}{1 - x_1} \delta.$$

The minimum talent $\underline{z}$ can be found by solving the inequality above in terms of z. By rewriting it, we have

$$pz^2 - wl - rk \geq \frac{x_1(wl - \delta l - \delta) + \delta}{1 - x_1},$$

and after doing some algebra, we have

$$z^2 \geq \frac{x_1(-\delta l - \delta - rk) + \delta + wl + rk}{p(1 - x_1)}. \tag{3.11}$$

Hence, $\underline{z}$, the minimum talent for entrepreneurs is the solution to the quadratic equation[12] formulated in (3.11), and it can be defined as

$$\underline{z}(x_1, w, r, p, \delta) = [\frac{x_1(-\delta l - \delta - rk) + \delta + wl + rk}{p(1 - x_1)}]^{1/2}.$$

According to Proposition 1, individuals with talent $z < \underline{z}$ always find that working for a wage is better than operating a firm although his initial wealth is greater than the threshold wealth level. Although they are financially unconstrained, namely that they are wealthy enough to set up a firm, their talent is so low that they never find it optimal to become an entrepreneur. Above this talent level, $\underline{z}$, individuals with wealth $b \geq \underline{b}$ can become an entrepreneur while individuals with wealth $b < \underline{b}$ do not find it optimal to become an entrepreneur, so they choose to be workers.

Hence, provided that an equilibrium exists, the share of entrepreneurs, x_1, is implicitly defined by Proposition 2.

Proposition 2 *Given (3.9) and Proposition 1, the share of entrepreneurs* x_1 *can be expressed as*

$$x_1 = Pr(b \geq \underline{b}) Pr(z \geq \underline{z}) = [1 - F(\underline{b})][1 - G(\underline{z})], \tag{3.12}$$

[12] Although the quadratic function (3.11) has two roots, I only take the positive root since talent is from a cumulative distribution function G with support on the interval $[0, 1]$

where $Pr(b \geq \underline{b})$ is the share of individuals with wealth greater than or equal to $\underline{b}$, $Pr(z \geq \underline{z})$ is the share of individuals with talent greater than or equal to the minimal talent required for entrepreneurs, b is drawn from a cumulative distribution function F with support on $\mathbb{R}_+$; z is drawn from a cumulative distribution function G with support on the interval $[0, 1]$, and these distributions are statistically independent.

Before identifying the existence and uniqueness conditions for such equilibrium, it is necessary to find how the minimal talent for entrepreneurs, $\underline{z}$, changes as the share of entrepreneur, x_1, changes. When x_1 increases, x_2 also increases, since $x_2 = lx_1$. If x_1 and x_2 increase, x_3 must decrease because of (3.5). In fact, when x_1 increases, the incentive to set up a firm decreases both because it increases competition and because it increases the demand for workers, thereby reducing the probability of ending up self-employed, given that $\pi^e > w \gg \delta > 0$. Therefore, less talented but rich individuals are more likely to become workers, increasing the average talent of the entrepreneurs, hence, the minimal talent level $\underline{z}$. Therefore, given Proposition 1, the minimal talent level increases with the share of entrepreneurs. This is shown in the next Lemma.

Lemma 1 *The minimum level of talent for entrepreneurs is increasing in the share of entrepreneurs such that $\frac{\partial \underline{z}}{\partial x_1} > 0$.*

Proof: Differentiating both sides of (3.10) with respect to x_1 gives;

$$\frac{\partial \underline{z}(x_1, w, r, p, \delta)}{\partial x_1} = \frac{\partial}{\partial x_1}([\frac{x_1(-\delta l - \delta - rk) + \delta + wl + rk}{p(1 - x_1)}]^{1/2})$$

That is,

$$\frac{\partial \underline{z}}{\partial x_1} = \frac{1}{2}[\frac{x_1(-\delta l - \delta - rk) + \delta + wl + rk}{p(1 - x_1)}]^{-1/2} \\ [\frac{pl(w - \delta)}{p^2(1 - x_1)^2} - \frac{(\frac{\partial p}{\partial x_1}(1 - x_1)x_1(-\delta l - \delta - rk) + \delta + wl + rk)}{p^2(1 - x_1)^2}]. \tag{3.13}$$

It is clear that $\frac{1}{2}[\frac{x_1(-\delta l - \delta - rk) + \delta + wl + rk}{p(1 - x_1)}]^{-1/2}$ is positive since $\underline{z} > 0$. Moreover $\frac{pl(w-\delta)}{p^2(1-x_1)^2}$ is positive since $w \gg \delta > 0$ and $x_1 < 1$. Remembering that p decreases in total output Q and decreases in the share of

entrepreneurs in the economy, that is, $\frac{\partial p}{\partial x_1}$ is negative. Hence, the RHS of (3.13) is positive, namely that $\frac{\partial \underline{z}}{\partial x_1} > 0$.

Proposition 3 *The equilibrium exists and it is unique. It is defined by (3.4), (3.5), and (3.12).*

Proof: Under what conditions can we be sure that a solution to (3.12) exists and the solution is unique? In order to characterize such equilibrium for the share of entrepreneurs in the economy, one should identify the conditions for the existence and uniqueness of equilibrium.

i) Existence of such equilibrium:

It is assumed in the model that each firm in the economy uses the same unit of capital and labour, and the number of workers equals firms' demand so that $x_2 = lx_1$. Moreover, in the economy everyone is given one occupation so that $x_1 + x_2 + x_3 = 1$, or namely that $x_1 = 1 - x_2 - x_3$. That is, the share of entrepreneurs is always bounded from above such that $x_1 \leq \frac{1}{1+l}$. Thus, the number of individuals who prefer to become workers is always more than or equal to the firms' demand so $x_2 = lx_1 \leq \frac{l}{1+l}$. In other words, there cannot be excess labour demand in the economy. Furthermore, labour supply is always $(1 - x_1)$, which never falls short of $\frac{l}{1+l}$. Hence, there exists at least one equilibrium and it is defined by (3.12).

ii) Uniqueness of such equilibrium:

The share of entrepreneurs is also bounded from below because when there are no entrepreneurs in the economy $(x_1 = 0)$ it is most profitable to be entrepreneurs in which case relatively less level of talent is required compared to $\underline{z}$ derived by (3.10), resulting in positive probability of setting up a firm, and so positive value of x_1. Moreover, the indifference condition for individuals (between becoming entrepreneurs or non-entrepreneurs) can be defined as

$$pz^2 - wl - rk = \frac{x_1(wl - \delta l - \delta) + \delta}{1 - x_1}.$$

It is clear to see that the LHS of the indifference condition is increasing in z, the RHS of it is decreasing in z because the function $x_1 = [1 - F(\underline{b})][1 - G(\underline{z})$ decreases clearly with z, and both sides are defined and continuous for all z and $x_1 \in (0, 1)$. Furthermore, an increase in the share of entrepreneurs increases the minimal level of talent, $\underline{z}$, that is $\frac{\partial \underline{z}}{\partial x_1} > 0$, which is shown in Lemma 1. Hence, x_1 is bounded both from below and above, and $\underline{z}$ is increasing in it, implying that there exists a unique equilibrium in the economy.

Now, let's suppose that the probability of success is independent of talent and is set to one as in Lloyd-Ellis and Bernhardt (2000) and Bianchi (2010). By doing so, I want to explore the effect of the relationship between individuals' talent and probability of success on the equilibrium outcome, which is the most crucial distinction between my model and the related literature.

Inserting into (3.1) the probability function $\theta = 1$, the profit function of an entrepreneur can be represented by:

$$\pi^e = pz - wl - rk$$

Hence, an individual, given his wealth b, prefers to become an entrepreneur if and only if

$$pz - wl - rk \geq \frac{x_1(wl - \delta l - \delta) + \delta}{1 - x_1},$$

where the left hand side is the expected income of an entrepreneur, and the right hand side is the expected income of a non-entrepreneur.

In this case, the minimal talent, let's name it as $\underline{z}_1$, can be found by inserting $x_2 = lx_1$ and solving the inequality condition above in terms of z, remembering that $\underline{b}$ is given exogenously. Hence, when the production success is independent of individuals' talent the minimal talent for entrepreneurs $\underline{z}_1$ can be defined as

$$\underline{z}_1 = \frac{x_1(-\delta l - \delta - rk) + wl + rk}{p(1 - x_1)}. \tag{3.14}$$

Lemma 2 *The relationship between talent z and probability of success θ changes the equilibrium share of entrepreneurs in the economy such that if the probability*

of production success is independent of individuals' talent (particularly when it is set to one), then the new equilibrium level of talent for an entrepreneur, $\underline{z}_1$, decreases, namely that $\underline{z}_1 \leq \underline{z}$. Hence, the interaction between x_1 and $\underline{z}$ changes the new equilibrium share of the entrepreneurs.

Proof: To prove Lemma 2, it is enough to show that $\underline{z}_1 \leq \underline{z}$. The proof comes from contradiction. Suppose that $\underline{z}_1 > \underline{z}$. Comparing the minimum levels of talent derived in (3.10) and (3.14) gives,

$$\underline{z}_1 = \frac{x_1(-\delta l - \delta - rk) + wl + rk}{p(1-x_1)} > [\frac{x_1(-\delta l - \delta - rk) + \delta + wl + rk}{p(1-x_1)}]^{1/2} = \underline{z}.$$

After some basic algebra, we have

$$(\underline{z}_1)^2 - \underline{z}_1 > \frac{\delta}{p(1-x_1)}.$$

Since $0 \leq \underline{z}_1 \leq 1$, $(\underline{z}_1)^2 - \underline{z}_1 < 0$. However, $\frac{\delta}{p(1-x_1)}$ is positive. Hence, by contradiction $\underline{z}_1 \leq \underline{z}$.

As proved in Lemma 2, it is obviously clear that once entrepreneurial talent is associated with the probability of production success, individuals who want to become entrepreneurs must have relatively high level of talent. Since the minimum talent to become an entrepreneur increases, there will be fewer but relatively talented entrepreneurs in equilibrium. This may cause an increase in income inequality as financial development efficiently allocates funds to more talented entrepreneurs, increasing their output disproportionately more than that of less talented entrepreneurs. On the other hand, since being an entrepreneur requires a high level of talent, rich but relatively less talented individuals become more likely to look for a job or to run one-man businesses, and hence, the income gap between the rich and poor individuals may start to decline. It should be noted that more efficient allocation of funds among entrepreneurs increases aggregate output and this might positively affect the well-being of the poor individuals. However, this does not have direct impact on my findings on the relationship between financial development and income inequality.

3.3.3 The Effect of Financial Development on the Share of Entrepreneurs

In this section, I study the effects of an increase in the level of financial development on the level of income inequality. I define the level of financial development with the amount of collateral needed to borrow from financial system, namely that $\underline{b}$. Hence, the higher the collateral, the lower is the level of financial development. Therefore, in the model the level of financial development affects income inequality to the extent it affects the equilibrium number of entrepreneurs.

The level of financial development, namely that $\underline{b}$, has two effects on the share of entrepreneurs, x_1; direct effect and indirect effect through $\underline{z}$. In this respect, the timing of the model can be described as follows:

1) When $\underline{b}$ increases, some poor individuals, though they are talented, cannot provide collateral, hence, they cannot be entrepreneurs (if they are already an entrepreneur they cannot borrow and invest any more, so they exit and look for a job). This reduces the number of entrepreneurs, x_1.

2) When x_1 decreases, x_2 also decreases since $x_2 = lx_1$. If x_1 and x_2 decrease, x_3 must increase because of (3.5).

3) When x_3 increases, the expected income of a non-entrepreneur decreases because $w \gg \delta$ and x_2 decreases. Therefore, the incentive to set up a firm increases.

4) Hence, rich but less talented individuals (who could afford the amount of collateral $\underline{b}$ but were not talented enough at the beginning) are more prone to become entrepreneurs. This will reduce the minimum talent level $\underline{z}$.

When x_1 decreases, the minimal talent to become entrepreneurs decreases, which is shown by Lemma 1. However, the interesting point in this framework is the indirect effect of $\underline{b}$ on $\underline{z}$ through x_1. In other words, $\underline{b}$ effects $\underline{z}$ because it first effects x_1, and then x_1 effects $\underline{z}$. Therefore,

all the equilibrium values are affected by $\underline{b}$, which is taken exogenously. Hence, equation (3.12) can be rewritten as

$$x_1 = Pr(b \geq \underline{b})Pr(z \geq \underline{z}(x_1)) = [1 - F(\underline{b})][1 - G(\underline{z}(x_1))]. \tag{3.15}$$

In order to see the effect of financial development on the share of entrepreneurs, I implicitly differentiate (3.15) with respect to $\underline{b}$ by taking into account the effect of $\underline{b}$ on $\underline{z}$, such that

$$\frac{\partial x_1}{\partial \underline{b}} = -\frac{\partial F(\underline{b})}{\partial \underline{b}} - \frac{\partial G(\underline{z}(x_1))}{\partial \underline{b}} + \frac{\partial F(\underline{b})}{\partial \underline{b}} G(\underline{z}(x_1)) + F(\underline{b}) \frac{\partial G(\underline{z}(x_1))}{\partial \underline{b}}$$

Since $\frac{\partial G(\underline{z}(x_1))}{\partial \underline{b}} = \frac{\partial G(\underline{z}(x_1))}{\partial \underline{z}(x_1)} \frac{\partial \underline{z}(x_1)}{\partial x_1} \frac{\partial x_1}{\partial \underline{b}}$, we have

$$\begin{aligned} \frac{\partial x_1}{\partial \underline{b}} = & -\frac{\partial F(\underline{b})}{\partial \underline{b}} - \frac{\partial G(\underline{z}(x_1))}{\partial \underline{z}(x_1)} \frac{\partial \underline{z}(x_1)}{\partial x_1} \frac{\partial x_1}{\partial \underline{b}} + \frac{\partial F(\underline{b})}{\partial \underline{b}} G(\underline{z}(x_1)) \\ & + F(\underline{b}) \frac{\partial G(\underline{z}(x_1))}{\partial \underline{z}(x_1)} \frac{\partial \underline{z}(x_1)}{\partial x_1} \frac{\partial x_1}{\partial \underline{b}}. \end{aligned}$$

Then,

$$\frac{\partial x_1}{\partial \underline{b}}[1 + \frac{\partial G(\underline{z}(x_1))}{\partial \underline{z}(x_1)} \frac{\partial \underline{z}(x_1)}{\partial x_1} - F(\underline{b}) \frac{\partial G(\underline{z}(x_1))}{\partial \underline{z}(x_1)} \frac{\partial \underline{z}(x_1)}{\partial x_1}] = -\frac{\partial F(\underline{b})}{\partial \underline{b}}[1 - G(\underline{z}(x_1)].$$

Thus, we have

$$\frac{\partial x_1}{\partial \underline{b}} = \frac{-\frac{\partial F(\underline{b})}{\partial \underline{b}}[1 - G(\underline{z}(x_1)]}{1 + [1 - F(\underline{b})] \frac{\partial G(\underline{z}(x_1))}{\partial \underline{z}(x_1)} \frac{\partial \underline{z}(x_1)}{\partial x_1}}. \tag{3.16}$$

As can be seen from the differentiation steps, when I take the derivative of x_1 with respect to $\underline{b}$, I also include the indirect effect of $\underline{b}$ on x_1 through $\underline{z}$. That is, $\frac{\partial x_1}{\partial \underline{b}}$ in (3.16) measures the overall effect (direct and indirect) of financial development on the share of entrepreneurs.

In (3.16), $\frac{\partial F(\underline{b})}{\partial \underline{b}}$ measures the change in the share of individuals who are not wealthy enough to become entrepreneurs as minimum wealth required to be an entrepreneur changes, hence, $\frac{\partial F(\underline{b})}{\partial \underline{b}} > 0$. In addition, $\frac{\partial G(\underline{z}(x_1))}{\partial \underline{z}(x_1)} \frac{\partial \underline{z}(x_1)}{\partial x_1}$ measures how the share of individuals who are not

talented enough to become entrepreneurs changes as the share of entrepreneurs increases, $\frac{\partial G(\underline{z}(x_1))}{\partial \underline{z}(x_1)} \frac{\partial \underline{z}(x_1)}{\partial x_1} > 0$, remembering that $\frac{\partial \underline{z}(x_1)}{\partial x_1} > 0$ from Lemma 1. Since the numerator is negative and the denominator is positive, $\frac{\partial x_1}{\partial \underline{b}} < 0$, indicating that if the amount of collateral required to borrow from the financial system increases, then the number of entrepreneurs in the economy decreases. Hence, the higher the financial development (i.e. the lower $\underline{b}$), the higher the share of entrepreneurs, and so the lower the income inequality in the society.

To sum up, as the financial system develops, namely that the amount of collateral required decreases, some poor individuals with relatively high talent can become entrepreneurs, resulting in increasing share of entrepreneurs and increasing average talent of entrepreneurs. Since the expected profit of an entrepreneur is higher than the worker's wage, a larger fraction of individuals will get higher income, which reduces income inequality. Moreover, competition among entrepreneurs and the demand for labour will increase as the share of entrepreneurs increases in the economy.[13] Since the labour demand increases, self-employed individuals become more likely to be assigned jobs, which will result in less income inequality. Hence, there will be more entrepreneurs and less self-employed in the economy, implying a lower income gap between individuals.

3.3.4 Does the Share of Entrepreneurs Really Impact Income Inequality?

In this subsection, I consider a scenario of increased level of financial development, and I study the impact of the enhanced number of entrepreneurs on income inequality. Since the higher the financial development the higher is the share of entrepreneurs, it is crucial to show whether the increasing number of entrepreneurs really reduces income inequality.

[13] It is important to note that financial development improves not only the efficiency of allocation of talent but also the efficient use of labour resources. Moreover, since financial development increases the number of entrepreneurs, as a consequence, labour demand will increase, and the price of consumption good will decrease.

To do that, let's first define how to measure income inequality. I use the GINI index (coefficient) to measure income inequality in the society. The GINI index is defined as a ratio of the areas on the Lorenz curve diagram. For a population uniform on the income values y_i, $i = 1$ to n, indexed in non-decreasing order ($y_i \leq y_{i+1}$), the GINI coefficient can be defined as

$$GINI = \frac{2\sum_{i=1}^{n} iy_i}{n\sum_{i=1}^{n} y_i} - \frac{n+1}{n}$$

Then, I consider a scenario such that there are n individuals with (x_1, x_2, x_3) shares of which consists of entrepreneurs, workers, and self-employed, respectively. The incomes of the entrepreneurs, self-employed and workers are π^e, w, δ, respectively, with $\pi^e > w \gg \delta > 0$. I assume, for the sake of simplicity, that all entrepreneurs get the same profit (independent from individuals' talent) from running firms, workers get the wage w, and self-employed individuals get δ (let's set $\delta = 0$ to simplify the calculations, noting that this does not change the results). I consider two cases which differ only in the level of financial development.

a) Suppose that there are equal numbers of each type of individuals ($x_1 = x_2 = x_3 = \frac{n}{3}$) in the economy and the minimum amount of collateral required to get credit is $\underline{b}_1$. Now, using the above formula for the GINI coefficient I have

$$GINI^a = \frac{1}{3}[\frac{2\pi^e}{\pi^e + w}]$$

b) Now, suppose that for exogenous reasons the financial system has developed in the economy, namely the minimum amount of collateral required to get credit decreases to $\underline{b}_2 < \underline{b}_1$. Since population size does not change over time, some poor but relatively talented individuals (they can be workers or self-employed) will become entrepreneurs. As the theoretical model suggested, the number of entrepreneurs will increase as the financial system develops. Noting that, since the labour demand increases, some self-employed

individuals may become workers because their expected income will increase, implying that there will be enough workers to meet firms' demand. Hence, as the financial system develops and access to finance becomes easier there will be more entrepreneurs in the economy. Suppose that there are $(x_1 = \frac{4n}{9}; x_2 = \frac{4n}{9}; x_3 = \frac{n}{9})$ entrepreneurs, workers and self-employed, respectively.[14] The new level of income inequality becomes

$$GINI^b = \frac{1}{9}[\frac{5\pi^e - 3w}{\pi^e + w}]$$

Comparing $GINI^a$ and $GINI^b$, I need to show that $GINI^b \leq GINI^a$. The proof comes from contradiction. Suppose that $GINI^b > GINI^a$, given that $\pi^e > w > 0$. Then,

$$\frac{1}{9}[\frac{5\pi^e - 3w}{\pi^e + w}] > \frac{1}{3}[\frac{2\pi^e}{\pi^e + w}]$$

Rewriting it,

$$-3w > \pi^e$$

which contradicts the assumption that $\pi^e > w > 0$.

Hence, it is proven that when the share of entrepreneurs increases income inequality will decreases in the society, namely that $GINI^b \leq GINI^a$.

3.4 Empirical Analysis

In this section I run panel regression to gain a deeper understanding of the relationship between financial development and income inequality. In the first subsection below, I discuss the variables that are used to measure the level of financial development and income inequality, and the selected sample. In the second subsection I establish a robust relationship between financial development and inequality. Finally, the last subsection is reserved for empirical testing of the model of the previous section.

[14] Changing the combination of (x_1, x_2, x_3) do not change the results. Moreover, fixing the population size n to a reel number would give the same results since the GINI coefficients in both cases are free of n.

3.4.1 Data

Variable Selection

To test the relationship between financial development, individuals' talent, and income inequality, I need to have compatible cross-country measures of talent and income distributions, and financial development.

Financial development The selection of key variables to measure financial development is one of the major problems in the related empirical literature. There is no directly measurable or reliable data available to measure the extent and efficiency of financial intermediation although the existing measures have been improved over the last years.[15] By following Ang and McKibbin (2007), principal component analysis (PCA) is utilized in this study to construct satisfactory and reliable indicators of financial development. Moreover, to capture a more complete picture, I use both bank-based and market-based financial proxies to measure the level of financial development.

To measure the level of financial development, I first use the logarithm of domestic credit to the private sector as a share of GDP (*private*). Credit to private sector captures the amount of credit channelled from savers, through financial intermediaries, to private firms. It is a comparatively comprehensive measure of credit issuing intermediaries since it also includes the credits of financial intermediaries that are not considered deposit money banks. Hence, it reflects the extent of efficient resource allocation since the private sector is able to utilize funds in a more efficient and productive manner. Second, I use the logarithm of the ratio of M2 (money and quasi money) to GDP (*money*). M2 comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. The ratio of M2 to GDP has been used as a traditional measure of financial depth and it captures the degree of monetization in the system. Third, I use the logarithm of stock market capitalization of listed companies to GDP (*mk-*

[15] Levine (2003) mentions the problem of choosing a proxy for measuring financial development and the differences among economies in terms of the availability of financial intermediation.

tcap). It measures the overall size of stock markets and reflects the importance of financing through equity issues in the capital mobilization and resource allocation process. Finally, I use the logarithm of the stock market turnover ratio (*turnover*) as a second proxy for stock market development. Turnover ratio is the ratio of total value traded to market capitalization, and it measures how active or liquid the stock market is relative to its size. All these indicators are selected from the literature by taking into account their comprehensiveness and availability. Table C.2 in Appendix C presents some empirical studies that use these indicators of financial development. Financial development indicators are compiled from the World Bank's World Development Indicators database.

However, these series are highly correlated. The correlation matrix presented in Table B.1 in Appendix B confirms the interrelations between the indicators, and suggests that the financial development indicators may contain common information, which may lead to multi-collinearity and over-parametrization problems. This multi-collinearity problem is a further justification for the construction of a new aggregate measure. Using these four financial development indicators, I develop an aggregate measure (*finance-aggregate*) to represent the level of financial development. This aggregate measure employs principal component analysis, which deals with the problems of over-parametrization and multi-collinearity. Theoretically, this new aggregate measure is able to capture most of the information from the original dataset.

Income inequality To measure the level of income inequality I use the Gini coefficient, which has been typically used in the literature and is available for a longer period of time compared to other income inequality measures. The Gini coefficient measures deviations from perfect income equality, and it is based on the Lorenz curve, a standard indicator of the distribution of income within a community. The Gini coefficient is expressed as a percentage, and ranges from 0 (perfect equality) to 1 (perfect inequality), that is, higher values imply greater income inequality. I use the net Gini coefficients for the panel countries, which are drawn from the SWIID, constructed by Solt (2009) using the Luxembourg Income Study as the harmonized benchmark for comparable estimates.

The net Gini coefficient describes income inequality across size-adjusted households after taxes and transfers taken into account. The SWIID is my preferred source of data on income inequality as it provides comparable figures across countries and over a longer span of time.

Individuals' talent As I showed in the theoretical model in part 3.3, becoming an entrepreneur requires both a minimum level of talent and a certain amount of wealth. In other words, individuals of a given talent can become entrepreneurs only if they are wealthy enough to post the required amount of collateral for getting credit. Similarly, individuals of a given wealth level prefer to become entrepreneurs only if their talent is high enough. Hence, financial development has an impact on income inequality since it determines who will become entrepreneurs. If there was no financial friction, then becoming an entrepreneur or worker would only depend on an individual's ability but not on his wealth. Hence, it is crucial to include a measure of individual talent in the regressions to empirically support the theoretical predictions of my model. Holding constant the level of financial development, I assume that a higher level of talent would be associated with a lower level of income inequality, namely that if a country, on average, has relatively more talented individuals, then there might be less income inequality. To the best of my knowledge, there is no such study that uses individuals' talent while determining the relationship between financial development and income inequality.

To measure the level of individuals' talent I use the mean mathematics performance of each country in PISA. The PISA is an internationally standardized assessment of student achievement that is organized and conducted by the Organisation for Economic Co-operation and Development (OECD). The tests are aimed to evaluate education systems worldwide every three years by assessing 15-year old individuals in schools and to provide a useful quantification of skills in reading, mathematics and science. The main advantage of the use of PISA scores for the purposes of this study is the uniform assessment of young people near the end of compulsory schooling. The PISA score captures students of the same age in each country independently of the structure of national

school systems. As a second advantage, PISA tests the young adults' ability to use their knowledge and skills in order to meet real-life challenges. Hence, PISA provides a single, comparable measure of skills for each country that can be used to index the talent of individuals prior to their entry into the economy. However, the PISA scores are available only for the years 2000, 2003, 2006, 2009, 2012. I collected the mean of the Math test score, noting that the correlation of student performance between the three subjects is quite substantial, and exceeds 0.95.

Other control variables To assess the strength of the linkage between financial development and income inequality, I control for other potential determinants of inequality in regressions. I use standard control variables that are widely used in the literature (for a survey, see Christiaensen et al., 2003). These variables are also introduced into the model as a test of robustness. First, I include the lagged value of the net Gini coefficient as a regressor to account for persistency in income inequality as in Beck et al. (2007), although this is a more data-demanding specification. Second, I add inflation rate (*inflation*) as a control variable since Ravallion (2001) and Dollar and Kraay (2002) all find evidence that this is a significant determinant of inequality. Since monetary instability hurts the poor and the middle class relatively more than the rich, because the latter have better access to financial instruments that allow them to hedge their exposure to inflation, I expect inflation to have a positive coefficient. Third, in order to test the impact of economic growth on inequality, I use the growth rate of the real per capita GDP (*growth*), as in Dollar and Kraay (2002) and Beck et al. (2007), assuming that it is crucial to control whether financial development affects those on low-incomes by its effect on GDP per capita. Fourth, I use the logarithm of the secondary school enrolment rate (*education*) to control for human capital accumulation, hypothesizing that countries with better and broader access to education in general are expected to have less income inequality. Fifth, the logarithm of the ratio of government consumption to GDP (*government*) is used to measure macroeconomic stability (see Beck et al., 2000). Sixth, I use the logarithm of the ratio of trade to GDP (*trade*) to capture the degree of openness of an economy. Seventh, I control for the effect of tax revenues

on income inequality since taxation generates revenues to fund public spending on social programs which can contribute to reducing income inequality. Hence, I expect the sign of the tax revenue to GDP ratio (*tax*) to be negative. Eighth, to measure the level of institutional quality I use corruption index (*corrupt*), lower values of which indicate higher level of corruption (or lower institutional quality), hence, expecting that lower values of corruption index should be associated with a higher level of income inequality as it shows how corrupt the public sector is. Finally, I control for the law and order index (*law*) to measure the political stability across and within the countries. Economic variables are collected from the World Bank's World Development Indicators database. Corruption and law and order data are taken from the International Country Risk Guide database, which is provided by the Political Risk Services.

The Sample

The sample consists of developed and developing countries as in those of Dollar and Kraay (2002) and Beck et al. (2007). Unfortunately, the data availability limits my choice of sample countries. This study uses a cross-country sample of 46 countries for the period of 1998-2012.[16] Since the PISA scores are only available for some years, I restricted my sample period to 15 years. Moreover, in contrast to developed countries, time series data on inequality are very limited in many emerging countries, since these countries only started recording such data in the early 2000s. Thus, data was available for only 46 countries of which have participated in PISA, have financial development and income inequality variables for the given sample period.[17] Therefore, I determine the countries for the

[16]The dataset includes the following 46 countries: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Peru, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States, Uruguay.

[17]There are, on average, 70 countries in PISA tests. However, since I need financial development and income inequality datasets for each country, I excluded the countries that do not have available data for the sample period. Therefore, I restricted the sample to 46 developed and developing countries each of which has PISA score, financial development,

panel based on the availability of financial development, individuals' talent data and income inequality indicators.

Data are averaged over five 3-year periods[18] rather than considered annually or quarterly in order to sweep out business cycle fluctuations. Moreover, averaging data over a period solves missing data problem. I require that a country should have data for at least four non-overlapping time points to be included in any estimated systems.

Descriptive Statistics

Table 3.1 provides descriptive statistics for all the variables used in this study.

Table 3.1: Complete Dataset Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Gini coefficient	230	33.13	7.70	22.23	54.38
GDP per capita growth	230	2.24	2.64	-6.69	11.64
Private credits to GDP	226	85.97	54.73	8.91	236.73
M2 to GDP	225	94.72	90.57	15.73	647.44
Market capitalization to GDP	230	58.01	47.82	0.33	254.80
Turnover ratio	229	64.79	58.37	0.16	323.03
PISA score	203	479.88	48.05	292.0	557.00
Government consumption to GDP	230	18.03	4.21	6.67	27.06
Inflation rate	230	5.00	7.81	-1.64	80.45
Tax revenue to GDP	205	18.80	5.53	9.12	34.04
School enrolment rate	221	100.96	14.95	59.90	156.61
Trade to GDP	230	82.60	47.82	18.53	339.26
Corruption index	230	3.63	1.21	1.08	6.00
Law and order index	230	4.66	1.19	1.00	6.00

Note: All variables are averaged over three-year period.
All variables are in percentage form except GDP per capita, PISA score, corruption index and law and order index.

There are considerable variations in financial development indicators across countries. For example, private credit to GDP ratio ranges from a low of 8.9% in Romania (in 1998-2000) to a high of 236.7% in Iceland (in 2004-2006). Turnover ratio ranges from a low of 0.16% in Luxembourg (in 2010-2012) to a high of 323% in the United States (in 2007-2009). Regarding income inequality, the sample contains countries with Gini co-

and income inequality variables.

[18] I have five periods. The first period represents the data averaged between 1998 and 2000, the second period represents the data averaged between 2001 and 2003, the third period represents the data averaged between 2004 and 2006, and so on.

efficients ranging from around 22% in Slovenia (in 2001-2003) to over 54% in Peru (in 1998-2000). Moreover, there are substantial differences in PISA scores, which are used to measure the talent distribution, across countries. The mean PISA Math test score varies between 292 for Peru (in 1998-2000) and 557 for Japan (in 1998-2000).

The pairwise correlations, which are presented in Table B.1 in B, indicate that income inequality is lower in countries with deeper financial markets; all financial development variables are significantly and negatively correlated with the Gini coefficient. Moreover, the mean PISA Math score is negatively and significantly correlated with the Gini coefficient while GDP per capita growth is positively but insignificantly associated with income inequality.

Principal Components

The results of the extraction of PCA for financial development indicators are presented in Table 3.2.

Table 3.2: Principal Component Analysis for Financial Development Variables

	PCA1	**PCA2**	**PCA3**	**PCA4**
Eigenvalues	2.54	0.87	0.43	0.16
% of variance	0.64	0.22	0.10	0.04
Cumulative %	0.64	0.86	0.96	1.00
	Eigenvectors			
Variable	**Vector 1**	**Vector 2**	**Vector 3**	**Vector 4**
Private credits to GDP	0.5699	-0.2584	0.2661	-0.7332
M2 to GDP	0.5244	-0.4942	0.214	0.6595
Market capitalization to GDP	0.5105	0.2081	-0.8341	0.0208
Stock market turnover	0.3736	0.8035	0.4332	0.1645

Source: Author's calculation.

The financial development indicator corresponds to the first principal component, the only one with an eigenvalue greater than 1, and which explains about 64% of the total variance. The remaining principal components are not considered since their marginal contributions are relatively small. For instance, while the second principal component explains 22% of the variation, the third principal component explains 10% of the variation, and the last principal component explains only 4% of

the variation. The synthetic variable, namely the aggregate measure of financial development (*finance-aggregate*), is computed as a linear combination of the four widely used indicators with weights given by the first eigenvector.

3.4.2 Econometric Methodology

In this subsection, I intend to find a robust relationship between financial development and income inequality. To this end, the cross-country analysis for a panel of 46 countries over the period 1998-2012 is conducted with the following specification:

$$ln(GINI_{i,t}) = \beta_0 + \beta_1 ln(FD_{i,t}) + \beta_2 ln(PISA_{i,t}) + \beta_3 ln(X_{i,t}) + c_i + \mu_t + \epsilon_{i,t} \tag{3.17}$$

where ln denotes the natural logarithm, $GINI_{i,t}$ is the net Gini coefficient in country i at period t. Each period t represents the three-year averaged time points, remembering that I have five time periods. $FD_{i,t}$ is the level of financial development measured by *finance-aggregate*; and $PISA_{i,t}$ is the mean mathematics score in the PISA test. $X_{i,t}$ is a vector of control variable including the lagged net Gini coefficient, per capita GDP growth, human capital accumulation, government consumption, inflation rate, trade openness, tax revenue, corruption index, and law and order index. The c_i and μ_t coefficients denote country and time specific effects, while $\epsilon_{i,t}$ is an idiosyncratic error term that satisfies the standard assumptions of zero mean and constant variance.

This study uses panel data analysis in order to estimate the model. As Gujarati (2003) says, "panel data methods are used because they can provide more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency". In the panel data model, c_i is called a "random effect" when it is treated as a random variable, and a "fixed effect" when it is treated as a parameter to be estimated for each cross section observation (Wooldridge, 2010). The term fixed effect means that one allows for arbitrary correlation between the unobserved effect c_i and the observed explanatory variables. Accord-

ingly, c_i is called an "individual fixed effect." In the regression model, the zero conditional mean assumption-where the mean of the error terms given a specific value of the independent variable is zero is the necessary condition for consistent fixed effects and random effects estimations.

The regressions are estimated with the fixed-effects (FE) model since fixed-effects estimators are considered to be quite efficient in the case of panel data analysis. In order to see if it is safe to use fixed-effects, the analysis also performs the Hausman test indicating that, since the fixed-effects model is consistent when observed explanatory variables and unobserved effects are correlated, but random-effects (RE) model is inconsistent, a statistically significant difference is interpreted as evidence in favour of the fixed-effects model.[19] However, the relationship between financial sector development and income inequality may exhibit contemporaneous reverse causation, as income inequality influences the provision of financial services. Estimating (3.21) using Ordinary Least Squares (OLS), FE, or RE estimations might introduce bias because OLS, FE and RE do not allow for possibility of reverse causality and so they do not take into account the issue of endogeneity. To deal with the problem of country specific effects and the problem of endogeneity, I use an instrumental variables (IV) approach, adopting instruments for financial sector development similar to the ones used in Levine (1999) and Clarke et al. (2006). The instruments are a set of dummy variables proposed by La Porta et al. (1997) that identify the origin of the country's legal system.[20] Several studies have shown that historically determined differences in legal origin can explain cross-country differences in financial development (see Clarke et al., 2006; Beck et al., 2001; La Porta et al., 1997, among others). It might be because different legal systems put different levels of emphasis on the rights of property owners or because some systems are more adaptable to exogenous changes than others (Clarke et al.,

[19]The advantage of the random-effects model is the consistent estimations of time-invariant variables, which cannot be estimated in the fixed-effects model, because it is not possible to distinguish the effects of time-invariant observables and unobservables (Wooldridge, 2010.

[20]The data for legal origin is collected from the Global Development Network Growth Database produced by William Easterly and Mirvat Sewadeh.

2006).[21]

Moreover, to account for persistency in income inequality I apply the System GMM estimator in a dynamic panel data model including lagged values of the dependent variable as a regressor. The System GMM approach provides more robust and consistent parameter estimates and overcomes the possible endogeneity of the explanatory variables in dynamic panel data models. In this case I estimate the following equation:

$$\begin{aligned} ln(GINI_{i,t}) =& \beta_0 + \beta_1 ln(GINI_{i,t-1}) + \beta_2 ln(FD_{i,t}) + \beta_3 ln(PISA_{i,t}) \\ &+ \beta_4 ln(X_{i,t}) + c_i + \mu_t + \epsilon_{i,t} \end{aligned} \tag{3.18}$$

To test the validity of the instruments, I first use the standard Hansen J test of over-identification, where the null hypothesis is that the instrumental variables are not correlated with the residual. Then, I provide the results of the AR (2) test for autocorrelation, where the null hypothesis is that there is no autocorrelation in the error terms. Both in the IV and dynamic panel data estimations, p values corresponding to two tests are provided in all of the tables.

3.5 Empirical Results

3.5.1 Main Results

I present the results from panel regressions. As noted in the previous subsection, I divide the data up into five three-year periods. To control for structural differences across periods, all regressions include time dummies, though the coefficients of the time dummies are not reported in the tables in order to conserve space. STATA 12 is used as the econometrics package. For the purpose of completeness, the models employ the OLS, FE, IV-RE and System GMM estimators. The OLS and FE estimates represent a biased modelling approach with some theoretical in-

[21] British Common law is usually said to stress private property rights and thus fosters financial development, whereas the protection for corporate shareholders and creditors are weakest in French Civil law countries. Beck et al. (2001) show that private credit is lower in French Civil law countries than in German Civil law and British Common law countries. For more details see La Porta et al. (1997), among others.

consistencies, and so the IV-RE and System GMM results are the primary source of the discussion. In all runs, I assume that control variables are exogenous and financial development indicators are endogenous in the sense of being correlated with shocks to income inequality measure in both the current and previous periods. Moreover, because GDP per capita growth is highly correlated with financial sector development (see Levine, 2005 for a review of the related literature), to make sure that the analysis is robust with respect to the multicollinearity between GDP per capita growth and financial development, I also estimate the model omitting this variable.[22]

Table 3.3 reports the outcomes of the regression models on *finance-aggregate* and the Gini coefficient. As a first exercise, I treat the financial development variable as exogenous and estimate a fixed-effects regression.[23] When the measure of financial development, *finance-aggregate*, is treated as exogenous, its coefficient is small, positive, and statistically significant (columns 1, 2, 3 and 4 of Table 3.3). However, the estimated coefficient of the talent distribution (*PISA*) is negative and statistically significant, indicating that as individuals' talent increases income inequality decreases (columns 2 and 3 of Table 3.3). With regard to the control variables, only government expenditure to GDP ratio and the inflation rate have statistically significant effects on income inequality with negative and positive signs, respectively.

As a second exercise, the financial development variable, *finance-aggregate*, is treated as endogenous. To control for endogeneity I use the legal origin of each country as instruments in a Two Stage Least Squares (2SLS) analysis. When I perform a Durbin-Wu-Hausman test (for the fixed-effects model), the null hypothesis that financial development is exogenous is rejected at 1% significance level, favouring the results from the 2SLS regressions. The STATA command for the instrumental variable method is

[22] In addition, a high correlation between the talent distribution variable (*pisa*) and secondary school enrolment rate (*education*) is observed in the data. Hence, I rerun the regressions by omitting (*education*).

[23] To decide between fixed-effects and random-effects model I use the Hausman test, where the null hypothesis that the country effects are uncorrelated with the additional variables is rejected, favouring the fixed-effects estimator.

xtivreg, specifying Baltagi's EC2SLS estimator of the random-effects model.[24] Since the legal origin of a country does not change over time, I am unable to estimate instrumental variable regressions that include fixed effects, though the Hausman test favours it. Moreover, an important concern with respect to the fixed-effects estimator would be that fixed effects might remove most of the variation in income inequality since a large portion of the variance in countries' inequality is cross-country variance compared to the cross-time variance (see Li et al., 1998). Therefore, I estimate the model using a random-effects instrumental approach. The results of the 2SLS analysis using legal origins as instruments are presented in the columns 5, 6, 7 and 8 of Table 3.3. It becomes evident that compared to fixed-effects all estimated coefficients of *finance-aggregate* are negative and statistically significant at 1% significance level, implying that financial development can effectively reduce income inequality. Hence, the IV-RE estimates show that financial development leads to a significant decrease in the entire distribution of income, which is measured by the Gini coefficient. In addition, the results suggest that individual talent (or talent distribution) is strongly and negatively associated with income inequality, that is, countries with higher PISA score have less income inequality. This is consistent with the theoretical background of this study which predicts that individuals' talent play an important role in determining the level of a country's income inequality.

The negative relationship between financial development and the Gini coefficient is robust to a number of sensitivity tests. In column 6 of Table 3.3, I control for GDP per capita growth. Although the relationship between growth and income inequality is statistically insignificant, financial development and talent distribution variables remain negative and significant at 1% significance level. I find that government consumption is a statistically significant factor with a positive effect on decreasing in-

[24]Baltagi and Li (1992) showed that the G2SLS instruments are a subset of those in EC2SLS. They also proved that asymptotic variance of G2SLS differs from that of EC2SLS by a positive semi-definite matrix, and in small samples, this difference may be different from zero and can lead to gains in small sample efficiency. See also http://www.stata.com/manuals13/xtxtivreg.pdfxtxtivreg for more details about the *xtivreg* command in Stata.

come inequality. The estimated coefficient of government consumption has the desired negative sign, indicating that government consumption lowers the net Gini coefficient. In line with the literature, I find that trade openness (*trade*) has a negative and statistically significant effect on income inequality in almost all specifications, improving the distribution of income in the selected sample of countries. Other than these inflation rate produces significant coefficients in some regressions, but not in all. The results suggest that high levels of inflation lead to greater income inequality. On the other hand, tax revenue to GDP ratio (*tax*) and secondary school enrolment rate (*education*) are positively but insignificantly correlated with income inequality. Corruption index (*corrupt*), lower values of which indicate better quality institutions, on the other hand, has an improving effect on income inequality, as expected, though statistically insignificant, suggesting that income inequality will decrease as countries become less corrupt.

Moreover, Table 3.4 reports the results when *GDP per capita growth* and *education* are omitted. The results for the 2SLS estimations are slightly different when I omit *GDP per capita growth* and *education* (columns 4-8 in Table 3.4). The estimated coefficients of *finance-aggregate* remain statistically significant and negative but with smaller significance levels. However, the coefficients of *PISA* do not change in terms of significance level, though their magnitudes become larger. Furthermore, in column 8 of Table 3.4, I control for the *law* as another aspect of political risk in each country. The results show that there is a negative and statistically significant relationship between *law* and *the net Gini coefficient*, indicating that countries with higher level of law enforcement have lower income inequality. With regard to the other control variables, the results do not differ significantly. The estimated coefficients for *trade* and *government* are statistically significant, as before.

To capture the persistency in income inequality, I employ the System GMM estimations in a dynamic panel data model. The System GMM results indicate a high degree of persistency in income inequality (column 9 of Table 3.3 and Table 3.4). The coefficient on the lagged net Gini coefficient is positive and statistically significant. However, noticeably, the

coefficient of *finance-aggregate* becomes statistically insignificant, though it is negative, when I consider the dynamic specification with other control variables.

Table 3.3: Financial Development and Income Inequality

Dependent Variable:	Gini Coefficient (natural log)								
Estimation Method:	FE	FE	FE	FE	IV-RE	IV-RE	IV-RE	IV-RE	GMM
Column:	1	2	3	4	5	6	7	8	9
Finance-aggregate	0.019	0.018	0.018	0.026	-0.090	-0.073	-0.037	-0.042	-0.017
	(0.007)**	(0.008)**	(0.008)**	(0.009)***	(0.026)***	(0.023)***	(0.013)***	(0.013)***	(0.027)
Pisa		-0.305	-0.275	-0.225	-0.409	-0.423	-0.507	-0.563	-0.449
		(0.105)***	(0.108)**	(0.231)	(0.148)***	(0.133)***	(0.127)***	(0.137)***	(0.213)**
Growth			-0.002	-0.001		0.0002	0.003	0.002	0.003
			(0.002)	(0.002)		(0.002)	(0.002)	(0.002)	(0.001)*
Trade				0.019			-0.086	-0.114	-0.088
				(0.039)			(0.033)**	(0.030)***	(0.039)**
Government				-0.169			-0.245	-0.194	-0.168
				(0.074)**			(0.049)***	(0.051)***	(0.118)
Inflation				0.019			0.011	0.013	0.017
				(0.008)**			(0.011)	(0.012)	(0.020)
Education				0.029			0.061	0.040	0.116
				(0.064)			(0.057)	(0.065)	(0.079)
Tax				-0.010			0.016	-0.048	0.007
				(0.059)			(0.042)	(0.051)	(0.036)
Corruption				0.008			-0.010	-0.006	-0.003
				(0.007)			(0.007)	(0.009)	(0.014)
Finance-aggregate square								-0.014	
								(0.009)	
Gini (t-1)									0.369
									(0.176)**
R-squared	0.07	0.09	0.10	0.22	0.45	0.48	0.69	0.70	
Observations	224	197	197	171	183	183	157	157	146
F test	2.34	2.45	2.27	2.52	6.54	4.88	8.29	11.74	21.49
Time F test	0.04	0.02	0.03	0.01	0.00	0.00	0.00	0.00	0.00
Hansen J test					0.34	0.35	0.38	0.12	0.26
AR (2) test									0.41

Note: All panel regressions include a country fixed effect and year dummies.
The instruments for the IV-RE analysis are dummies indicating legal origin.
The suitable lagged values of covariates and dependent variable are the instruments for the System GMM analysis.
Time F test gives the p value for the joint significance of year dummies. T-statistics are robust standard errors and reported in parenthesis.
*, **, *** denote 10%, 5% and 1% confidence levels, respectively.

Table 3.4: Financial Development and Income Inequality: Omitting GDP Per Capita Growth and Education

Dependent Variable:	Gini Coefficient (natural log)								
Estimation Method:	OLS	FE	IV-RE	IV-RE	IV-RE	IV-RE	IV-RE	IV-RE	GMM
Column:	1	2	3	4	5	6	7	8	9
Finance-aggregate	0.023	0.019	-0.091	-0.045	-0.048	-0.036	-0.037	-0.029	-0.022
	(0.012)*	(0.009)**	(0.021)***	(0.016)***	(0.017)***	(0.021)*	(0.019)*	(0.015)*	(0.037)
Pisa	-0.863	-0.357	-0.317	-0.506	-0.515	-0.524	-0.515	-0.449	-0.437
	(0.141)***	(0.211)*	(0.157)**	(0.119)***	(0.118)***	(0.11)***	(0.111)***	(0.111)***	(0.189)**
Trade	-0.133	0.019	-0.113	-0.083	-0.078	-0.049	-0.056	0.072	-0.096
	(0.022)***	(0.034)	(0.037)***	(0.029)***	(0.029)***	(0.036)	(0.036)	(0.031)**	(0.038)**
Government	-0.170	-0.184		-0.259	-0.263	-0.265	-0.256	-0.230	-0.101
	(0.106)	(0.080)**		(0.048)***	(0.048)***	(0.051)***	(0.051)***	(0.048)***	(0.077)
Inflation	0.067	0.015			-0.008	0.01	0.010	0.013	0.018
	(0.020)***	(0.008)*			(0.009)	(0.009)	(0.009)	(0.010)	(0.026)
Tax	-0.009	-0.013				0.032	0.029	0.011	0.001
	(0.053)	(0.056)				(0.048)	(0.046)	(0.041)	(0.033)
Corruption	-0.031	0.006					-0.008	-0.005	0.0006
	(0.012)**	(0.007)					(0.007)	(0.007)	(0.019)
Law								-0.098	
								(0.039)**	
Gini (t-1)									0.364
									(0.134)***
R-squared	0.75	0.21	0.56	0.67	0.66	0.65	0.66	0.71	
Observations	179	179	183	183	183	165	165	165	153
F test	36.78	2.26	8.18	13.84	11.93	7.13	6.91	10.06	53.14
Time F test	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hansen J test			0.27	0.26	0.23	0.23	0.30	0.27	0.43
AR (2) test									0.48

Note: All panel regressions include a country fixed effect and year dummies.

The instruments for the IV-RE analysis are dummies indicating legal origin.

The suitable lagged values of covariates and dependent variable are the instruments for the System GMM analysis.

Time F test gives the p value for the joint significance of year dummies. T-statistics are robust standard errors and reported in parenthesis.

*, **, *** denote 10%, 5% and 1% confidence levels, respectively.

3.5.2 Testing for the Inverted U-Shaped Relationship

In this subsection, I test the inverted U-shaped relationship between financial development and income inequality. To test whether the data predict a linear or an inverted U-shaped relationship between financial development indicators and income inequality, I run the following equation:

$$GINI_{i,t} = \beta_0 + \beta_1 FD_{i,t} + \beta_2 FD_{i,t}^2 + \beta_3 PISA_{i,t} + \beta_4 X_{i,t} + c_i + \mu_t + \epsilon_{i,t}$$

where $GINI$ is the net Gini coefficient, and FD represents the level of financial development. The models of Banerjee and Newman (1993) and Galor and Zeira (1993) found a linear relationship ($\beta_1 < 0$ and $\beta_2 = 0$) while the model of Greenwood and Jovanovic (1989) predicted an inverted U-shaped relationship ($\beta_1 > 0$ and $\beta_2 < 0$) between financial development and income inequality.

Column 8 of Table 3.3 reports the result for the non-linearity test. When I include the square of *finance-aggregate* as a regressor, its estimated coefficient enters negatively, though it is statistically insignificant. Hence, the regression result does not suggest an evidence of non-linearity between financial development and income inequality. However, the significance level of *finance-aggregate* does not change and it is still negatively associated with the net Gini coefficient.

To visualize the relation between the Gini coefficient and financial development, namely *finance-aggregate*, Figure 3.1 plots the logarithm of the Gini coefficient and the fitted value from the regression of the logarithm of the Gini coefficient on *finance-aggregate* against *finance-aggregate*.[25] The plot in Figure 3.1 suggests a negative and possible non-linear relationship between financial development and income inequality. Moreover, to test the non-linear relationship between financial development and income inequality I include *finance-aggregate* and its square as regressors in the econometric analysis and the estimated coefficient of the square of *finance-aggregate* appears statistically insignificant. Hence, the findings

[25]The fitted line is from a regression of log (Gini) on the first principal component that measures the level of financial development and its square. All data are averaged over five 3-year periods between 1998 and 2012.

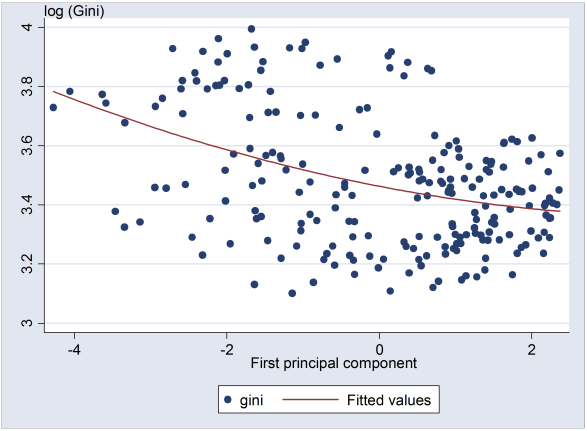

Figure 3.1: Log (Gini) and finance-aggregate in a panel of 46 countries

clearly do not support the non-linear hypothesis for the relationship between financial development and income inequality.

3.6 Concluding Remarks and Policy Implications

In this chapter I study the relationship between income inequality and financial development. I first build an occupational choice model with heterogeneous agents to explore the role of financial development in reducing income inequality through promoting the efficient allocation of talent. In the model, I define the level of financial development as the amount of collateral needed to obtain credit from the financial sector. The level of financial development affects income inequality to the extent that it affects the equilibrium number of entrepreneurs and average entrepreneurial talent. In other words, as the financial system develops, namely that the amount of collateral required decreases, some poor individuals with relatively high talent can become entrepreneurs, resulting in an increasing share of entrepreneurs and increasing average talent of entrepreneurs. Hence, the higher the financial development (the lower is the collateral), the higher is the fraction of individuals who can con-

sider setting up a firm. In the equilibrium of the model, I show that an increase in the level of financial development induces more individuals to become entrepreneurs, resulting in less income inequality.

Then, I empirically test the impact of financial development on income inequality by using a cross-country panel data set of 46 countries for the period of 1998-2012. There has been little systematic empirical study on the relationship between financial development and income inequality. In this chapter, I provide a robust support in favour of the negative relationship between financial development and income inequality. I employ principal component analysis to construct satisfactory and reliable measures of financial development. As a consequence of the theoretical predictions, I also consider the role of the talent distribution of each country in reducing income inequality. I use mean mathematics performance in each country in the PISA test as a proxy for talent distribution. The PISA is an internationally standardized assessment of student achievement that is organized and conducted by the OECD. The PISA score captures students of the same age in each country independently of the structure of national school systems, and it provides a single, comparable measure of skills for each country that can be used to proxy talent of individuals prior to their entry into the economy.

The empirical findings presented in this study are consistent with the existing literature on the relationship between financial development and income inequality. First, I show that an increase in the level of financial development - instrumented by the legal origin of each country - leads to a decrease in the net Gini coefficient. Second, the findings clearly support the linear hypothesis for the relationship between financial development and income inequality. Third, I show that both government consumption and trade openness reduce income inequality. Fourth, taxation seems to increase income inequality, though its effect is not strong. The taxation system needs to be broadened in a more progressive way to help narrow income inequality since taxation may generate sufficient revenues to fund public spending on social programs. The results suggest that there is a negative and statistically significant relationship between individuals' talent and income inequality. Economies with tal-

ented individuals have less income inequality compared to ones with relatively less talented individuals. This result is indeed important since none of the existing empirical studies has ever tried to proxy individuals' talent with PISA scores to investigate their impact on inequality.

Overall, observations on relations between financial development and income inequality have significant policy implications. One of the most important implications, regarding the positive impact on inequality reduction of financial development in selected countries, is that the challenge of inequality may require global policy response, due to its potential global threat. In this context, redistributive social/economic policies and institutional improvements in law/finance would be a more effective/direct approach to reducing inequality, in addition to minimizing financial market imperfections/constraints and lack of finance. The empirical results of this study show that political stability plays an important role in reducing income inequality such that countries with higher level of law enforcement and better institutions have experienced lower income inequality. The outcomes of this study may also imply that more democratized access to credit markets reduces income inequality. The concentrated political/economic power of elites and higher income groups may result in their easier access to credit while institutional/legal obstacles for the poor may result in limited/weak access to the financial services. As a result, income inequality will increase in the economy. On the other hand, these outcomes emphasize the importance of collateral use by the poor population. In this respect, a lack of sufficient collateral use, arising from unequal wealth distribution and problems in existing laws and market practices may also play a role in restricting the access of the poor to finance. Furthermore, the poor are more likely to use microfinance institutions than commercial banks or other financial institutions. However, it is not clear whether microfinance institutions reach the extremely poor to the same extent as the moderately poor.

This study can be extended in a number of ways. First, we still know little about the channels through which financial development affects income inequality. Second, the theoretical model presented in this study can be developed by introducing the idea that individuals derive util-

ity not only from their material consumption but also from bequest to their offspring and from their social status. It is well recognized that people care about their social standing and consequently are willing to improve it even if there is no income gain by doing so. It should also be noted that I focus on financial size and liquidity measures due to the data availability across countries and time: however, access and use of financial services may be more relevant to narrowing income inequality. Hence, I should point to this critical aspect regarding the selection of the financial development indicators. Moreover, cross-country or panel analyses of financial development and inequality may not be able to reveal the key characteristics of their relationship. These can be better captured in intra-country studies. Future research should aim to shed light on whether the mechanisms through which financial development affects income inequality are country-, case-, or time-specific. It would also be valuable to investigate the relationship between financial development and inequality measures across income levels.

Chapter 4

Does Financial Development Reduce Poverty? Evidence from Emerging Countries

4.1 Introduction

Much effort has been expended by scientists to explore the sources and the socio-economic consequences of poverty, and the disadvantages of the persistence. The Millennium Declaration, adopted by the United Nations in 2000, suggests that success in development goals in poverty eradication lies at the foundation of good governance within each country and at the international level, and it depends on transparency in the financial, monetary, and trading systems. Although the influence of finance is not explicitly mentioned among these goals, both policymakers and academics agree that addressing inequalities in access to resources and the distribution of power are important contributors to the achievement of most of the goals (see Claessens and Feijen, 2007 and Littlefield et al., 2003).

Economists have long debated whether financial sector development

can bring direct benefits to the poor. One strand of literature stresses that capital market imperfections and lending constraints that limit access to finance may affect poverty during economic development. Persistent financial market imperfections have been the key determinants of poverty in many models (see Greenwood and Jovanovic, 1989 and Banerjee and Newman, 1993, among others). These models suggest that financial market imperfections prevent the poor from investing in human capital, health, entrepreneurial activities, etc. In addition, informal asymmetries produce credit constraints that are particularly binding on the poor as they do not have collateral to access bank credit; therefore, they have to use their own resources to fund their projects. Through better access to credit, poor individuals may be given the opportunity to set up small business or the so-called microenterprises, which are employment-intensive. This may help reduce poverty since job creation is one of the important pathways to increase income of the poor. These views have pointed out the vital importance of financial sector development in promoting economic growth and supporting poverty reduction. However, although it is known that absolute poverty has been reduced over the last two decades, the exact impact of financial sector development on poverty reduction has not been well defined in empirical studies. Moreover, crisis periods, the recent global financial crisis, and macroeconomic instabilities have also increased the attention paid to the finance-growth-poverty (FGP) nexus. In this aspect, it is argued in the literature that financial systems have a potentially important role to play in equalizing economic and politic opportunities and reducing poverty, and therefore, it is important to consider the link between financial sector development and poverty reduction.

Finance can reduce poverty by facilitating transactions, reducing the costs of remitting funds, providing the opportunity to accumulate assets, smoothing consumption, enabling poor households to better cope with financial shocks, and improving the efficiency of capital allocation. There are two main channels through which financial sector development can impact poverty reduction. First, the poor are directly involved in the economy via enhanced access to financial services, namely through the

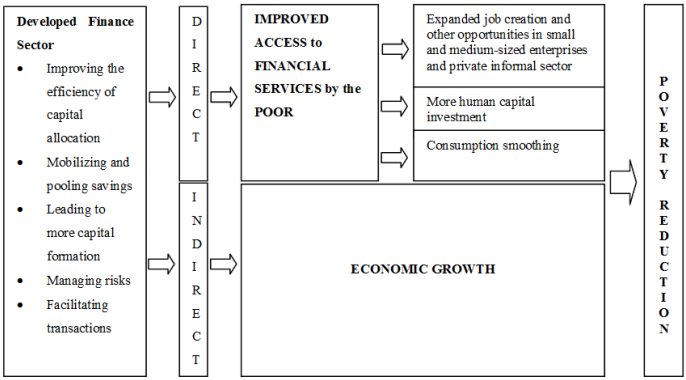

Figure 4.1: Financial sector development and poverty reduction

achievement of a higher number of those who are self-employment in small and medium-sized enterprises such as microfinance institutions. Second, the contribution of the financial sector to the achievement of poverty reduction can work indirectly through the achievement of higher economic growth. In other words, better investment opportunities for firms and entrepreneurs reach the poor indirectly, through advanced economic performance, better employment opportunities, higher tax revenues etc. Figure 4.1 briefly summarizes these two channels.

The main goal of this chapter is to examine whether developments in the banking sector and stock markets, as well as overall financial sector, have contributed to a reduction in poverty, and to identify the channels through which financial development affects poverty. Although financial development may affect poverty in two ways, directly and indirectly, this study mainly focuses on the former. In this respect, the chapter empirically investigates whether improved access to banking or stock market opportunities is the main channel through which financial development contributes to a reduction in poverty. In other words, this chapter assesses the finance-poverty (FP) nexus by taking both the separate and simultaneous impacts of banks and stock markets into account. The study makes six main contributions to the literature. The first contribution of

this study to the FP literature is that I develop aggregate measures to examine the separate and simultaneous impacts of developments of stock market and banks on poverty. To the best of my knowledge, this is one of the first comprehensive studies that examines the simultaneous and separate impacts of two components of the financial sector on poverty reduction by constructing aggregate measures to represent banking and stock market development as well as the overall financial sector. This is an original approach to the analysis of the relationship between bank and stock market development and poverty, and changes in the relationship occurred by considering the separate and simultaneous impacts of finance, and by the choices of financial development indicators. Second, it is important to note that I also examine the impact of stock markets, which was generally ignored in the early literature on the FGP nexus in emerging economies. Third, this study adopts two different specifications to measure the level of poverty, one of which is the specification of Dollar and Kraay (2002) where aggregate poverty is measured by the average per capita income of the poorest quantile and depends on the level of real GDP per capita and other variables, and the other is adopted from Honohan (2004) in which poverty is measured by the share of the population earning less than two dollars per day. On the other hand, since the choice of proxy used for financial development has been one of the major issues, and seriously influenced the findings in empirical literature, it is important to construct reliable indicators of bank and stock market development. A fourth contribution is the utilization of principal component analysis to construct satisfactory financial development proxies. Fifth, the sample period provides an opportunity to better understand the connections among local, regional, and global financial crisis, development of banks and stock markets, and poverty trends in emerging countries. Finally, I re-examine the finance-growth (FG) nexus to test whether a well-functioning financial system is successful in promoting economic growth in emerging countries.

Two key points have been debated intensively in the emerging market context: whether growth in the financial sector would be also beneficial for the poor, and if so, whether poverty would be reduced by fi-

nancial sector growth. These highly debated issues have complex socio-economic and political dimensions. To examine the relationship between financial development and poverty reduction, I specifically focus on the experience of emerging countries, with a more diverse selection of countries to identify patterns between financial structure, economic development, and poverty. Emerging market experiences provide an interesting case study for four main reasons. First, examining the role of the financial sector/intermediation in the growth-development process of emerging countries would be an important research area, as it views FG nexus from a new perspective. Second, as the main focus of the research, the study provides further evidence and policy suggestions on the FP nexus, which has conflicting results in the literature, from an emerging markets' perspective. Third, the analysis on emerging countries would also contribute to discussions on interactions between growing globalization/liberalization and poverty levels in the emerging market context ever since the post 1980 period marked the starting point of market liberalization for most of emerging countries, with a specific emphasis on the importance of financial markets. A final reason is the importance of policy implication of empirical findings, which can support policymakers by enabling them to understand whether, and in which context finance is an instrument that can influence poverty reduction. Because there is no consensus on the role of financial development in reducing poverty, further empirical investigation is needed to distinguish between the competing conjectures, especially in emerging economies.

Methodologically, I construct a panel with data averaged over four-year non-overlapping intervals from 1987 to 2011 to smooth out short-term fluctuations in the data. I use a dynamic panel data approach to address the omitted variable and endogeneity issues. The empirical part of this study employs the Generalized-Method-of-Moments (GMM) approach developed by Arellano and Bond (1991) and Blundell and Bond (1998). In order to increase the explanatory power of financial development on poverty, I use the following as control variables; secondary school enrolment rate, government consumption share in GDP, inflation rate, trade as a ratio of GDP, lagged values of poverty indicators, real

GDP per capita, real GDP per capita growth, and one-lagged value of financial development indicator. This study finds that while financial sector development contributes to long-term economic growth, it may not be beneficial for those on low-incomes in a sample of 45 emerging countries. The results show that bank development-compared to stock market development-has a greater and significant impact on income poverty. The results also show no evidence of a statistically significant relation between financial development and poverty when the combined impact of banks and stock markets (the overall development in the financial sector) is tested.

The remainder of the chapter is structured as follows. Section 2 reviews the broad literature of the research field. Section 3 describes the measures of financial development and poverty. This section also discusses the construction of the aggregate measures for bank and stock market development. Section 4 discusses the methodology. Section 5 is reserved for empirical analysis. Section 6 draws conclusions and offers policy recommendations.

4.2 Literature Review

The question of whether deeper financial markets leads to greater economic growth but also less poverty has long been examined throughout the FGP nexus over the last two decades. Fundamentally, the theoretical literature reveals that financial development via enhancing asset size, depth, liquidity (in stock exchange), stability, variety of instruments, legal/regulatory background, competition, access to financial services, contract quality, number of participants, effectiveness of intermediaries, mobilizing saving/investment, expanding opportunities and providing risk sharing channels etc. may lead to subsequent economic growth and to a reduction in poverty. For example, Banerjee and Newman (1993) underline that countries with larger financial market imperfections, such as information asymmetries and transactions costs that limit access to finance, are more exposed to income inequality and poverty. That is, there is a potential of a negative relationship between financial sector develop-

ment and income inequality/poverty. Similarly, Galor and Zeira (1993) show that, in the case of capital market imperfections, the rich that invest on human capital would remain rich while the poor remain poor and stay in the unskilled labour sector, indicating that financial constraints are particularly binding on the poor. According to this view, finance alleviates poverty both by improving the access to finance and by boosting economic growth.[1]

However, from an empirical perspective, the findings provide inconclusive results on the FP link, but the majority of studies suggest a positive linkage between finance (more specifically, size of financial sector) and poverty reduction. For example, Honohan (2004) suggests a robust effect of financial development (measured as the ratio of private credit to GDP) on poverty headcount ratio (based on both the 1- and 2-a-day poverty lines). Given that per capita GDP is controlled in the analysis, the results suggest that a direct relationship between financial development and poverty reduction exists independently of the indirect effect through growth. By analysing 47 developing economies from 1984 through 2008, Kpodar and Singh (2011) find that when institutions are weak, bank-based financial systems are better at reducing poverty but, as institutions develop, market-based financial systems become more effective towards this end. Jalilian and Kirkpatrick (2002) show that financial development makes a clear contribution to poverty reduction. According to Beck et al. (2007), financial development disproportionately raises the income of the poorest quantile and reduces income inequality. They also find that financial development is strongly associated with poverty alleviation. Li et al. (1998) find that financial development reduces income inequality and increases the income of the lower 80% of the population based on data for 49 developed and developing countries over 1947 to 1994. Claessens and Feijen (2007) investigate the role of financial development in achieving Millennium Development Goal targets. They show that financial development and greater access to financial services can lead to income growth and a reduction in poverty. Similarly, Dollar

[1]See Chapter 3 for a broader review of theoretical literature on the finance-inequality-poverty nexus.

and Kraay (2002), White and Anderson (2001) and Ravallion (2001) have explained that finance has a positive effect on poverty reduction. Kappel (2010) finds that financial development can reduce both poverty and income inequality, but the effect of financial development on poverty in particular is not only significant in itself, but also clearly greater than the effect on income inequality.

In contrast, other studies predict that financial development may fail to reduce poverty. Charlton (2008) argues that stock market liquidity does not directly benefit the poor in developing countries. Quartey and Prah (2008) finds that there is an insignificant relationship, though positive, between financial sector development and poverty reduction in Ghana. In a more focused study, Amin et al. (2003) show, using panel data from Bangladesh, that microfinance institutions are less effective in reaching the vulnerable, which are the very poor among the population, than reaching the poor. More recently, Fowowe and Abidoye (2013) examine the relationship between financial development and poverty reduction in African countries. Their results suggest that financial development does not seem to reduce poverty but poverty is reduced by trade openness and low inflation.

4.3 Data Description

I use measures of bank development, stock market development, and poverty as well as the set of conditioning information. This section describes the variables and principal components, and provides a summary statistics for all variables used in the analysis.

4.3.1 The Sample

The sample consists of emerging countries only, in contrast to that of Dollar and Kraay (2002) and Beck et al. (2007), which analysed both developed and developing countries. My reasons for focussing solely on emerging countries are threefold: Firstly, these countries may have different determinants of poverty compared to developed countries, due to

structural differences in fundamental economic and political institutions. Second, by focusing on a specific group of countries, it is possible to reduce sample heterogeneity. Finally, for developed countries, the existing financial sector development indicators may not be able to fully capture the level of financial development, since their financial systems are more diversified and more mature.

I use a sample of 45 emerging countries for the period 1987-2011. The analysis period provides significant knowledge on the process of financial market developments in emerging countries since the 1990s. However, in contrast to developed countries, time series data on poverty in many emerging countries are very limited, since these countries only started recording such data in the late '90s. Thus, data was available for only 45 emerging countries for banking sector analyses, and 38 countries for stock market analyses.[2] Therefore, I determine the countries for the panel based on the availability of bank and stock market development data and poverty indicators. Data are averaged over six 4-year periods[3] rather than considered annually or quarterly in order to sweep out business cycle fluctuations. I require that a country should have data for at least four non-overlapping time points to be included in any estimated systems. Moreover, averaging data over a period solves missing data problem. I prefer averaging data over a period also because the key econometric model, the System GMM estimator, requires fewer time points and larger cross-sectionals. For the averaging period, however, it has been observed that empirical literature uses three, four, or five year averages. Since the variables used in this study become stationary, I prefer four-year averages in order to maximize the number of time points.[4]

[2]See Table C.1 in Appendix C for the list of these countries along with their main variables.

[3]I have six periods. The first period represents the data averaged between 1987 and 1991 (only for the first period I use 5 year averages), the second period represents the data averaged between 1992 and 1995, the third period represents the data averaged between 1996 and 1999, and so on.

[4]I also use five-year averages to assess the robustness of results. The estimated coefficients and the signs do not change dramatically when I rerun the analyses with the five-year averaged data.

4.3.2 Variable Selection

The selection of key variables to measure financial development is one of the major problems in the empirical literature of the FGIP nexus.[5] To measure the financial development level, the literature has mostly used the ratio of private sector credits to GDP (see, King and Levine, 1993; Clarke et al., 2006; Beck et al., 2007, among others).[6] The ratio of private sector credits to GDP has been shown as a good proxy for the extent to which private sector agents have access to financial intermediation. Private credits to GDP might be a good indicator of financial development in less developed countries, where traditional borrowing and lending activities are the key business in financial intermediation because stock markets are either underdeveloped or non-existent. In emerging economies, however, financial intermediation is relatively sophisticated and has more dimensions. Therefore, to capture a more complete picture, I use both bank-based and market-based financial proxies to measure financial development in emerging countries. However, researchers do not have direct measures of the degree to which a financial system, as a whole, performs its key functions. In this respect, by following Ang and McKibbin (2007), principal component analysis (PCA) is utilized in this study to construct satisfactory and reliable indicators of bank and stock market developments.

To measure bank development, I choose five indicators that are most widely used by the literature. I use logarithm of liquid liabilities to GDP (*liquid*), which is used by King and Levine (1993) and Rousseau and Wachtel (2000), among many others; logarithm of private credit by deposit money banks and other financial institutions to GDP (*private*), which is used by Clarke et al. (2006) and Kappel (2010); logarithm of bank deposits to GDP (*deposit*), which is used by Rioja and Valev (2004) and Barajas et al. (2013); logarithm of bank private credit to GDP (*bpri-*

[5] There is no directly measurable or reliable data available to measure the extent and efficiency of financial intermediation although the existing measures have been improved over the last years (Ang and McKibbin, 2007). In this context, Levine (2003) mentions the problem of choosing a proxy for measuring financial development and the differences among economies in terms of the availability of financial intermediation.

[6] Also see, Table C.2 in Appendix C.

vate), which is employed in the works of Demirgüç-Kunt et al. (2012) and Ang and McKibbin (2007); and logarithm of deposit money bank assets to GDP (*bassets*), which is employed in Clarke et al. (2006). Furthermore, I use logarithm of stock market capitalization to GDP (*mktcap*), which is used by Levine and Zervos (1998) and many others; logarithm of stock market total value traded to GDP (*traded*), which is used by Levine and Zervos (1998) and Kappel (2010); and logarithm of stock market turnover ratio (*turnover*), which is used by King and Levine (1993), as proxies for stock market development.[7] However, these series are highly correlated. The correlation matrix presented in Table C.3 in Appendix C confirms the interrelations between the indicators, and suggests that the financial development indicators may contain common information, which may lead to multi-collinearity and over-parametrization problems. This multi-collinearity problem is a further justification for the construction of new aggregate measures. When all eight financial development indicators are included in regressions, I generally obtain inconsistent results, possibly because of the high correlation between financial development indicators. At this point, PCA solves the problems of multi-collinearity.[8] It should be noted that PCA does not search for causal relations; instead, it searches for interdependence between indicators, without defining the direction of the causal relation. Moreover, compare to the factor analysis, PCA is a more appropriate technique for data reduction when the intention is to obtain synthetic variables (see Hair et al., 1998).

I develop three aggregate measures: one for bank development (*bank-aggregate*) by using five indicators of banking development, one for stock market development (*market-aggregate*) by using three indicators of stock market development, and the last one for the overall financial development (*finance-aggregate*) by using both banking and stock market development indicators. Each aggregate measure employs principal component analysis, which deals with the problems of over-parametrization and multi-collinearity. Theoretically, these new aggregate measures are

[7] The sources and short definitions of all variables used in the analyses are provided in Table C.2 in Appendix C.

[8] Principal component analysis has been used to reduce a large set of correlated variables into a smaller set of uncorrelated variables. See Stock and Watson (2002).

able to capture most of the information from the original dataset.

The results of the extraction of PCA for bank development and stock market development indicators are presented in Table C.4 and Table C.5 in Appendix C, respectively. The financial development indicator for the banking sector corresponds to the first principal component, which is the only one with an eigenvalue greater than 1 and explains about 93.2% of the total variance. The remaining principal components are not considered since their marginal contributions are relatively small.[9] The synthetic variable, in other words, the measure of bank development (*bank-aggregate*), is computed as a linear combination of the five widely used measures of bank development with weights given by the first eigenvector. In the case of stock market development, I extract again the first principal component, which is able to capture 76.6% of the information from the original dataset, while the last two components explain 23.3% of the total variance. In addition, the first principal component is the only one with an eigenvalue greater than 1. The first component is computed as a linear combination of the three standard measures of stock market development with weights given by the first eigenvector, and it is named as *market-aggregate*.

I use two indicators for measuring the level of poverty. I first use the average per capita income of the poorest quantile, which measures the average income of the lowest 20% of the population. To calculate the average income, I multiply the income share of the lowest 20% quantile, which is provided by the World Bank's Database, by the average per capita GDP and divide by 0.2. A second poverty indicator is the percentage of the population living below US$2.00 a day at 2005 international prices, namely that headcount ratio. These data are based on primary household survey data obtained from government statistical agencies and World Bank country departments.

[9] For instance, while the second principal component explains 4.4% of the variation, the third principal component explains 1.3% of the variation, and the last two components together explain only 1.1% of the variation.

4.3.3 Summary statistics

Table 1 provides summary statistics for the eight financial development indicators, three dependent variables and six control variables.

Table 4.1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Poverty headcount ratio (at 2$ a day, PPP)	250	22.16	23.51	0	88.67
Average per capita income of the poorest quintile	242	1133.7	1313.6	47.51	7067.75
Bank private credit to GDP	249	34.1	26.77	1.26	150.17
Deposit money bank assets to GDP	251	41.57	28.98	2.83	157.84
Liquid liabilities (M3) to GDP	242	42.48	28.62	4.03	160.91
Private credit by financial system to GDP	249	35.23	27.14	1.26	150.17
Bank deposits to GDP	251	33.64	22.89	2.64	116.61
Stock market capitalization to GDP	200	27.03	32.77	0.19	221.82
Stock market total value traded to GDP	197	11.91	21.75	0.002	141.21
Stock market turnover ratio	198	40.85	55.77	0.81	396.66
GDP per capita (constant 2005 US $)	267	3663.4	3217.62	191.7	19446.5
General government final consumption to GDP	267	14.48	4.75	3.99	29.89
Inflation, annual GDP deflator	267	77.6	412.79	-4.71	5740.22
School enrolment rate, secondary gross	250	73	23.02	9.8	107.71
Trade to GDP	267	80	40.24	14.49	204.33

Note: All variables (except GDP per capita) are in percentage form and averaged over four-year period.

Definitions of variables are same as in Table A.2 in Appendix.

Obs., Std. Dev., Min., and Max. denote observation, standard deviation, minimum, and maximum, respectively.

There are considerable variations in financial development indicators across countries. Private credit ranges from 1.26% of GDP in Ukraine (in 1992-1995) to 150% of GDP in Thailand (in 1996-1999). Liquid liabilities to GDP ratio ranges from 4% in El Salvador (in 1992-1995) to 161% in China (in 2008-2011), while stock market turnover ratio ranges from 0.34% in Uganda (in 2008-2011) to 397% in Pakistan (in 2000-2003). The dependent variables also show a large variation. For example, poverty headcount ratio (at 2$ per day) has its minimum value of 0 in several countries (for instance, Kyrgyzstan and Slovak Republic, in 1987-1991) while it takes maximum value of 89 in Pakistan (in 1987-1991).

4.4 Econometric Methodology

I use dynamic panel GMM techniques to address the problems of potential endogeneity, and unobserved country-specific effects in the data.

Equation (4.1) shows the baseline regression model for the analysis.

$$y_{i,t} = \alpha y_{i,t-1} + \beta FD_{i,t} + \gamma X_{i,t} + \eta_i + \xi_t + \epsilon_{i,t} \tag{4.1}$$

where $y_{i,t}$ represents, alternatively, logarithm of the average income of the poorest quantile and logarithm of the headcount ratio for country i in period t, where each period represents the four year-averaged time points. The first explanatory variable is the lagged value of the dependent variable, $y_{i,t-1}$, which introduces a dynamic specification to measure the persistency in poverty. $FD_{i,t}$ represents the level of financial development at period t. $X_{i,t}$ represents the set of explanatory variables such as secondary school enrolment rate, trade as a ratio of GDP, inflation rate, government consumption share in GDP, real per capita GDP, real per capita GDP growth, and one lagged value of financial development indicator. Finally, η_i captures unobserved country-specific effects, ξ_t is a period-specific constant, and $\epsilon_{i,t}$ is the error term.

By construction, there is a problem of endogeneity due to the simultaneous presence of the country-specific effect (η_i) and the lagged dependent variable. In other words, the strict exogeneity hypothesis that excludes feedback of error towards the explanatory variables is rejected, since the lagged dependent variable is correlated with the error term. To overcome this problem, I employ the System GMM approach, an augmented version of GMM outlined in Arellano and Bond (1991) and fully developed in Blundell and Bond (1998), who more precisely articulated the necessary assumptions for the augmented estimator, and tested it with Monte Carlo simulations. The System GMM estimator provides consistent and efficient estimates, overcomes the endogeneity problem, and is a better fit for panel studies, having fewer time points and greater numbers of individuals (Blundell and Bond, 1998). In the System GMM, the original equations in levels can be added to the system, and the additional moment conditions could increase efficiency, while lagged levels are often poor instruments for first differences. In other words, predetermined and endogenous variables in levels are instrumented with suitable lags of their own first differences; the predetermined and endogenous variables in first-differences are instrumented with suitable lags of

their own levels; strictly exogenous regressors, as well as any other instruments, enter the instrument matrix in the conventional instrumental variables fashion, which requires one column per instrument.[10]

To have valid instruments, I use the standard Hansen test of overidentification, where the null hypothesis is that the instrumental variables are not correlated with the residual, and the serial correlation test, where the null hypothesis is that there is no second-order serial correlation in the error terms. The Arellano-Bond test for autocorrelation has a null hypothesis that there is no autocorrelation. The tests for AR (1) process in first differences rejects the null hypothesis since $\Delta\epsilon_{i,t} = \epsilon_{i,t} - \epsilon_{i,t-1}$ and, $\Delta\epsilon_{i,t-1} = \epsilon_{i,t-1} - \epsilon_{i,t-2}$, that is, both have $\epsilon_{i,t-1}$. However, the test for AR (2) in first differences is more important because it detects autocorrelation in levels. Moreover, the number of instruments should be less than or equal to the number of groups to have valid instruments.

To assess the strength of the linkage between financial development and poverty reduction, I control for other potential determinants of poverty in regressions. I use standard control variables that are widely used in the literature (for a survey, see Christiaensen et al., 2003). These variables are also introduced into the model as a test of robustness. I first control for the one lagged levels of poverty indicators, which allows me to test persistency in poverty, as in Beck et al. (2007), although this is a more data-demanding specification. Then, I use logarithm of the secondary school enrolment rate (*education*) to control for human capital accumulation. I also use logarithm of the ratio of trade to GDP (*trade*) to capture the degree of openness of an economy. I add inflation rate (*inflation*) as a control variable since, Ravallion and Datt (1999), Easterly and Fischer (2001), and Dollar and Kraay (2002) all find evidence that this is a significant determinant of poverty. Moreover, I also use logarithm of the ratio of government consumption to GDP (*government*) to measure macroeconomic stability (see Beck et al., 2000). In order to test the impact of economic growth on poverty, I use the growth rate of the real GDP per capita (*growth*), as in Dollar and Kraay (2002) and Beck et al.

[10]See Appendix A.3 for the brief summary of the System GMM estimator, which is also utilized in Chapter 2.

(2007). A large body of the FG literature predicts that effective financial systems can promote economic growth and reduce poverty by ameliorating information and transaction costs (Bencivanga et al., 1995; King and Levine, 1993a; Beck and Levine, 2004). Therefore, it is crucial to control whether financial development affects those on low-incomes by its effect on GDP per capita. Hence, I also control for real GDP per capita (*gdpc*) to establish whether there is a disproportionate effect of financial development on the income of the lowest-paid quantile. I finally control for the effect of the lagged value of financial development, $FD_{i,t-1}$. Since financial development may have delayed effects on poverty, I include the one-period lagged value of financial development as a regressor (for simplicity, the same number of lags is used for dependent variable as for financial development).

4.5 Empirical Results

The basic specification tests the impact of financial development on the level of poverty indicators. That is, I regress the natural log of the (i) average income of the poorest quantile, and (ii) headcount ratio on the measure of financial development, consecutively. Then, I introduce the lagged levels of poverty measures (log of the one-lagged value of dependent variable), secondary school enrolment rate, trade to GDP ratio, government consumption to GDP ratio, GDP deflater, real GDP per capita growth, real GDP per capita, real GDP per capita square, and one lagged value of financial development, where control variables are included one by one in the regressions. Stata 12 is used as the econometrics package. For the purpose of completeness, the models employ both the OLS and System GMM estimators. The OLS estimates represent the biased modelling approach with some theoretical inconsistencies, and so the System GMM results are primary source of the discussion. Moreover, the over-identification test (Hansen-p) and the serial correlation test (AR(2)), are valid for all specifications. The p-values for these tests are presented at the end of each table. All regressions include time dummies, which I find to be jointly insignificant in almost every regression, to account for

time-specific effects. In order to save space, the coefficients of the time dummies are not reported in the tables. In all runs, I assume that control variables are exogenous[11] and financial development indicators are endogenous in the sense of being correlated with shocks to poverty measures in both the current and previous periods.

4.5.1 Bank Development and Poverty Reduction

Table 4.2 sets out the results for the regression models on *bank-aggregate* and *average income of the poorest quantile*, as the first proxy of poverty indicator. Policymakers may theoretically expect a positive linkage between the average income of the poor and bank development, as the development in banking sector could reduce poverty. However, the System GMM results show that bank development fails to benefit those on low-incomes in emerging countries. I find that the effect of bank development on the level of the average income of the poorest quantile is negative, which is shown in columns 5, 6, 7, 8, and 9 of Table 4.2 (remembering that the System GMM results are the preferred ones). That is, the direct effect of bank development on poverty reduction is negative, implying countries with higher levels of bank development experienced higher levels of poverty in terms of the average income of the poorest quantile in emerging countries. This may suggest that in emerging countries, access to banking services for the poor is limited compared to the access for the rest of the population. This finding contradicts that of Beck et al. (2007), who find a positive effect of bank development on poverty reduction by using a private credit to GDP ratio as an indicator of financial development. The reason could lie in the sample composition and the selection of the bank development indicator. In this study, the sample consists of emerging economies, while theirs comprises both developing and developed economies, the latter having bigger and more diverse financial systems. Moreover, I employ PCA to five indicators of bank development, rather than private credits to GDP ratio.

[11] Dollar and Kraay (2002) and Easterly and Fischer (2001) find that the income of the poorest quantile is significantly affected by inflation. However, when I treat inflation as an exogenous or an endogenous variable, the results do not change dramatically.

The negative relationship between bank development and average income of the poorest is robust to a number of robustness tests. In each column, I control for the one-period lagged value of the average income of the poorest quantile, which enters significantly and positively in the regressions, suggesting that countries with lower level of poverty at the previous period tend to experience faster reductions in poverty in the current period. When I control for secondary school enrolment rate, trade openness, inflation rate and government consumption (column 6 of Table 4.2), *bank-aggregate* enters negatively and statistically significantly at 10% level, while only inflation rate enters significantly (at 1% level) among the other control variables. The negative sign of the inflation rate indicates the importance of macroeconomic stability for poverty reduction in emerging countries. In addition, the coefficient of *bank-aggregate* becomes insignificant when I control for real GDP per capita growth as shown in column 7 of Table 4.2. On the other hand, when I control for real GDP per capita and its square, the coefficient of *bank-aggregate* again improves in magnitude and significance compared to the equations in columns 5 and 6 of Table 4.2. However, there is no evidence of non-linearity between the dependent variable and real GDP per capita since the estimated coefficient of the real per capita GDP square is statistically insignificant. In column 9 of Table 4.2, I control for the one-lagged value of bank development indicator (*bank-aggregate (t-1)*). Although the coefficient of *bank-aggregate (t-1)* appears positively and insignificantly, the coefficient of *bank-aggregate* remains negative and statistically significant at 5% level. The result suggests that bank development does not have delayed effect (at least in one lagged period) on poverty measured by average income of the poorest quantile.

The bank development and poverty linkage was also analysed through the level of the headcount ratio, the percentage of the population living below US$2.00 a day, as the second proxy of poverty indicator. There is a negative but insignificant linkage between *bank-aggregate* and *headcount ratio*, according to the results of the System GMM equations in columns 6, 7, 8 and 9 of Table 4.3. The results suggest that bank development might reduce headcount ratio in emerging countries; however, its effect

on headcount ratio is not statistically significant. When I control for possible determinants of headcount ratio, the significance of the estimated coefficient does not change. On the other hand, the results show that secondary school enrolment rate and government consumption have negative and significant impacts on the level of the headcount ratio as shown in columns 6 and 7 of Table 4.3. The negative sign of the secondary school enrolment rate justifies the need for the human capital investment in order to reduce headcount ratio in emerging countries. Moreover, in column 8, I test the effect of real GDP per capita and its square on the headcount ratio. Columns 8 and 9 of Table 4.3 show that there is an inverted U-shaped relationship between GDP per capita and headcount ratio. In addition, although real GDP per capita and its square enter significantly, this does not improve the explanatory power of *bank-aggregate*.

Table 4.2: Bank-aggregate and Poverty Reduction (Dependent variable: Average Income of the Poorest Quantile)

Variable	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) Sys-GMM	(6) Sys-GMM	(7) Sys-GMM	(8) Sys-GMM	(9) Sys-GMM
Constant	0.525	0.450	0.399	3.861	-0.040	-0.201	-0.001	-17.624	-10.864
	(0.155)***	(0.269)*	(0.235)*	(1.349)***	(0.890)	(1.120)	(1.86)	(19.057)	(9.802)
Lagged average income	0.945	0.940	0.934	0.783	0.997	1.062	1.080	0.662	0.767
	(0.022)***	(0.028)***	(0.026)***	(0.047)***	(0.137)***	(0.150)***	(0.157)***	(0.492)	(0.488)
Bank-aggregate	0.011	-0.002	-0.013	0.005	-0.083	-0.120	-0.125	-0.138	-0.199
	(0.012)	(0.008)	(0.006)**	(0.007)	(0.054)	(0.067)*	(0.104)	(0.067)**	(0.090)**
School enrolment		0.074	0.096	0.139		-0.283	-0.349	-0.420	-0.439
		(0.055)	(0.047)**	(0.067)**		(0.434)	(0.571)	(0.462)	(0.336)
Trade openness		0.032	0.055	0.033		0.194	0.169	0.091	0.154
		(0.050)	(0.038)	(0.050)		(0.146)	(0.300)	(0.161)	(0.155)
Inflation rate		-0.307	-0.028	-0.181		-0.541	-0.597	-0.390	-0.189
		(0.079)***	(0.048)	(0.066)***		(0.174)***	(0.342)*	(0.348)	(0.499)
Government		-0.034	-0.015	-0.065		0.071	0.240	0.500	0.339
		(0.056)	(0.038)	(0.068)		(0.167)	(0.724)	(0.575)	(0.387)
GDP per capita growth			1.111				-0.082		
			(0.108)***				(0.893)		
GDP per capita				-0.820				4.932	2.965
				(0.328)**				(5.308)	(2.750)
GDP per capita square				0.064				-0.288	-0.160
				(0.020)***				(0.341)	(0.175)
Bank-aggregate (t-1)									0.037
									(0.062)
Observations	176	164	164	164	176	164	164	164	156
R-squared	0.947	0.925	0.969	0.958					
F-statistic	375.78	463.57	892.78	859.58					38.62
Number of Groups					44	43	43	43	42
Number of Instruments					13	16	15	17	17
Hansen test p-value					0.56	0.701	0.465	0.757	0.658
AR(2)					0.069	0.246	0.417	0.375	0.120

Note: The table presents the results for the estimated coefficients and their robust standard errors in parenthesis. The dependent variable is the four-year (non-overlapping) average level of the average income of the poorest quantile for each country, which yields six observations per country. Four-year averages for all of the independent variables are computed over the same period. Definitions of variables are same as in Table C.2 in Appendix. The following are also reported: specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen p-value test of over-identification test, and AR(2) test of the error terms. Time dummies for six time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

Table 4.3: Bank-aggregate and Poverty Reduction (Dependent variable: Headcount Ratio)

Variable	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) Sys-GMM	(6) Sys-GMM	(7) Sys-GMM	(8) Sys-GMM	(9) Sys-GMM
Constant	0.231	-1.185	-1.000	-10.036	2.566	-5.923	-4.852	-70.939	-41.015
	(0.148)	(0.698)*	(0.719)	(4.412)**	(2.203)	(1.634)***	(1.782)***	(43.539)	(21.605)*
Lagged Headcount ratio	0.838	0.780	0.787	0.544	1.609	0.125	0.251	0.035	0.536
	(0.055)***	(0.066)***	(0.068)***	(0.094)***	(0.711)**	(0.174)	(0.211)	(0.169)	(0.178)***
Bank-aggregate	-0.049	-0.007	0.013	-0.004	0.200	-0.105	-0.132	-0.215	-0.155
	(0.027)*	(0.027)	(0.031)	(0.019)	(0.326)	(0.170)	(0.104)	(0.241)	(0.255)
School enrolment		-0.365	-0.372	-0.216		-1.440	-1.184	-2.083	-0.837
		(0.166)**	(0.148)**	(0.185)		(0.451)***	(0.489)**	(2.170)	(1.113)
Trade openness		-0.063	-0.110	-0.164		-0.191	-0.142	-0.329	-0.311
		(0.133)	(0.132)	(0.155)		(0.370)	(0.308)	(0.372)	(0.257)
Inflation rate		0.606	0.188	0.320		0.260	-0.216	-0.366	-0.880
		(0.528)	(0.638)	(0.365)		(0.513)	(0.487)	(0.439)	(0.614)
Government		-0.373	-0.396	-0.530		-1.448	-1.265	0.070	0.269
		(0.273)	(0.269)	(0.280)*		(0.671)**	(0.632)*	(0.828)	(0.512)
GDP per capita growth			-1.892				-1.792		
			(0.796)**				(1.130)		
GDP per capita				2.562				18.514	11.165
				(1.275)*				(10.535)*	(5.533)**
GDP per capita square				-0.204				-1.245	-0.764
				(0.088)**				(0.630)*	(0.350)**
Bank-aggregate (t-1)									0.057
									(0.166)
Observations	182	170	169	169	182	170	169	169	157
R-squared	0.796	0.799	0.813	0.835					
F-statistic	126.79	104.02	115.87	185.32					17.33
Number of Groups					44	43	43	43	42
Number of Instruments					11	19	23	24	24
Hansen test p-value					0.782	0.149	0.047	0.582	0.293
AR(2)					0.538	0.392	0.673	0.641	0.983

Note: The table presents the results for the estimated coefficients and their robust standard errors in parenthesis. The dependent variable is the four-year (non-overlapping) average level of the headcount ratio for each country, which yields six observations per country. Four-year averages for all of the independent variables are computed over the same period. Definitions of variables are same as in Table C.2 in Appendix. The following are also reported: specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen p-value test of over-identification test, and AR(2) test of the error terms. Time dummies for six time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

4.5.2 Stock Market Development and Poverty Reduction

Stock market development has received much attention in emerging countries in the last 20-25 years, given the fact that the financial structure of these countries is mostly bank-based. Hence, in this context, it may be appropriate considering the effect of stock markets in the measurement of financial development. In this respect, I also analyse the relationships between stock market development and poverty indicators, using a sample of 38 emerging countries for the period of 1987-2011. The results of the regressions are reported in Table 4.4 and Table 4.5. To represent the development in stock markets, I use the first principal component, which is obtained through PCA as explained in (4.3.2), namely that *market-aggregate*. I run the same regressions with the aggregate measure of stock market development. I also utilize the same control variables as indicated previously.

Table 4.4 presents the results for the regression models on *market-aggregate* and *average income of the poorest quantile*, as the first proxy of poverty indicator. It is suggested in Table 4.4 that stock market development may have positive impact on the average income of the poorest quantile. This relationship is statistically significant in the System GMM results of columns 6 and 8, with respectively 10% and 1% significance levels. When I control for secondary school enrolment rate, trade openness, inflation rate, and government consumption (column 6 of Table 4.4), the coefficient of *market-aggregate* enters positively and significantly at 10% level. Furthermore, when I add real GDP per capita and its square in addition to the other control variables (column 8), *market-aggregate* enters positively and significantly at 1% level. As regards other explanatory variables, the secondary school enrolment rate and trade openness enter positively and significantly in columns 6 and 7, respectively. When I control for real GDP per capita growth, I see that the coefficient of *market-aggregate* becomes insignificant as shown in column 7. Therefore, in the context of the results of Table 4.4, it is possible to argue that stock market development may have positive impacts on poverty reduction, which is measured by the average income of the poorest quantile in emerging

countries; moreover, this result appears to be supported by some control variables such as secondary school enrolment rate, trade openness, GDP per capita growth, and government consumption. Additionally, when I test the delayed effect of *market-aggregate* on the average income of the poorest quantile, I find that there is no significant relationship between these two, though the relationship is negative. However, including the lagged value of market-aggregate in the regression changes its significance effect on poverty as can be seen by comparing columns 8 and 9 of Table 4.4.

The relationship between stock market development and poverty was also analysed using a *headcount ratio* as the second poverty indicator. The System GMM results of columns 5, 6, 7, 8 and 9 of Table 4.5 imply a possible negative, but statistically insignificant, relation between stock market development and headcount ratio. Moreover, none of the control variables, except log of the lagged headcount ratio, enters significantly in the regressions. The log of the lagged headcount ratio is the only statistically significant control variable among those presented in Table 4.5.

Table 4.4: Market-aggregate and Poverty Reduction (Dependent variable: Average Income of the Poorest Quantile)

Variable	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) Sys-GMM	(6) Sys-GMM	(7) Sys-GMM	(8) Sys-GMM	(9) Sys-GMM
Constant	0.441	0.553	0.411	3.971	0.509	0.940	1.060	1.359	2.734
	(0.138)***	(0.260)**	(0.171)	(1.874)**	(1.014)	(2.839)	(0.774)	(4.985)	(11.21)
Lagged average income	0.962	0.928	0.931	0.782	0.952	0.816	0.866	0.540	0.954
	(0.018)***	(0.025)***	(0.017)***	(0.037)***	(0.147)***	(0.308)**	(0.090)***	(0.153)***	(0.276)***
Market-aggregate	0.012	0.014	-0.004	0.026	0.027	0.277	0.017	0.073	0.068
	(0.008)	(0.010)	(0.007)	(0.008)***	(0.028)	(0.148)*	(0.023)	(0.022)***	(0.100)
Secondary enrolment		0.116	0.095	0.161		0.965	0.212	0.237	0.266
		(0.081)	(0.060)	(0.106)		(0.493)*	(0.153)	(0.216)	(0.305)
Trade openness		0.092	0.078	0.094		0.115	0.094	0.099	0.104
		(0.041)**	(0.031)**	(0.039)**		(0.196)	(0.040)**	(0.079)	(0.057)*
Inflation rate		-0.004	0.122	0.172		-1.230	0.174	0.470	0.104
		(0.092)	(0.063)*	(0.072)**		(1.321)	(0.114)	(0.172)***	(0.425)
Government		-0.034	-0.027	-0.045		-0.372	0.001	0.041	-0.041
		(0.070)	(0.040)	(0.085)		(0.450)	(0.085)	(0.154)	(0.147)
GDP per capita growth			0.941				0.741		
			(0.108)***				(0.197)***		
GDP per capita				-0.800				0.106	-0.459
				(0.438)*				(1.243)	(2.637)
GDP per capita square				0.060				0.017	0.022
				(0.027)**				(0.075)	(0.167)
Market-aggregate (t-1)									-0.032
									(0.047)
Observations	147	137	137	137	147	137	137	137	118
R-squared	0.962	0.963	0.977	0.968					
F-statistic	566.8	405.1	941.9	721.2	82.76	19.43	509.19	130.95	284.82
Number of Groups					38	37	37	37	37
Number of Instruments					15	18	23	34	21
Hansen test p-value					0.454	0.817	0.652	0.879	0.620
AR(2)					0.076	0.691	0.325	0.283	0.230

Note: The table presents the results for the estimated coefficients and their robust standard errors in parenthesis. The dependent variable is the four-year (non-overlapping) average level of the average income of the poorest quantile for each country, which yields six observations per country. Four-year averages for all of the independent variables are computed over the same period. Definitions of variables are same as in Table C.2 in Appendix. The following are also reported: specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen p-value test of over-identification test, and AR(2) test of over-identification test, AR(1) and AR(2) test of the error terms. Time dummies for six time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

Table 4.5: Market-aggregate and Poverty Reduction (Dependent variable: Headcount Ratio)

Variable	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) Sys-GMM	(6) Sys-GMM	(7) Sys-GMM	(8) Sys-GMM	(9) Sys-GMM
Constant	-0.217	-0.951	-1.137	-5.803	-1.605	7.431	1.671	-2.212	71.243
	(0.156)	(0.709)	(0.643)*	(6.716)	(0.649)**	(7.944)	(3.757)	(56.012)	(95.12)
Lagged Headcount ratio	0.938	0.848	0.856	0.718	0.616	1.722	1.185	0.437	0.831
	(0.031)***	(0.055)***	(0.056)***	(0.119)***	(0.216)***	(0.839)**	(0.429)***	(0.366)	(0.480)*
Market-aggregate	-0.065	-0.048	-0.017	-0.038	-0.095	-0.547	-0.048	-0.282	-0.667
	(0.041)	(0.044)	(0.040)	(0.045)	(0.191)	(1.041)	(0.254)	(0.209)	(0.683)
Secondary enrolment		-0.281	-0.222	-0.187		1.298	0.429	1.914	2.655
		(0.243)	(0.191)	(0.123)		(2.701)	(1.235)	(1.531)	(2.457)
Trade openness		-0.203	-0.181	-0.210		-0.026	-0.123	-0.038	0.441
		(0.119)*	(0.117)	(0.145)		(0.446)	(0.249)	(0.388)	(0.861)
Inflation rate		0.295	-0.040	0.179		-2.201	0.626	-2.723	5.694
		(0.248)	(0.305)	(0.195)		(5.312)	(0.693)	(3.879)	(8.122)
Government		-0.382	-0.366	-0.494		1.961	0.398	-0.131	0.963
		(0.303)	(0.286)	(0.295)		(2.618)	(0.876)	(1.095)	(1.714)
GDP per capita growth			-1.791				0.923		
			(0.642)***				(2.986)		
GDP per capita				1.272				3.212	-14.80
				(1.816)				(15.171)	(23.72)
GDP per capita square				-0.101				-0.362	0.758
				(0.123)				(0.988)	(1.465)
Market-aggregate (t-1)									0.194
									(0.525)
Observations	148	138	137	137	148	138	137	137	117
R-squared	0.855	0.852	0.864	0.861					
F-statistic	304.9	217.8	139.3	214.2	14.4	7.58	81.63	11.74	6.35
Number of Groups					38	37	37	37	37
Number of Instruments					13	14	17	23	23
Hansen test p-value					0.482	0.751	0.787	0.32	0.18
AR(2)					0.683	0.487	0.609	0.712	0.236

Note: The table presents the results for the estimated coefficients and their robust standard errors in parenthesis. The dependent variable is the four-year (non-overlapping) average level of the headcount ratio for each country, which yields six observations per country. Four-year averages for all of the independent variables are computed over the same period. Definitions of variables are same as in Table A.2 in Appendix. The following are also reported: specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen p-value test of over-identification test, and AR(2) test of the error terms. Time dummies for six time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

The estimated coefficients of market-aggregate are mostly statistically insignificant according to the results of Table 4 and Table 5. I find statistically significant coefficients only for the regressions between *market-aggregate* and *average income of the poorest quantile* (see, columns 6 and 8 of Table 4.4), suggesting that stock market development could contribute to income of the poorest quantile. The results suggest a statistically weak linkage between stock market development and poverty reduction, despite the emphasis on the former after the 1980s in emerging countries. There may be several explanations for the finding. First, it is possible that stock markets tend to benefit large/mature firms, due to the high costs of issuing equity. Hence, small firms or financially constrained entrepreneurs need to rely on personal wealth or internal resources for investment. This restricted access to stock markets eventually has negative impacts on inequality/poverty reduction. Second, the results related to *market-aggregate* appear to support Lin's (2009) argument that emerging countries' primary need is for banks rather than more sophisticated financial institutions like stock markets. Finally, probably because stock markets have less developed in emerging countries and hence not yet reached the minimum levels of size and activity required to provide opportunities/benefits for all market participants, positive contributions of stock market to poverty reduction may be somehow limited.

4.5.3 Banks, Stock Markets and Poverty Reduction

I also examine the simultaneous effect of bank and stock market development (overall development in the financial sector) on poverty reduction. As proxies for overall financial development, I use liquid liabilities, private credit by deposit money banks and other financial institutions, bank deposits, bank private credit, deposit money bank assets, stock market capitalization, stock market total value traded, and stock market turnover.[12] I combine eight conventional measures (five indicators of bank development and three indicators of stock market development, which are used in the previous sections) of financial development

[12]The descriptions of the variables are same as shown in Table C.2 in Appendix C.

to construct a composite indicator using principal component analysis as described in part (4.3.2).

According to the results of PCA of these eight indicators, the first principal component explains about 70% of the variation in the original data, while the second principal component explains 18% of the standardized variance.[13] Therefore, the first principal component is chosen to represent the overall financial development in the sample of 45 emerging economies. Theoretically, this new variable, *finance-aggregate*, is able to capture most of the information from the original dataset. Equation (4.1) is estimated through the OLS and System GMM procedures. I present the System GMM results only, since it is the preferred estimator. As dependent variables, I use *average income of the poorest quantile* and *headcount ratio*, as described previously.

Table 4.6 presents the results for the one-step System GMM estimates. Columns 1 and 2, and columns 3 and 4 report the results for the average income of the poorest quantile and headcount ratio, respectively. As can be seen from Table 4.6, I find no evidence of significant relationship between the overall financial development variable, measured by *finance-aggregate*, and the poverty measures. The second column of Table 4.6 shows that despite a positive relationship between *finance-aggregate* and *average income of the poorest quantile*, this relationship is statistically insignificant. Among the explanatory variables, only the secondary school enrolment rate is statistically significant (at 10% level), and positively associated with the average income of the poorest quantile. In the last column of Table 4.6, I examine the effect of financial development on the headcount ratio. The result predicts a negative but insignificant relationship between *finance-aggregate* and *headcount ratio*. The results in Table 4.6, therefore, indicate that overall financial development generally exerts a positive but statistically insignificant effect on poverty reduction.

When I examine the simultaneous effect of bank and stock market development, the results change dramatically, compared to their separate effects, which are presented through Table 4.2 to Table 4.5. That is, while Table 4.4 suggests that stock market development may have

[13]The results are not presented in order to conserve space.

Table 4.6: Finance-aggregate and Poverty Reduction (Estimation method: one-step System GMM

Variable	Average income of the poorest	Average income of the poorest	Headcount ratio	Headcount ratio
Lagged dependent variable	0.952	0.539	1.391	0.767
	(0.217)***	(0.391)	(0.540)**	(0.210)***
Finance-aggregate	-0.023	0.042	0.077	-0.15
	(0.035)	(0.085)	(0.268)	(0.117)
Secondary enrolment		0.669		-0.441
		(0.389)*		(0.438)
Trade openness		0.054		-0.022
		(0.121)		(0.245)
Inflation rate		0.304		-0.321
		(0.576)		(0.447)
Government		0.133		-0.465
		(0.364)		(0.606)
Observations	150	140	153	143
Number of Groups	41	40	41	40
Number of Instruments	13	16	11	19
Hansen test p-value	0.291	0.429	0.611	0.294
AR(2)	0.078	0.245	0.479	0.486

Note: The table presents the results for the estimated coefficients and their robust standard errors in parenthesis. The dependent variable is the four-year (non-overlapping) average of (i) the average income of the poorest quantile, and (ii) Headcount index for each country, which yields six observations per country. Four-year averages for all of the independent variables are computed over the same period. Definitions of variables are same as in Table C.2 in Appendix. The following are also reported: specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen p-value test of over-identification test, and AR(2) test of the error terms. Time dummies for six time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

a positive and significant, though statistically weak, impact on the average income of the poorest quantile, the third and fourth columns of Table 4.6 suggest a statistically insignificant relationship between overall financial development and the average income of the poorest quantile. Thus, considering the simultaneous effects of banks and stock markets alone may not fully capture the relationship between financial development and poverty reduction. Moreover, omitting the impact of either banks or stock markets may also result difficulties in assessing the exact impact of financial development (see Beck and Levine, 2004). Using a combined variable, *finance-aggregate* implies two points. First, from a methodological perspective the results prove the need for investigating both simultaneous and separate effects of banks and stock market development on poverty reduction. Second, the outcome suggests that interactions between stock markets, banks and poverty may have different channels based on sector specific interactions with fund allocation, risk sharing, and mobilization of savings etc.

In addition to the robustness tests that I performed using various control variables in the regressions through Tables 4.2-4.6, I also analyse the relationship between banks, stock markets and poverty using both yearly and 5-year averaged data for the 1987-2011 period, instead using 4-year averaged data. I rerun all the regressions for both average income of the poorest quantile and headcount ratio. However, the sign and significance level of the estimated coefficients did not change dramatically. The results of the regression analyses with yearly and 5-year averaged data suggest that financial development does not have a statistically significant (or strong) impact on poverty reduction in emerging countries for the given period.

4.5.4 Banks, Stock Markets and Economic Growth

Theory and evidence show that an effective financial system promotes subsequent economic growth. To test this hypothesis in the emerging markets context, I examine the effect of overall financial development, including banks and stock markets, on economic growth using a sample of 45 countries. I do not examine the separate impacts of banks and stock markets on growth, since FG nexus is not the target area of interest. I use the same indicators of financial development as described previously. I use *finance-aggregate*, which is the first principal component obtained through PCA process employed in part (4.5.3), to measure the overall financial development.

The results presented in Table 4.7 suggest that overall financial development (banks and stock markets) promotes subsequent economic growth in a sample of 45 emerging economies during the period of 1987-2011. Column 1 represents the results for the baseline regression, while regression in Column 2 controls for other determinants of growth. The estimated coefficient of *finance-aggregate* is 0.031 and statistically significant at 1% level, as shown in Column 2. Among the control variables, only the secondary school enrolment rate enters significantly with a positive impact on economic growth. Moreover, the lagged level of real GDP per capita is negatively and significantly correlated with economic

growth, consistent with findings of previous studies (see, for example, Barro, 1989; Bekaert et al., 2005).

Table 4.7: Finance-aggregate and Economic Growth (Estimation method: one-step System GMM)

Variable	one-step System-GMM	one-step System-GMM
Log of lagged GDP per capita	-0.053	-0.240
	(0.040)***	(0.151)***
Finance-aggregate	0.029	0.056
	(0.008)***	(0.017)***
Secondary school enrolment		0.397
		(0.233)*
Trade openness		-0.004
		(0.057)
Inflation rate		-0.056
		(0.070)
Government consumpiton		0.036
		(0.128)
Observations	177	153
Number of Groups	41	35
Number of Instruments	33	22
Hansen test p-value	0.313	0.320
AR (2)	0.007	0.076

Note: The table presents the results for the estimated coefficients and their robust standard errors in parenthesis. The dependent variable is the four-year (non-overlapping) average of the real GDP per capita growth for each country, which yields six observations per country. Four-year averages for all of the independent variables are computed over the same period. Definitions of variables are same as in Table C.2 in Appendix. The following are also reported: specification statistics including R-squared, F-statistics, number of groups, number of instruments, Hansen p-value test of over-identification test, and AR(2) test of the error terms. Time dummies for six time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

In line with majority of the evidence provided by the FG literature, these empirical results based on the System GMM estimates show that well-functioning financial systems may support economic growth in emerging countries. As a consequence, I believe that financial development can improve the investment opportunities and diversify the risks for large and mature firms, and thus enhance overall growth and employment opportunities for the poor. Hence, in the long-run, financial development may indirectly lead to poverty reduction by stimulating economic growth, since I find evidence of its positive contribution to growth and growth is good for the poor. This finding is confirmed by the results, though not strongly, presented in column 7 of Table 4.4, which suggest a positive and significant relationship between real GDP per capita growth and the average income of the poorest quantile.

4.6 Concluding Remarks and Policy Implications

The question of whether deeper financial markets lead not only to more economic growth, but also to reduced poverty has been continually examined throughout the FGP nexus over the last two decades. Although a large body of literature has shown that financial sector development is correlated with subsequent economic growth, theory provides conflicting predictions about the impact of finance on poverty reduction. This study tests the hypothesis of whether bank and stock market development would reduce poverty, in the context of newly emerging FP nexus. I use data from 45 emerging countries for the period of 1987-2011. Using several financial development indicators to take the various dimensions of the financial sector into account, I develop three aggregate measures, one each for bank development (*bank-aggregate*), stock market development (*market-aggregate*), and the overall financial development (*finance-aggregate*) in order to investigate whether development of financial sector creates better conditions for the poor.

Four main points emerge from the study. First, with regards the regressions between bank development and poverty reduction, I find that bank development, measured by *bank-aggregate*, has a negative and statistically significant effect on the average income of the poorest quantile, while the effect is insignificant, though negative, for the headcount ratio. Second, the results of the regressions between stock market development indicator, *market-aggregate*, and poverty measures suggest a positive and statistically significant effect of stock market development on the average income of the poorest quantile, and insignificant effects on the headcount ratio. The results underline that stock market development may have positive impacts on poverty reduction. Some support for this result is provided by certain specific indicators, such as the secondary school enrolment rate, trade openness, GDP per capita growth, and government consumption. Moreover, the size of the effect of bank development on poverty is clearly larger than for the stock market, indicating the greater importance of the role of banks for poverty reduction in emerging countries. This finding is consistent with the fact that the fi-

nancial structure of emerging countries is mostly bank-based, despite the amount of attention to stock market development in the last 20-25 years. Third, regarding the effect on poverty of overall financial development, measured by *finance-aggregate*, the results indicate that it generally exerts positive but statistically insignificant effect, suggesting that considering only the simultaneous effects of banks and stock markets may not fully capture the effect of financial development on poverty reduction. These conflicting results justify the need for investigating both simultaneous and separate effects of bank and stock market developments. Fourth, with regards the other explanatory variables, the results suggest that countries with higher inflation rates are likely to have more difficulties in reducing poverty, indicating the importance of macroeconomic stability for poverty reduction in emerging countries. The regression results also suggest that the secondary school enrolment rate and government consumption also have negative and statistically significant impacts on the headcount ratio.

The results indicate that financial development in banks and stock markets failed to reach the poorest segments of society in emerging countries, despite the positive but weak impact of stock markets on poverty reduction. Although financial systems have developed over the last two decades, especially in terms of size and liquidity, the poor could not benefit from these improvements. Less democratized access to credit markets, high income inequalities, institutional obstacles, concentrated political or economic power of higher income groups, government policies, and the lack of sufficient collateral use can be shown as the main reasons for the limited access to finance of the poor in emerging countries. It is also important to note that a large proportion of the poor live in rural areas, which are often beyond the reach of financial services, especially banking services. That could be another reason for the lack of democratized access to financial services. The results may also suggest that the poor do not have sufficient access to financial services, or they have access to some activities, but not to poverty reducing. Furthermore, it is widely accepted that broadening the access to finance for microenterprises, SMEs, and vulnerable groups is particularly im-

portant for poverty reduction. Some Latin American countries such as Brazil and Argentina have succeeded in reducing poverty via enhancing microfinance institutions. To benefit effectively from such institutions and credit programs they should be well designed and accompanied by other services such as assistance in accessing markets, provision of capacity building, etc. In addition, the critical importance of the effective regulatory and supervisory mechanisms for managing the possible risks that financial sector development could bring should be taken seriously by the policymakers. The investigation of the effects of such factors on poverty reduction is left for the future research.

Appendix A

Appendix for Chapter 2

A.1 Tables

Table A.1: List of Countries Used in the Estimations

High-Income (45)	Middle-Income (77)		Low-Income (24)
Aruba	Angola	Macedonia	Burundi
Australia	Albania	Mongolia	Benin
Austria	Argentina	Mauritius	Burkina Faso
Belgium	Armenia	Malaysia	Bangladesh
Bahrain	Azerbaijan	Nigeria	Central African Rep.
Bahamas, The	Bulgaria	Pakistan	Ethiopia
Barbados	Belarus	Panama	Gambia, The
Canada	Belize	Peru	Guinea-Bissau
Switzerland	Bolivia	Philippines	Kenya
Cyprus	Brazil	Papua New Guinea	Kyrgyzstan
Czech Republic	Bhutan	Paraguay	Cambodia
Germany	Botswana	Romania	Madagascar
Denmark	China	Russian Federation	Mali
Spain	Cote d'Ivoire	Sudan	Mozambique
Estonia	Cameroon	Senegal	Malawi
Finland	Congo, Rep.	Solomon Islands	Niger
France	Colombia	El Salvador	Nepal
United Kingdom	Costa Rica	Suriname	Rwanda
Equatorial Guinea	Dominica	Swaziland	Chad
Greece	Dominican Rep.	Seychelles	Togo
Hong Kong SAR	Algeria	Thailand	Tanzania
Croatia	Ecuador	Tonga	Uganda
Hungary	Egypt, Arab Rep.	Tunisia	Congo, Dem. Rep.
Ireland	Fiji	Turkey	Zimbabwe
Iceland	Gabon	Ukraine	
Israel	Georgia	Uruguay	
Italy	Ghana	St. Vincent and the Grenadines	
Japan	Grenada	Vietnam	
St. Kitts and Nevis	Guatemala	Vanuatu	
Korea, Rep.	Guyana	Samoa	
Luxembourg	Honduras	South Africa	
Macao SAR	Indonesia	Zambia	
Malta	India		
Netherlands	Iran, Islamic Rep.		
Norway	Jordan		
New Zealand	Kazakhstan		
Poland	Lao PDR		
Portugal	St. Lucia		
Saudi Arabia	Sri Lanka		
Singapore	Lesotho		
Slovak Republic	Lithuania		
Slovenia	Latvia		
Sweden	Morocco		
Trinidad and Tobago	Moldova		
United States	Mexico		

Table A.2: Variable Definitions and Sources

Name	Source	Definition
Log real GDP per capita	WDI	Logarithm of real GDP per capita (constant 2005 US$).
Private credit/GDP	IFS	Deposit Money bank credit to the private sector as a percentage of GDP.
Liquid liabilities/GDP	IFS	The ratio of liquid liabilities to GDP
Deposit money bank assets/GDP	IFS	Claims on domestic real nonfinancial sector by deposit money banks as a share of GDP.
Bank deposits/GDP	IFS	Demand, time and saving deposits in deposit money banks as a share of GDP.
Financial system deposits/GDP	IFS	Demand, time and saving deposits in deposit money banks and other financial institutions as a share of GDP.
Deposit money bank assets/ (deposit money + central) bank assets	IFS	Ratio of deposit money bank claims on domestic nonfinancial real sector to the sum of deposit money bank and Central Bank claims on domestic nonfinancial real sector.
Stock market value traded/GDP	IFS	The value of total shares traded on the stock market exchange as a percentage of GDP
Stock market capitalization/GDP	IFS	The value of listed shares on a countrys stock exchange as a percentage of GDP
Stock market turnover	IFS	The ratio of the value of total shares traded to average real market capitalization
Log of initial real GDP per capita	WDI	Logarithm of real GDP per capita of the previous period.
School enrollment, secondary	WDI	Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group.
Trade/GDP	WDI	Trade is the sum of exports and imports of goods and services measured as a share of GDP.
General government final consumption/GDP	WDI	General government final consumption expenditure includes all government current expenditures for purchases of goods and services, as a share of GDP.
Inflation rate	WDI	Inflation as measured by the annual growth rate of the GDP implicit deflator.

Note: All series used in the estimations, except real GDP per capita, are in percentage form and in their natural logs.

Table A.3: Correlation Matrix Between Financial Development Variables

Variable	Private	Liquid	Central	Assets	Deposits	Finsys	Mktcap	Traded	Turnover
Private	1.000								
Liquid	0.775	1.000							
Central	0.478	0.362	1.000						
Assets	0.976	0.805	0.467	1.000					
Deposits	0.759	0.963	0.365	0.793	1.000				
Finsys	0.756	0.963	0.358	0.789	0.999	1.000			
Mktcap	0.515	0.512	0.337	0.506	0.533	0.535	1.000		
Traded	0.479	0.335	0.248	0.458	0.323	0.321	0.705	1.000	
Turnover	0.258	0.143	0.113	0.256	0.101	0.096	0.211	0.608	1.000

Note: Definitions of variables are same as in Table A.2.

Table A.4: PCA of Bank Development Indicators

	PCA 1	**PCA 2**	**PCA 3**	**PCA 4**	**PCA 5**	**PCA 6**
Eigenvalues	5.1436	0.5995	0.1712	0.0488	0.0349	0.0017
% of variance	0.8573	0.0999	0.0285	0.0081	0.0058	0.0003
Cumulative %	0.8573	0.9572	0.9857	0.9939	0.9997	1.0000

Eigenvectors

Variable	Vector 1	Vector 2	Vector 3	Vector 4	Vector 5	Vector 6
Private	0.4208	0.0172	-0.6640	-0.1652	0.5953	0.0080
Liquid	0.4222	-0.2610	0.2168	0.8213	0.1789	-0.0055
Central	0.3045	0.9277	0.1983	0.0853	0.0028	0.0018
Assets	0.4282	-0.0479	-0.4451	0.0528	-0.7832	0.0042
Deposits	0.4297	-0.1822	0.3630	-0.3816	0.0102	-0.7104
Finsys	0.4290	-0.1883	0.3779	-0.3774	0.0096	0.7037

Note: Definitions of variables are same as in Table A.2.

Table A.5: PCA of Stock Market Development Indicators

	PCA 1	**PCA 2**	**PCA 3**
Eigenvalues	2.3846	0.6037	0.0116
% of variance	0.7949	0.2013	0.0039
Cumulative %	0.7949	0.9961	1.0000

Eigenvectors

Variable	Vector 1	Vector 2	Vector 3
Mktcap	0.5295	0.7386	0.4172
Traded	0.6452	-0.0314	-0.7634
Turnover	0.5508	-0.6734	0.4932

Note: Definitions of variables are same as in Table A.2.

Table A.6: PCA of Overall Financial Development Indicators

	PCA 1	**PCA 2**	**PCA 3**	**PCA 4**	**PCA 5**	**PCA 6**	**PCA 7**	**PCA 8**	**PCA 9**
Eigenvalues	6.157	1.299	0.734	0.552	0.168	0.054	0.019	0.010	0.003
% of variance	0.684	0.144	0.081	0.061	0.018	0.006	0.002	0.001	0.001
Cumulative %	0.684	0.828	0.910	0.972	0.990	0.996	0.998	0.999	1.000
					Eigenvectors				
Variable	Vector 1	Vector 2	Vector 3	Vector 4	Vector 5	Vector 6	Vector 7	Vector 8	Vector 9
Private	0.379	-0.122	0.041	0.196	-0.616	-0.052	0.646	0.006	-0.003
Liquid	0.372	-0.209	-0.206	0.126	0.236	0.837	0.010	-0.007	-0.026
Central	0.232	-0.043	0.942	0.095	0.210	0.045	-0.030	0.004	0.007
Assets	0.385	-0.117	-0.035	0.189	-0.466	-0.095	-0.756	0.019	0.036
Deposits	0.377	-0.233	-0.159	0.017	0.352	-0.390	0.039	0.024	-0.705
Finsys	0.376	-0.234	-0.173	-0.002	0.376	-0.353	0.081	-0.019	0.706
Mktcap	0.303	0.156	0.035	-0.831	-0.113	0.072	-0.006	0.413	0.002
Traded	0.310	0.542	-0.035	-0.165	0.020	0.001	0.001	-0.760	-0.026
Turnover	0.197	0.704	-0.093	0.426	0.149	-0.036	0.028	0.498	0.018

Definitions of variables are same as in Table A.2.

Table A.7: Private Credit and Economic Growth (Robustness Test)

Variable	(1) Low-Income	(2) Middle-Income	(3) High-Income
Constant	0.140	2.3865	3.267
	(0.562)	(0.934)**	(1.127)***
Initial real GDP per capita	-0.0310	-0.4102	-0.2076
	(0.101)***	(0.129)***	(0.042)***
Private credit to GDP	0.0951	0.2283	-0.085
	(0.047)*	(0.0787)***	(0.0427)*
Secondary school enrolment rate	0.0232	-0.0187	-0.030
	(0.025)	(0.0642)	(0.187)
Trade openness	-0.1025	-0.0447	-0.052
	(0.050)*	(0.076)	(0.059)
Government consumption	0.0713	0.0652	-0.196
	(0.045)	(0.101)	(0.200)
Inflation rate	-0.005	0.0637	0.046
	(0.026)	(0.0316)**	(0.216)
Observations	111	392	202
Number of Groups	23	74	43
Number of Instruments	21	22	17
Hansen test p-value	0.244	0.016	0.216
Difference-in-Hansen test p-value	0.277	0.025	0.100
AR(2)	0.799	0.578	0.605

Note: Dependent variable is the three-year (non-overlapping) average of real per capita GDP growth, and all independent variables are averaged over the same three-year period. Based on our panel of 1991-2011, there are seven time 3-year time periods. Robust standard errors are given within parentheses. Definitions of variables are same as in Table A.2. Specification statistics including R-squared, number of groups, number of instruments, Hansen test p-value and Difference in Hansen test p-value tests of over-identification test, and AR(2) test of the error terms are also reported. Time dummies for seven time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

Table A.8: Stock Market Turnover and Economic Growth (Robustness Test)

Variable	(1) Middle-Income	(2) High-Income
Constant	1.483	-0.092
	(0.686)**	(0.238)
Initial real GDP per capita	-0.184	0.013
	(0.056)***	(0.030)***
Stock market turnover	0.043	0.0420
	(0.022)*	(0.017)**
Secondary school enrolment rate	-0.010	0.016
	(0.024)	(0.018)
Trade openness	-0.029	-0.023
	(0.029)	(0.025)
Government consumption	0.091	-0.010
	(0.050)*	(0.026)
Inflation rate	0.059	0.004
	(0.070)	(0.016)
Observations	178	201
Number of Groups	38	39
Number of Instruments	21	21
Hansen test p-value	0.451	0.209
Difference-in-Hansen test p-value	0.589	0.626
AR(2)	0.609	0.051

Note: Dependent variable is the three-year (non-overlapping) average of real per capita GDP growth, and all independent variables are averaged over the same three-year period. Based on our panel of 1991-2011, there are seven time 3-year time periods. Robust standard errors are given within parentheses. Definitions of variables are same as in Table A.2. Specification statistics including R-squared, number of groups, number of instruments, Hansen test p-value and Difference in Hansen test p-value tests of over-identification test, and AR(2) test of the error terms are also reported. Time dummies for seven time points are included in the model. *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

Table A.9: Summary of the sign and the significance level of the relationship between bank development, stock market development, and economic growth in full sample, low-, middle-, and high-income countries.

Development/Income Group	Low-Income	Middle-Income	High-Income	Full Sample
Bank Development	+, **	+, **	-, ***	x
Stock Market Development	x	+, **	+, **	x
Overall Financial Development	+, 0	+, 0	+, **	+, **

Note: The sign + denotes the positive relationship between given type of financial development and economic growth in specific income group, "-" denotes the negative relationship, "0" denotes the statistically insignificant relationship, and "x" denotes no observation (regression results). *, **, and *** denote statistically significant coefficient at 10%, 5% and 1% levels, respectively.

A.2 Principal Component Analysis

Principal Component Analysis (PCA) is a well-established technique for dimensionality reduction (Hotelling, 1933; Stock and Watson, 2002). The popularity of PCA comes from three important properties:

- It is the optimal (in terms of mean squared error) linear scheme for compressing a set of high dimensional vectors into a set of lower dimensional vectors and then reconstructing.
- The model parameters can be computed directly from the data, for example, by diagonalizing the sample covariance.
- The compression and decompression are easy operations to perform given the model parameters, they require only matrix multiplications.

Historically PCA was first formulated in a statistical setting: to estimate the principal components of a multivariate random variable x from given sample points $\{x_i\}$. For a multivariate random variable $x \in \mathbb{R}^D$ and any $d < D$, the d "principal components" are defined to be *d uncorrelated* linear components of x:

$$y_i = u_i^T x \ \in \mathbb{R}, \quad i = 1, ..., d \tag{A.2.1}$$

for some $u_i \in \mathbb{R}^D$ such that the variance of y_i is maximized subject to

$$u_i^T u_i = 1, \quad Var(y_1) \geq Var(y_2) \geq ... \geq Var(y_d). \tag{A.2.2}$$

For example, to find the first principal component, we seek a vector $u_1^* \in \mathbb{R}^D$ such that

$$u_1^* = arg \max_{u_1 \in \mathbb{R}^D} Var(u_1^T x), \quad \text{s.t.} \quad u_1^T u_1 = 1. \tag{A.2.3}$$

A.3 The System GMM Estimator

I use dynamic panel GMM techniques to address the problems of potential endogeneity, and unobserved country-specific effects in the data. Equation (A.3.1) shows the baseline regression model for the analysis.

$$y_{i,t} = \alpha y_{i,t-1} + \beta X_{i,t} + \eta_i + \xi_t + \epsilon_{i,t} \tag{A.3.1}$$

where $y_{i,t}$ represents the dependent variable for country i in period t. The first explanatory variable is the lagged value of the dependent variable, $y_{i,t-1}$, which introduces a dynamic specification. $X_{i,t}$ represents the set of explanatory variables except initial level of dependent variable. Finally, η_i captures unobserved country-specific effects, ξ_t is a period-specific constant, and $\epsilon_{i,t}$ is the error term.

By construction, there is a problem of endogeneity due to the simultaneous presence of the country-specific effect (η_i) and the lagged dependent variable. To show that let us define $\eta_i + \xi_t + \epsilon_{i,t} = u_{i,t}$. Then, we clearly see that $E[u_{i,t}|y_{i,t}] \neq 0$ because both $y_{i,t-1} = \alpha y_{i,t-2} + \beta X_{i,t-1} + u_{i,t-1}$ and $u_{i,t-1}$ include η_i which is also in $u_{i,t}$. In other words, the strict exogeneity hypothesis that excludes feedback of error towards the explanatory variables is rejected since the lagged dependent variable is correlated with the error term. To overcome this problem and to control for the endogeneity of other explanatory variables, I employ the System GMM approach, which can be briefly summarized as below.

The first step in the estimation procedure is to eliminate the country-specific effects via a first-difference transformation:

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta(X_{i,t} - X_{i,t-1}) + (\xi_t - \xi_{t-1}) + (\epsilon_{i,t} - \epsilon_{i,t-1}) \tag{A.3.2}$$

Equation (A.3.2) shows that country-specific effects are wiped out from the regression. However, there is still the possibility that past shocks predict contemporary regressors so there could be a correlation between $(y_{i,t-1} - y_{i,t-2})$ and $(\epsilon_{i,t} - \epsilon_{i,t-1})$. Hence, I need to use instrumental variables. According to Arellano and Bond (1991), I can overcome this bias with the following two assumptions.

$$E[X_{i,t-s}(\epsilon_{i,t} - \epsilon_{i,t-1})] = 0, \text{ for } s \geq 2; t = 3, ..., n \quad \text{(A.3.3)}$$

$$E[y_{i,t-s}(\epsilon_{i,t} - \epsilon_{i,t-1})] = 0, \text{ for } s \geq 2; t = 3, ..., n \quad \text{(A.3.4)}$$

Nevertheless, Blundell and Bond (1998) have shown that when the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the regression equation expressed in first-differences. This is likely to lead to biased coefficients, and the problem is generally exacerbated in small samples. The solution Blundell and Bond (1998) adopted is to use the System GMM estimator, which basically combines in a system the first-differenced with the same equation expressed in levels. The instruments for the regression in differences are the same as those described above, while the instruments for the equation in levels are lagged differences of the corresponding variables. I have additional moment conditions such as;

$$E[(y_{i,t-s} - y_{i,t-s-1})(\eta_i + \epsilon_{i,t})] = 0, \text{ for } s = 1 \quad \text{(A.3.5)}$$

$$E[(X_{i,t-s} - X_{i,t-s-1})(\eta_i + \epsilon_{i,t})] = 0, \text{ for } s = 1 \quad \text{(A.3.6)}$$

I use moment conditions given in equation (A.3.3), (A.3.4), (A.3.5), and (A.3.6) to get the System GMM estimators. To have valid instruments, I use the standard Hansen test of over-identification, where the null hypothesis is that the instrumental variables are not correlated with the residual, and the serial correlation test, where the null hypothesis is that there is no second-order serial correlation in the error terms. The Arellano-Bond test for autocorrelation has a null hypothesis that there is no autocorrelation. The tests for AR (1) process in first differences rejects the null hypothesis since $\Delta\epsilon_{i,t} = \epsilon_{i,t} - \epsilon_{i,t-1}$ and, $\Delta\epsilon_{i,t-1} = \epsilon_{i,t-1} - \epsilon_{i,t-2}$, that is, both have $\epsilon_{i,t-1}$. However, the test for AR (2) in first differences is more important because it detects autocorrelation in levels. Moreover, the number of instruments should be less than or equal to the number of groups to have valid instruments.

Appendix B

Appendix for Chapter 3

Table B.1: Pairwise Correlations of All Variables

	Gini	Prvt	Money	Mktcap	Trnvr	PISA	Growth	Govern	Inf	Tax	Educ	Trade	Corrupt	Law
Gini	1.000													
Prvt	-0.3684*	1.000												
Money	-0.3017*	0.5494*	1.000											
Mktcap	-0.1686*	0.5720*	0.4704*	1.000										
Trnvr	-0.2182*	0.4507*	0.090	0.3284*	1.000									
PISA	-0.7925*	0.5423*	0.2689*	0.3347*	0.3819*	1.000								
Growth	0.0606	-0.4078*	-0.2198*	-0.096	-0.2235*	-0.117	1.000							
Govern	-0.5291*	0.3049*	0.082	0.018	0.1339*	0.4101*	-0.1706*	1.000						
Inf	0.2694*	-0.4090*	-0.2486*	-0.2535*	-0.076	-0.3991*	0.070	-0.3396*	1.000					
Tax	-0.3579*	0.1972*	0.1586*	0.104	-0.0708	0.1726*	-0.1295	0.4825*	-0.1539*	1.000				
Educ	-0.4998*	0.4463*	0.1573*	0.2921*	0.2123*	0.5435*	-0.1490*	0.5404*	-0.3469*	-0.014	1.000			
Trade	-0.4461*	0.1398*	0.5971*	0.118	-0.2594*	0.2640*	0.086	0.1337*	-0.1378*	-0.083	0.078	1.000		
Corrupt	-0.4664*	0.5253*	0.3480*	0.5298*	0.2692*	0.4861*	-0.2003*	0.3809*	-0.3108*	0.2323*	0.5157*	0.1377*	1.000	
Law	-0.7043*	0.6325*	0.4144*	0.4705*	0.3204*	0.7497*	-0.1544*	0.4161*	-0.3229*	0.4551*	0.5638*	0.2934*	0.6888*	1.000

Gini = Gini coefficient, Prvt = Private credits to GDP, Money = M2 to GDP ratio, Mktcap = Stock market capitalization to GDP ratio, Trnvr= Stock market turnover ratio, PISA = mean PISA Math score, Growth = GDP per capita growth, Govern = General government consumption to GDP ratio, Inf = Inflation deflater rate, Tax = Tax revenue to GDP ratio, Educ= Secondary school enrolment rate (gross), Trade = Trade as a share of GDP, Corrupt = Corruption index, Law= Law and order index.

Appendix C

Appendix for Chapter 4

Table C.1: Main Variables by Country

Country	GDP per capita	Headcount ratio	Average income of the poorest quintile	Private credit	Market capitalization
Argentina	4191,766	7.83	798,48	15.67	24.89
Brazil	4541,577	21.01	530,40	35.17	32.46
Bulgaria	3199,96	2.14	1276,72	33.47	11.96
China	1289,561	63.79	354,89	94.41	41.48
Colombia	3221,849	23.35	427,46	28.52	21.73
Costa Rica	4113,213	10.82	795,05	23.77	8.91
Cote d'Ivoire	1004,446	42.32	323,93	21.32	13.93
Croatia	9177,23	0.14	3798,76	44.77	27.7
Dominica	3207,409	13.56	728,47	28.31	-
Ecuador	2841,811	21.63	482,97	23.61	7.92
Egypt	1118,592	21.44	518,64	41.38	31.42
El Salvador	2435,234	20.74	413,11	4.13	17.1
Estonia	8279,566	1.91	2454,06	50.08	24.29
Georgia	1545,319	32.46	363,26	14.01	5.47
Honduras	1289,232	42.75	167,23	34.8	7.47
Hungary	9161,635	0.3	4321,40	36.7	19.2
India	609,4635	77.47	282,07	30.26	42.33
Indonesia	1141,252	65.82	510,22	31.76	22.8
Iran	2347,621	9.42	610,16	29.55	13.55
Jordan	2130,865	6.61	837,77	71.49	100.02
Kazakhstan	3122,078	11.47	1379,55	23.01	19.27
Kyrgyzstan	500,2003	32.55	188,99	5.96	1.46
Latvia	5530,69	1.55	2032,81	33.81	7.36
Lithuania	6426,539	2.94	2173,96	22.94	15.62
Malaysia	4664,931	8.13	1097,07	106.67	151.15
Mauritania	683,6619	54.32	195,11	25.98	-
Mexico	7327,676	11.45	1683,74	19.39	26.73
Moldova	931,6679	31.21	310,13	18.06	3.04
Pakistan	615,9417	72.82	280,94	23.47	17.74
Panama	4240,666	20.69	500,76	68.01	23.79
Paraguay	1530,87	17.52	240,13	22.3	3.04
Peru	2680,203	20.53	542,51	16.97	29.45
Philippines	1104,655	47.99	313,03	31.36	46.88
Poland	6959,33	1.41	2895,97	25.12	17.81
Romania	4162,894	7.32	1884,54	20.42	9.76
Russia	4862,351	3.79	1486,10	21.2	35.86
Slovakia	10013,61	0.32	5540,40	42.03	5.66
Slovenia	15382,98	0.06	6420,11	45.42	18.83
Sri Lanka	1051,022	37.78	430,15	22.99	15.62
Thailand	2269,568	17.61	720,04	105.35	53.42
Tunisia	2712,184	12.91	850,90	60.42	11.65
Turkey	6127,208	6.81	1870,27	19.35	19.49
Uganda	273,3343	80.48	82,01	5.74	8.33
Ukraine	1839,854	3.75	817,99	23.81	17.05
Uruguay	5041,278	2.78	1241,03	28.97	0.67

Note: All variables are averaged over the 1987-2011 period.

Table C.2: Description of the Data Sample and Sources

Name	Description	Employed in	Source
Dependent variable			
Headcount Ratio	The percentage of the population living below $2.00 a day at 2005 international prices. I use logarithmic growth of the headcount ratio as a dependent variable.	Beck et al. (2007); Kappel (2010)	PovStats
Average Income of the Poorest Quintile	The average per capita income of the lowest %20 quantile. I use logarithmic growth of the average per capita income of the poorest quantile as a dependent variable.	Dollar and Kraay (2002); Jeanneney and Kpodar (2008); Canavire-Bacarreza and Rioja (2008)	PovStats
Financial development variables			
Bank private credit to GDP	The financial resources provided to the private sector by domestic banks as a share of GDP.	Acemoglu and Johnson (2005); Ang and McKibbin (2007); Rioja and Valev (2011); Demirgc-Kunt et al. (2012)	IFS
Liquid liabilities to GDP	Ratio of liquid liabilities (M3) to GDP.	King and Levine (1993); Rousseau and Wachtel (2000); Baltagi et al. (2007); Wu et al. (2010)	IFS
Bank deposits to GDP	The total value of demand, time and saving deposits at domestic deposit money banks as a share of GDP.	Rioja and Valev (2011); Barajas et al. (2013)	IFS
Private credit to GDP	Private credit by deposit money banks and other financial institutions to GDP.	Clarke, Xu, and Zou (2006); Kappel (2010); Rioja and Valev (2011)	IFS
Deposit money bank assets to GDP	Total assets held by deposit money banks as a share of GDP.	Clarke, Xu, and Zou (2006)	IFS
Stock market capitalization to GDP	The value of listed shares on a countrys stock exchange as a percentage of GDP.	Levine and Zervos (1998); Acemoglu and Johnson (2005); Herger et. al.(2007); Kappel (2010); Rioja and Valev (2011)	IFS
Stock market total value traded to GDP	The value of total shares traded on the stock market as a percentage of GDP.	Levine and Zervos (1998); Girma and Shortland (2004); Baltagi et al. (2007); Kappel (2010); Rioja and Valev (2011)	IFS
Stock market turnover ratio	The ratio of the value of total shares traded to average real market capitalization.	King and Levine (1993); Levine and Zervos (1998); Rioja and Valev (2011),	IFS
Control variables			
Real GDP per capita	Real GDP per capita at constant prices of 2005 US$.	Dollar and Kraay (2002); Beck et al. (2004); Clarke, Xu, and Zou (2006)	WDI
Real GDP per capita growth	Logarithmic growth rate of the real GDP per capita.	Beck et al., (2004); Dollar and Kraay (2002)	OC
Education	Gross enrolment rate is the ratio of total enrolment in secondary school, regardless of age, to the population of the age group.	Dollar and Kraay (2002); Kappel (2010); Beck and Levine (2004); Hasan et al. (2009)	WDI
Trade openness	Sum of exports/imports of goods and services as a share of GDP.	Rajan and Zingales (2003b); Beck and Levine (2004); Rioja and Valev (2011)	WDI
Inflation rate	Inflation is measured by the annual growth rate of the GDP implicit deflater.	Beck and Levine (2004); Clarke, Xu, and Zou (2006); Rioja and Valev (2011)	WDI
Government Consumption	General government final consumption expenditure includes all government current expenditures for purchases of goods and services, as a share of GDP.	Beck and Levine (2004); Kappel (2010); Rioja and Valev (2011)	WDI

Note: WDI: World Development Indicators; IFS: International Financial Statistics; OC: Own Calculations

Table C.3: Correlation Matrix Between Financial Development Variables

Variable	private	liquid	deposit	bprivate	bassets	mktcap	traded	turnover
private	1							
liquid	0.883	1						
deposit	0.871	0.944	1					
bprivate	0.994	0.878	0.863	1				
bassets	0.937	0.907	0.902	0.94	1			
mktcap	0.547	0.542	0.572	0.542	0.569	1		
traded	0.462	0.549	0.527	0.465	0.538	0.791	1	
turnover	0.149	0.293	0.232	0.143	0.255	0.261	0.7767	1

Note: Definitions of variables are same as in Table C.2.

Table C.4: PCA for Bank Development Variables

	PCA 1	**PCA 2**	**PCA 3**	**PCA 4**	**PCA 5**
Eigenvalues	4.658	0.221	0.064	0.050	0.004
% of variance	0.931	0.044	0.013	0.010	0.001
Cumulative %	0.931	0.976	0.989	0.999	1

	Eigenvectors				
Variable	Vector 1	Vector 2	Vector 3	Vector 4	Vector 5
private	0.449	-0.475	0.289	0.059	-0.695
liquid	0.444	0.471	0.225	-0.727	-0.003
deposit	0.441	0.556	0.171	0.682	0.034
bprivate	0.449	-0.490	0.211	0.019	0.715
bassets	0.451	-0.045	-0.889	-0.028	-0.050

Note: Definitions of variables are same as in Table C.2

Table C.5: PCA for Stock Market Development Variables

	PCA 1	**PCA 2**	**PCA 3**
Eigenvalues	2.300	0.683	0.015
% of variance	0.766	0.228	0.005
Cumulative %	0.767	0.995	1.000

	Eigenvectors		
Variable	Vector 1	Vector 2	Vector 3
mktcap	0.536	-0.699	0.471
traded	0.656	-0.005	-0.754
turnover	0.530	0.714	0.456

Note: Definitions of variables are same as in Table C.2

References

Daron Acemoglu and James A Robinson. Economics versus politics: Pitfalls of policy advice. Technical report, National Bureau of Economic Research, 2013. 46

Philippe Aghion and Patrick Bolton. A theory of trickle-down growth and development. *The Review of Economic Studies*, 64(2):151–172, 1997. 43, 44

Philippe Aghion, Peter Howitt, and David Mayer-Foulkes. The Effect of Financial Development on Convergence: Theory and Evidence. *The Quarterly Journal of Economics*, 120(1):173–222, 2005. 9, 14

Franklin Allen and Anthony M Santomero. What do financial intermediaries do? *Journal of Banking & Finance*, 25(2):271–294, 2001. 28

Sajeda Amin, Ashok S Rai, and Giorgio Topa. Does microcredit reach the poor and vulnerable? evidence from northern bangladesh. *Journal of development economics*, 70(1):59–82, 2003. 92

James B Ang and Warwick J McKibbin. Financial liberalization, financial sector development and growth: evidence from malaysia. *Journal of Development Economics*, 84(1):215–233, 2007. 9, 17, 19, 64, 94, 95

Jean-Louis Arcand, Enrico Berkes, and Ugo Panizza. Too much finance? 2012. 13

Manuel Arellano and Stephen Bond. Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2):277–297, 1991. 9, 12, 22, 89, 98

Manuel Arellano and Olympia Bover. Another look at the instrumental variable estimation of error-components models. *Journal of econometrics*, 68(1):29–51, 1995. 22, 23

Philip Arestis, Panicos O Demetriades, and Kul B Luintel. Financial development and economic growth: the role of stock markets. *Journal of Money, Credit and Banking*, pages 16–41, 2001. 12, 13

Badi H Baltagi and Qi Li. A note on the estimation of simultaneous equations with error components. *Econometric Theory*, 8(01):113–119, 1992. 75

Abhijit V Banerjee and Andrew F Newman. Occupational choice and the process of development. *Journal of political economy*, pages 274–298, 1993. 41, 43, 46, 80, 86, 90

Mr Adolfo Barajas, Mr Ralph Chami, and Mr Reza Yousefi. *The Finance and Growth Nexus Re-examined: Do All Countries Benefit Equally?* Number 13-130. International Monetary Fund, 2013. 14, 94

Robert J Barro. Economic growth in a cross section of countries. Technical report, National Bureau of Economic Research, 1989. 18, 21, 24, 36, 114

Thorsten Beck. Finance and oil: Is there a resource curse in financial development? *European Banking Center Discussion Paper*, (2011-004), 2011. 13

Thorsten Beck and Ross Levine. Stock markets, banks and growth: panel evidence. *Journal of Banking & Finance*, 28(3):423–442, 2004. 7, 12, 17, 18, 22, 33, 36, 100, 112

Thorsten Beck, Ross Levine, and Norman Loayza. Finance and the sources of growth. *Journal of financial economics*, 58(1):261–300, 2000. 19, 67, 99

Thorsten Beck, Asli Demirgüç-Kunt, and Ross Levine. Law, politics, and finance. *World Bank Policy Research Working Paper*, (2585), 2001. 72, 73

Thorsten Beck, Asli Demirgüç-Kunt, and Ross Levine. Finance, inequality and the poor. *Journal of economic growth*, 12(1):27–49, 2007. 46, 67, 68, 91, 92, 94, 99, 101

Geert Bekaert, Campbell R Harvey, and Christian Lundblad. Does financial liberalization spur growth? *Journal of Financial Economics*, 77(1):3–55, 2005. 12, 36, 114

Valerie Bencivanga and Bruce Smith. Financial intermediation and endogenous growth. *The Review of Economic Studies*, 58(2):195–209, 1991. 7

Valerie Bencivanga, Bruce Smith, and Ross Star. Transaction costs, technological choice, and endogenous growth. *Journal of Economic Theory*, 67(1):153–177, 1995. 7, 100

Amar Bhide. The hidden costs of stock market liquidity. *Journal of Financial Economics*, 34(1):31–51, 1993. 13

Milo Bianchi. Credit constraints, entrepreneurial talent, and economic development. *Small business economics*, 34(1):93–104, 2010. 41, 44, 45, 48, 50, 57

Richard Blundell and Stephen Bond. Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1):115–143, 1998. 9, 22, 23, 89, 98

John Bonin and Paul Wachtel. Financial sector development in transition economies: Lessons from the first decade. *Financial Markets, Institutions and Instruments*, 12(1):1–66, 2003. 6

John H Boyd and Edward C Prescott. Financial intermediary-coalitions. *Journal of Economic Theory*, 38(2):211–232, 1986. 13

Francesco Caselli, Gerardo Esquivel, and Fernando Lefort. Reopening the convergence debate: a new look at cross-country growth empirics. *Journal of economic growth*, 1(3):363–389, 1996. 21

Stephen G Cecchetti and Enisse Kharroubi. Reassessing the impact of finance on growth. 2012. 13

Andrew Charlton. Capital market liberalization and poverty. *Capital market liberalization and development*, pages 121–138, 2008. 46, 92

Luc Christiaensen, Lionel Demery, and Stefano Paternostro. Macro and micro perspectives of growth and poverty in africa. *The World Bank Economic Review*, 17(3):317–347, 2003. 67, 99

Martin Cihak, Asli Demirgüç-Kunt, Erik Feyen, and Ross Levine. Benchmarking financial systems around the world. *World Bank Policy Research Working Paper*, (6175), 2012. 7

Stijn Claessens and Erik Feijen. *Financial sector development and the millennium development goals*. Number 89. World Bank Publications, 2007. 85, 91

Stijn Claessens and Enrico Perotti. Finance and inequality: Channels and evidence. *Journal of Comparative Economics*, 35(4):748–773, 2007. 46

George RG Clarke, Lixin Colin Xu, and Heng-fu Zou. Finance and income inequality: what do the data tell us? *Southern economic journal*, pages 578–596, 2006. 45, 72, 94, 95

Era Dabla-Norris, Yan Ji, Robert M Townsend, and D Filiz Unsal. Distinguishing constraints on financial inclusion and their impact on gdp and inequality. Technical report, National Bureau of Economic Research, 2015. 41, 45

Klaus Deininger and Lyn Squire. New ways of looking at old issues: inequality and growth. *Journal of development economics*, 57(2):259–287, 1998. 46

Panicos O Demetriades and Khaled A Hussein. Does financial development cause economic growth? time-series evidence from 16 countries. *Journal of Development Economics*, 51(2):387–411, 1996. 12

Panicos O Demetriades and Peter L Rousseau. Government, openness and finance: Past and present*. *The Manchester School*, 79(s2):98–115, 2011. 17

Asli Demirgüç-Kunt and Harry Huizinga. Bank activity and funding strategies: The impact on risk and returns. *Journal of Financial Economics*, 98(3):626–650, 2010. 28

Asli Demirgüç-Kunt and Ross Levine. Finance, financial sector policies, and long-run growth. *World Bank Policy Research Working Paper Series, Vol*, 2008. 11

Asli Demirguc-Kunt, Ross Levine, A Demirguc-Kunt, and R Levine. Financial structure and economic growth: Perspective and lessons. *Financial structure and economic growth: A cross-country comparison of banks, markets, and development*, pages 3–14, 2001. 14

Asli Demirgüç-Kunt, Erik Feyen, and Ross Levine. The evolving importance of banks and securities markets. *The World Bank Economic Review*, page lhs022, 2012. 10, 14, 17, 29, 95

David Dollar and Aart Kraay. Growth is good for the poor. *Journal of economic growth*, 7(3):195–225, 2002. 46, 67, 68, 88, 91, 92, 99, 101

William Easterly and Stanley Fischer. Inflation and the poor. *Journal of Money, Credit and Banking*, pages 160–178, 2001. 99, 101

Babajide Fowowe and Babatunde Abidoye. The effect of financial development on poverty and inequality in african countries*. *The Manchester School*, 81(4): 562–585, 2013. 92

Oded Galor and Omer Moav. From physical to human capital accumulation: Inequality and the process of development. *The Review of Economic Studies*, 71 (4):1001–1026, 2004. 43

Oded Galor and Joseph Zeira. Income distribution and macroeconomics. *The review of economic studies*, 60(1):35–52, 1993. 43, 46, 80, 91

Ernesto R Gantman and Marcelo P Dabós. A fragile link? a new empirical analysis of the relationship between financial development and economic growth. *Oxford Development Studies*, 40(4):517–532, 2012. 23

Raymond W Goldsmith. Finance structure and development, 1969. 11, 17

Jeremy Greenwood and Boyan Jovanovic. Financial development, growth, and the distribution of income. Technical report, National Bureau of Economic Research, 1989. 44, 80, 86

DN Gujarati. Basic econometrics mcgraw-hill companies. *New York*, 2003. 71

Joseph F Hair, Rolph E Anderson, Ronald L Tatham, and C William. Black. 1998. *Multivariate data analysis*, 5:87–135, 1998. 95

M Kabir Hassan, Benito Sanchez, and Jung-Suk Yu. Financial development and economic growth: New evidence from panel data. *The Quarterly Review of economics and finance*, 51(1):88–104, 2011. 14, 16, 36

Anke E Hoeffler. The augmented solow model and the african growth debate*. *Oxford Bulletin of Economics and Statistics*, 64(2):135–158, 2002. 22

Douglas Holtz-Eakin, Whitney Newey, and Harvey S Rosen. Estimating vector autoregressions with panel data. *Econometrica: Journal of the Econometric Society*, pages 1371–1395, 1988. 12, 22

Patrick Honohan. Financial development, growth, and poverty: how close are the links? 2004. 88, 91

Harold Hotelling. Analysis of a complex of statistical variables into principal components. *Journal of educational psychology*, 24(6):417, 1933. 125

Hossein Jalilian and Colin Kirkpatrick. Financial development and poverty reduction in developing countries. *International Journal of Finance & Economics*, 7 (2):97–108, 2002. 91

Vivien Kappel. The effects of financial development on income inequality and poverty. *CER-ETH-Center of Economic Research at ETH Zurich, Working Paper*, (10/127), 2010. 46, 92, 94, 95

John Maynard Keynes. The general theory of interest, employment and money, 1936. 38

Robert King and Ross Levine. Finance and growth: Schumpeter might be right. *Quarterly Journal of Monetary Economics*, 108(3):717–737, 1993a. 7, 11, 17, 100

Robert G King and Ross Levine. Finance, entrepreneurship and growth. *Journal of Monetary Economics*, 32(3):513–542, 1993. 11, 17, 21, 33, 94, 95

Kangni Kpodar and Raju Jan Singh. Does financial structure matter for poverty? evidence from developing countries. *Evidence from Developing Countries (December 1, 2011). World Bank Policy Research Working Paper Series, Vol*, 2011. 91

Rafael La Porta, Florencio Lopez-de Silanes, Andrei Shleifer, and Robert W Vishny. Legal determinants of external finance. *Journal of finance*, pages 1131–1150, 1997. 18, 72, 73

Siong Hook Law, Hui Boon Tan, et al. The role of financial development on income inequality in malaysia. *Journal of Economic Development*, 34(2):153, 2009. 46

Ross Levine. Financial development and economic growth: views and agenda. *Journal of economic literature*, pages 688–726, 1997. 40

Ross Levine. Law, finance, and economic growth. *Journal of financial Intermediation*, 8(1):8–35, 1999. 72

Ross Levine. Napoleon, burses, and growth: With a focus on latin america in market augmenting government, 2001. 12

Ross Levine. More on finance and growth: more finance, more growth? *REVIEW-FEDERAL RESERVE BANK OF SAINT LOUIS*, 85(4):31–46, 2003. 9, 64, 94

Ross Levine. *Handbook of Economic Growth*, chapter Finance and Growth: Theory and Evidence, pages 865–933. Elsevier, North-Holland, 2005. 7, 74

Ross Levine and Sara Zervos. Stock markets, banks, and economic growth. *American Economic Review*, pages 537–558, 1998. 12, 17, 18, 33, 95

Ross Levine, Norman Loayza, and Thorsten Beck. Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics*, 46(1):31–77, 2000. 12, 16, 17, 22

Hongyi Li, Lyn Squire, and Heng-fu Zou. Explaining international and intertemporal variations in income inequality. *Economic journal*, pages 26–43, 1998. 45, 75, 91

Justin Y Lin, Xifang Sun, and Ye Jiang. Toward a theory of optimal financial structure. *World Bank Policy Research Working Paper Series, Vol*, 2009. 15

Elizabeth Littlefield, Jonathan Morduch, and Syed Hashemi. Is microfinance an effective strategy to reach the millennium development goals? *Focus Note*, 24 (2003):1–11, 2003. 85

Huw Lloyd-Ellis and Dan Bernhardt. Enterprise, inequality and economic development. *The Review of Economic Studies*, 67(1):147–168, 2000. 41, 44, 45, 57

Robert E Lucas. On the mechanics of economic development. *Journal of Monetary Economics*, 22(1):3–42, 1988. 13

Robert E Lucas. The industrial revolution: Past and future. *Lectures on economic growth*, pages 109–188, 2002. 38

Ronald I McKinnon. *Money and capital in economic development*. Brookings Institution Press, 1973. 11

Samy Naceur and Samir Ghazouani. Stock markets, banks and growth: empirical evidence from the MENA region. *Research in International Business and Finance*, 21(2):297–315, 2007. 7, 13

Marco Pagano. Financial markets and growth: an overview. *European Economic Review*, 37(2):613–622, 1993. 11

Peter Quartey and Frank Prah. Financial development and economic growth in ghana: is there a causal link? *African Finance Journal*, 10(1):28–54, 2008. 92

Martin Ravallion. Growth, inequality and poverty: looking beyond averages. *World development*, 29(11):1803–1815, 2001. 46, 67, 92

Martin Ravallion and Gaurav Datt. When is growth pro-poor? evidence from the diverse experiences of india's states. *Evidence from the Diverse Experiences of India's States (December 1999). World Bank Policy Research Working Paper*, (2263), 1999. 99

Felix Rioja and Neven Valev. Finance and the sources of growth at various stages of economic development. *Economic Inquiry*, 42(1):127–140, 2004. 9, 14, 17, 18, 94

Felix Rioja and Neven Valev. Stock markets, banks and the sources of economic growth in low and high income countries. *Journal of Economics and Finance*, 38 (2):302–320, 2014. 15, 36

Joan Robinson. The generalisation of the general theory. *The Rate of Interest and Other Essays*, 2:1–76, 1952. 13

D Roodman. How to do xtabond2: An introduction to difference and system gmm in stata. stata journal, 9 (1), 86-136. *FOR ONLINE PUBLICATION*, 2009a. 23

David Roodman. A note on the theme of too many instruments*. *Oxford Bulletin of Economics and statistics*, 71(1):135–158, 2009b. 22

Peter L Rousseau and Paul Wachtel. Equity markets and growth: cross-country evidence on timing and outcomes, 1980–1995. *Journal of Banking & Finance*, 24 (12):1933–1957, 2000. 11, 12, 18, 21, 94

Gerald W Scully. The size of the state, economic growth and the efficient utilization of national resources. *Public choice*, 63(2):149–164, 1989. 19

Edward Stone Shaw. *Financial Deepening in Economic Development*, volume 270. Oxford University Press New York, 1973. 11

Frederick Solt. Standardizing the world income inequality database*. *Social Science Quarterly*, 90(2):231–242, 2009. 65

Joseph Stiglitz. *The price of inequality*. Penguin UK, 2012. 38, 47

Joseph E Stiglitz. Credit markets and the control of capital. *Journal of Money, Credit and Banking*, pages 133–152, 1985. 13

Joseph E Stiglitz. New theoretical perspectives on the distribution of income and wealth among individuals: Part iv: Land and credit. Technical report, National Bureau of Economic Research, 2015. 39

James H Stock and Mark W Watson. Forecasting using principal components from a large number of predictors. *Journal of the American statistical association*, 97(460):1167–1179, 2002. 18, 95, 125

Robert M Townsend and Kenichi Ueda. Financial deepening, inequality, and growth: a model-based quantitative evaluation. *The Review of Economic Studies*, 73(1):251–293, 2006. 41

Howard White and Edward Anderson. Growth versus distribution: does the pattern of growth matter? *Development Policy Review*, 19(3):267–289, 2001. 46, 92

Jeffrey M Wooldridge. *Econometric analysis of cross section and panel data*. MIT press, 2010. 71, 72

Jyh-Lin Wu, Han Hou, and Su-Yin Cheng. The dynamic impacts of financial institutions on economic growth: Evidence from the european union. *Journal of Macroeconomics*, 32(3):879–891, 2010. 10