TWO ESSAYS IN INTERNATIONAL MACROECONOMICS

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Abstract: The first essay re-examines the growth effects of stock market and banking system development for 64 Middle-income (MICs) and High-income (HICs) countries using dynamic panel GMM and traditional system GMM methods. Regression results show that while bank credit spurs growth of both Upper- and Lower-MICs, stock market liquidity has a robust impact on growth of only the Upper-MICs. On the other hand, the bank credit is found to be not robust and the stock market liquidity is only marginally significant in the case of Non-European HICs. For European HICs, the stock market liquidity is found to be not a strong determinant of growth, although the bank credit is.

The second essay attempts to examine the possibly differential growth impacts of financial development using a sample of 40 countries and the period 1989-2012. It employs dynamic panel GMM and traditional GMM models to four more homogeneous income convergence clubs, identified using a regression based club convergence test suggested by Phillips and Sul (2007). Regression results show that financial development, particularly banking system development, has different growth effects depending on the fundamentals and stages of development of countries analyzed.

Keywords: Banking system development, club convergence algorithm, convergence, economic growth, financial development, GMM, log t club convergence test, stock market development.

JEL classification: C33, F43, G15, G21, O40, O47.

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CHAPTER I

ESSAY 1: THE ROLE OF STOCK MARKETS AND BANKS IN ECONOMIC GROWTH: A SYSTEM APPROACH

I.1 INTRODUCTION

A substantial body of the theoretical literature on finance-growth nexus underlines that better functioning financial system improves the allocation of resources and hence promotes economic growth by mitigating the effects of information asymmetry and transaction cost (Bencivenga & Smith, 1991; Bencivenga, Smith, & Starr, 1995; Bertocco, 2008; Greenwood & Jovanovic, 1990; Khan, 2001; King & Levine, 1993a; and Morales, 2003). However, some of the earlier studies contend that financial sector develops merely in response to economic growth (Robinson, 1952) or has no significant contribution to growth (Lucas, 1988)[1]. At the same time, an extensive body of the literature debates the comparative importance of banks and securities markets in economic activity. Some argue that banks are relatively better at reducing market frictions associated with the mobilization and allocation of resources toward more productive activities (Allen & Gale, 1997; Bhide, 1993; Boot & Thakor, 1997; Coval & Thakor, 2005; Diamond, 1984; Stiglitz, 1985; Stulz, 2000, among others). Others, including Allen and Gale (1999), Boyd and Smith (1998), Holmstrom and Tirole (1993) contend that well-functioning markets are better at reducing information and transaction costs and fostering economic growth. Still others emphasize that the focus should be on creating well-functioning banks and markets rather than on making a choice between the two as they are not only competing sources of financing but also complementary (Allen & Gale, 2000;

[1]Levine (1997, 2005) and Beck (2011, 2013) provide thorough review of the literature.

Holmstrom & Tirole, 1997; Levine, 1997; Merton & Bodie, 1995; Song and Thakor, 2012, to name but a few).

Theory also stresses that the relative merits of banks and markets evolve over time and varies at different levels of economic growth of countries. As countries grow economically the services provided by securities markets become relatively more important and countries become more market-based (Boot & Thakor, 1997; Boyd & Smith, 1998; Song & Thakor, 2012). These theories imply that the services provided by banks have a significant contribution to the process of economic growth at the early stages of development.

Lin (2009), for instance, argues that stock markets positively influence economic growth only when a country becomes more advanced and is dominated by large capital-intensive industries. He further argues, based on the experience of now developed countries, that developing countries- particularly those in the early stages of development-should focus on making small local banks the major source of financial services and resist any temptations to expand stock markets until later periods when their economies boost large-scale industrial firms.[2] Singh and Weisse (1998) also argue that stock markets are unlikely to spur long-term economic growth in developing countries as they encourage short-term profits and also require sophisticated monitoring system to function effectively. Banks, on the other hand, nurture long-term relationship with investors and hence provide stable source of finance for achieving long-term economic growth and industrialization.

Empirical evidence concerning the roles of banks and stock markets in economic growth is also inconclusive and lacks robustness. Many cross-country and panel data studies mainly assess the roles of banks, without also including stock markets, in boosting economic growth (Beck, Levine, & Loayza, 2000; Bordo & Rousseau, 2012; De Gregorio & Guidotti, 1995; Deidda & Fattouh, 2002; Favara, 2003; King & Levine, 1993a, b; Levine, Loayza, & Beck, 2000; Loayza & Ranciere, 2006; Rioja & Valev, 2004; Rousseau & Wachtel, 2002; among others).

[2] Justin Lin, the chief economist at the World Bank, presents his case in a guest article titled *Walk, don't run* published in *The Economist* on July 11, 2009.

In the absence of control for stock markets, it is difficult to assess if financial intermediaries and markets have independent effects on growth and if the relationship between financial intermediaries and growth still holds after controlling for stock market development. A number of empirical works, including but not limited to Arcand, Berkes, and Panizza (2012); Beck and Levine (2004); Deidda and Fattouh (2008); Demirguc-Kunt, Feyen, and Levine (2013); Levine and Zervos (1998); Rousseau and Wachtel (2000, 2011); and Saci, Giorgioni, and Holden (2009) attempt to overcome this shortcoming by simultaneously examining the causal effects of stock markets and banks on growth. Levine and Zervos (1998) provide evidence showing that banking and stock market development independently influence economic growth. They, however, employ cross-country OLS, which neither accounts for potential simultaneity bias nor for country fixed effects. Rousseau and wachtel (2000) employ difference GMM, which is known to suffer from weak instrument and hence exhibit biased finite sample properties. They also use annual data that is susceptible to business cycle influence.

Beck and Levine (2004) significantly improve the statistical and conceptual weaknesses of previous studies. Using a system GMM for panel data and data averaged over five- year periods (to reduce potential business cycle effects), they show that banks and stock markets exert strong, independent positive effects on economic growth. They also properly deflate the financial development and GDP measures to avoid stock-flow problems in their measurement, which could distort results particularly in high-inflation countries. However, they pool together developed and developing countries and assess the causal effects of banks and markets on growth in one pass. This may not be very informative as it is likely that financial intermediaries and markets may have quite different impacts on growth depending on the stage of economic development of a country.

Deidda and Fattouh (2008), besides pooling together countries at different stages of economic growth, rely on value of the variables averaged over the entire study period, which might represent loss of information and may not show the dynamic relationship between financial measures and economic growth. Saci et al. (2009), although they apply panel GMM to annual data for a group of developing countries, use one-step estimator, which assumes homoscedastic errors, and is asymptotically inefficient relative to the two-step estimator. Besides, the fact that they do not include the control variables in the growth equation and only use them as instruments runs against the theoretical prediction that the control variables have independent effects on growth.

Two recent papers that show the weakening effect of financial deepening on economic growth are Rousseau and Wachtel (2011) and Arcand et al. (2012). The former demonstrate that the positive and significant impact of financial deepening on growth for 1960-1989 is vanishing in recent periods (1990-2004). Arcand et al. (2012) also show that at intermediate level financial deepening (measured by private credit to GDP ratio) promotes growth, but beyond a given threshold very high levels of credit are associated with less growth. However, both studies do not show explicitly if stock markets have any independent role. Rousseau and Wachtel use the sum of M3 and stock market capitalization to GDP ratios as a broad measure of finance and it is not clear why they fail to control for both measures separately. Arcand et al., on the other hand, mention that their finding is robust to the inclusion of stock market turnover ratio, but do not show it in the paper.

Demirguc-Kunt et al. (2013) based on a quantile regression argue that although both banks and stock markets are positively associated with economic growth, their importance evolves with stages of economic growth. However, the study does not necessarily indicate a causal relationship between the stock markets and banks and economic growth.

Against this backdrop, this study attempts to re-examine the association between stock markets and banks and economic growth for both developed and developing countries using the most recent available dataset and system GMM for panel data estimation. The closest study to ours is Beck and Levine (2004). But, this study differs in four ways: (1) it employs the most recent dataset to a group of 64 countries for the period 1989-2012. Beck and Levine use data on 40 countries from 1976-1998; (2) it assesses the association between stock markets and banks and economic growth for both high-income (HICs) and middle-income countries (MICs) separately to see if the roles of markets and banks differ based on the different stages of growth of countries.Panel regressions that do not address the heterogeneity in the cross-sectional units may mask the likely differential effects of the financial development that emanate from differences in the stages of growth of countries, among other factors. That is, panel regression results that are based on pooled heterogeneous cross-country observations may have limited policy relevance. We attempt to attenuate this problem by sorting out our data into a relatively more homogeneous country subgroups in our regressions; (3) it employs recent improvements to system GMM (Windmeijer small-sample correction to variance-covariance matrix of system GMM estimator) that is shown to overcome the instrument over-fitting problem and significantly reduce the potential biases in small samples (Windmeijer, 2005); (4) it applies iterative traditional GMM to a system of growth equations, one for each country, to assess if the panel GMM results hold not only for the two income groups, but also for the relatively more homogeneous sub-groups of them: Upper-and Lower- MICs and European and Non-European HICs. Theoretically, the iterative traditional GMM applied to relatively homogeneous countries produces more efficient estimates than the two-step panel GMM as it utilizes more information in the variance-covariance matrix of residuals; it also continuously updates the estimates until some sort of converge is achieved and this can help remedy the shortcoming of one- and two-step GMM estimators, where different initial values and weighting matrices will lead to different point estimates. Besides, it is more flexible than the panel GMM, which is better suited to short but wide panels (panels with small T and large N),and hence can help us handle smaller and more homogeneous country groups to derive a more policy relevant conclusion.

Both the dynamic panel GMM and iterative traditional GMM regression results show that while bank credits and stock market liquidity (marginally) have a robust and strong impact on economic growth of MICs, the same cannot be said of their effect on growth of the HICs. The regression results imply that bank credits are strong determinants of economic growth of both Upper- and Lower-MICs; however, the stock market liquidity exerts a robust influence on economic growth of only Upper-MICs. The bank credit is found to be not robust and the stock market liquidity is only marginally significant in the case of Non-European HICs. For European HICs, the stock market liquidity is found to be not a strong determinant of growth, although bank credit is.

The fact that stock market measures are overall statistically not significant for HICs, except that they are marginally significant for Non-European HICs, is somewhat surprising as stock markets are regarded as having comparative advantage over banks in raising funds for innovative and high-tech investments that characterize these countries.

For MICs, the lower-MICs in particular, the insignificant coefficient estimates of stock market measures perhaps imply that the already established stock markets may have not yet reached some minimum size and activity level beyond which they robustly influence economic growth, or that lack of transparency in the stock market may lead to poor performance (Jin and Meyers, 2006), or that the banking system, by establishing and nurturing a long-run personal relationship with investors may have continued to be the major source of financial services in these countries.

The finding that for lower-MICs the banking system measures are statistically significant but the stock markets are generally not lends credence to the argument put forward by Singh & Weisse (1998) and Lin (2009) that developing countries should focus on making the banking sector the primary source of their financial services rather than diverting scarce resources to the promotion of sophisticated financial institutions, like stock markets, which not only rely on more sophisticated monitoring and infrastructure but also encourage short-term profits.

Our finding of lack of robust growth effect of financial sector, especially for HICs, is in line with recent cross-country and panel studies that also conclude that the effect of financial deepening on economic growth is vanishing since 1990s (Rousseau and Watchel, 2011); the prevalence of excess bank credit -credit boom-in many developed countries is dampening economic growth (Arcand et al., 2012); and there is no clear evidence that finance spurs growth, although the correlation between the two is well-established (Favara, 2003).

The rest of the paper is organized as follows: Section 2 presents literature review, while Section 3 provides information on the data and measurement. Section 4 discusses the methodology and results, and is followed by Section 5 that concludes the paper.

I.2 LITERATURE REVIEW

The literature on finance-growth nexus traces the argument that finance spurs economic growth in the early works of Bagehot (1873) and Schumpeter (1934) and the later works of Goldsmith (1969), McKinnon (1973), and Shaw (1973) who formally developed and expanded the argument. Economic theory shows that well-functioning financial systems, by reducing information and transaction costs, facilitate better allocation of resources and thus spur growth (Bencivenga & Smith, 1991; Bencivenga et al., 1995; Bertocco, 2008; Greenwood & Jovanovic, 1990; Khan, 2001; King & Levine, 1993a; and Morales, 2003). Levine (2005) decomposes this primary function of financial systems- enhancement of resource allocation by mitigating market frictions- into five basic functions: production of ex ante information about investment opportunities that leads to improvement in capital allocation, ex post monitoring and implementation of corporate governance that will increase investors' willingness to finance new projects, facilitation of risk management and diversification, mobilization and pooling of savings, and facilitation of exchange of goods and services by providing payment services and thus reducing transaction costs. Financial systems provide these functions, which through promotion of technological innovation, productivity growth, and/or capital accumulation ultimately foster long-run economic growth. According to Stiglitz (1994), financial markets can be thought of as the "brain" of the entire economic system as they primarily involve the allocation of resources.

There are, however, some economists who contend that financial sector develops merely in response to demand for certain financial services created by economic development (Robinson, 1952) or that financial factors have no significant contribution to economic growth (Lucas, 1988).

At the same time, an extensive body of the literature debates the comparative importance of banks and securities market in economic activity. Some models argue that banks are relatively better at screening borrowers, ameliorating moral hazard issue, sharing intertemporal risk, and financing standardized, well-collateralized and relatively low-risk ventures (Allen & Gale, 1997; Bhide, 1993; Boot & Thakor, 1997; Chakraborty & Ray, 2006; Coval & Thakor, 2005; Diamond, 1984; Stiglitz, 1985; Stulz, 2000; among others). Others, including Allen and Gale (1999), Boyd and Smith (1998), Holmstrom and Tirole (1993), and Levine (1991) highlight that well-functioning markets enhance growth by providing better cross-sectional risk sharing, easing transfer of ownership without disrupting production process, providing customized financial arrangements and fostering incentives for innovative and high-risk projects that often rely on intangible inputs and reducing the inherent inefficiencies associated with banks. Still others emphasize that the focus should be on creating well-functioning banks and markets rather than on making a choice between the two as they are not only competing sources of financing but also complementary (Allen & Gale, 2000; Holmstrom & Tirole, 1997; Merton & Bodie, 1995; Levine, 1997; Song & Thakor, 2012, to name but a few).

Theory also stresses that the relative merits of banks and markets evolve over time and varies at different levels of economic growth of countries. As countries grow economically the services provided by securities markets become relatively more important and countries become more market-based (Boot & Thakor, 2000; Boyd & Smith, 1998; Song & Thakor, 2012). These theories imply that the services provided by banks have a significant contribution to the process of economic growth at the early stages of development. Singh and Weisse (1998), for example, argue that developing countries, given that they are more prone to internal and external shocks, should focus on strengthening their banking systems rather than promoting stock markets. The authors emphasize that stock markets are unlikely to spur long-term economic growth in developing countries as they encourage short-term profits and also require sophisticated monitoring system to function effectively. Banks, on the other hand, nurture long-term relationship with investors and hence provide stable source of finance for achieving long-term economic growth and industrialization.

Although a growing number of studies attempt to investigate the association between financial development and economic growth, the empirical evidence concerning the roles of banks and stock markets in the process of economic growth is mixed and inconclusive.

On the one hand, many studies solely assess the impact of the development of banks on economic growth without also assessing the roles of stock market development. King and Levine (1993a), using OLS cross-country regressions and data on 80 countries over the period 1960-1989, show that there is a positive relationship between the levels of financial indicators (M3/GDP) and economic growth and that the current level of financial development is a good predictor of future rates of economic growth. King and Levine (1993b) extends the earlier work and also uses case studies and firm-level evidence to show that financial liberalization tends to promote the funding of more efficient firms and growth of an economy. De Gregorio and Guidotti (1995), utilizing simple cross-country growth regressions on a sample of 98 countries during 1960-1985, find that financial depth (measured by private credit to GDP ratio) has a positive effect on long-term growth of real per capita GDP. They also find that the effect is stronger in the 1960s than in the 1970s and 1980s and in middle- and low-income countries than in high-income countries. However, when they restrict the dataset to only 12 Latin American countries for 1950-1985, they find significant negative correlation between financial depth and growth. They posit that this latter finding is due to the financial liberalization that took place in the region in the 1970s and 1980s in the absence of well-developed regulatory infrastructure. However, the authors- King and Levine and De Gregorio and Guidotti-do not prove that financial development causes growth. Levine et al. (2000) and Beck et al. (2000), both employing pure cross-country instrumental variables regression -on data for 71 and 63 countries- where the country's legal origin is used as instrument for financial development, and dynamic panel techniques (on a panel of 74 and 77 countries), respectively, for the 1960-1995 period, conclude that there is a strong, positive link between financial intermediary development (measured by liquid liabilities, private credit, and commercial bank asset as a ratio of all bank asset) and economic growth. They also provide evidence in support of a causal link going from financial development to economic growth. Beck et al. (2000) also show that the link between financial depth and economic growth goes through productivity growth and not through factor accumulation. Deidda and Fattouh (2002), applying a threshold regression model to King and Levine's (1993a) dataset, find that while in low income countries there is no significant relationship between financial intermediary development and growth, in high income countries the relationship is positive and strongly significant. Rousseau and Wachtel (2002),using panel regressions and data for 84 countries for 1960- 1995, conclude that there is inflation threshold for finance to positively influence economic growth and once inflation exceeds the threshold, finance(proxied by M3/GDP, M3-M1/GDP, and total credit/GDP) no more affects growth. Favara (2003), for a sample of 85 countries over the period 1960-1998, use cross-country instrumental variables and one step generalized method of moments estimations and conclude that the effect of financial development (liquid liabilities and private credit) on economic growth is insignificant. But, the evidence from the non-parametric approach shows that financial sector exerts positive effect on growth only at intermediate levels of financial development. From another study, Rioja and Valev (2004), based on generalized method of moments estimation applied to data from 74 countries spanning the period 1960-1995, conclude that financial development (measured by same indicators as in Beck et al., 2000) exerts positive and significant influence on economic growth only at intermediate level of financial development and at low level, its effect on growth is mixed. Loayza and Ranciere (2006), using a panel error correction model on annual data from 75 countries over the period 1960-2000, conclude that over the long-run financial development supports and promotes economic growth but in the short-run it may negatively affect growth mainly due to financial crises. Bordo and Rousseau (2012), applying a set of cross country and dynamic panel data models to a historical data (1880-2004) for 17 countries, show that financial development affects growth positively throughout the study period. Other studies with evidence of a positive effect of financial development on overall economic performance include Benhabib and Spiegel (2000), McCaig and Stengos (2005), Beck, Demirguc-Kunt, and Peria (2007), and Aghion, Bacchetta, Ranciere, and Rogoff (2009).

Some of the time-series studies that document a positive impact of financial intermediary development on economic growth include Calderon and Liu (2003); Christopoulos and Tsionas (2004); Dawson (2010); Hassan, Sanchez, and Yu (2011); Luintel and Khan (1999); and Xu (2000). Other time-series studies with weak or negative support for the hypothesis that financial development influences economic growth include Demetriades and Hussien (1996); Kar, Nazlioglu, and Agir (2011); and Shan (2005).

Although the recent studies have used better estimation techniques, all these studies solely rely on measures of financial intermediaries and fail to include the measures of stock market development when investigating the effect of financial development on economic growth. In the absence of control for stock markets, it is difficult to assess if financial intermediaries and markets have independent effects on growth and if the relationship between financial intermediaries and growth still holds after controlling for stock market development.

A number of empirical works, including but not limited to Levine and Zervos (1998), Rousseau and Wachtel (2000), Beck and Levine (2004), Deidda and Fattouh (2008), Saci et al. (2009), Rousseau and Wachtel (2011), Arcand et al. (2012), and Demirguc-Kunt et al. (2013) attempt to overcome this shortcoming by simultaneously examining the causal effects of stock markets and banks on growth. Levine and Zervos (1998), employing least-squares regression and data on 47 countries from 1976-1993, demonstrate that the stock market liquidity (measured by value of stock trading relative to the size of the market) and banking development (measured by bank credit to private sector as share of GDP) in 1976 are positively and strongly correlated with both the current and future rates of economic growth, even after controlling for other factors that are associated with growth. They also conclude that stock markets provide different financial services from banks. They, however, employ cross-country OLS, which neither accounts for potential simultaneity bias nor for country fixed effects. Besides, they use only initial values, rather than contemporaneous values, of stock market and bank development when assessing the association between economic growth and both stock market and banking development. The use of initial values, however, does not capture the dynamic interaction between financial development and economic growth. Rousseau and Wachtel (2000) combine a panel vector autoregression with difference generalized-method-of-moments techniques to examine the effects of stock markets (measured by stock market capitalization and value traded, deflated by price index of national stock exchange, to GDP ratios) and financial intermediation (M3/GDP) on economic growth. The regression estimates for a set of 47 countries with annual data for 1980-1995 show that both stock market liquidity and bank development exert strong positive effect on economic growth. Although Rousseau and Wachtel employ a panel estimation technique that controls for simultaneity bias and unobserved country-specific effects, the difference GMM is shown to suffer from weak instrument and hence biased finite sample properties. They also use annual data that is susceptible to business cycle influence. Beck and Levine (2004) significantly improve the statistical and conceptual weaknesses of previous studies.

Utilizing GMM for panel data estimation, which significantly minimizes the potential biases due to endogeneity and simultaneity of variables, and a panel of 40 countries over the period 1976 to 1998, they show that banks and stock markets exert strong, independent positive effects on economic growth. They use data averaged over five- year periods to reduce potential business cycle effects and also properly deflate the financial development (are measured at the end-of-period and thus deflated by end-of-period price deflators) and GDP measures (are flow variables measured over the whole period and thus deflated by the deflator for the whole period) to avoid stock-flow problems in their measurement, which could distort results particularly in high-inflation countries. However, they pool together developed and developing countries and assess the causal effects of banks and markets on growth in one pass. This may not be very informative as it is likely that financial intermediaries and markets may have quite different impacts on growth depending on the stage of economic development of a country.

Deidda and Fattouh (2008), utilizing cross country data set with OLS (71 observations) and instrumental variables (about 40 observations) regressions, where the instruments for financial development are legal origin of a country, creditor rights index, shareholder rights index, and accounting standards, attempt to examine the effect of financial intermediaries on long-term economic growth in the presence of expanding stock markets. They use the average value of the major variables-growth rate of real per capita GDP, bank credit to the private sector, and stock market turnover ratio-over the period 1980-1995 with control for other major determinants of growth. Their findings show that both banks and financial markets positively affect long-term real per capita GDP growth. However, the interaction term between banks and stock market measures shows that at higher levels of stock market development, the contribution of bank development becomes less positive. Like Beck and Levine (2004), Deidda and Fattouh pool together countries at different stages of economic development in their estimation. They also take average of the variables over the study period, which might represent loss of information and may not show the dynamic relationship between the variables of interest. Besides, the cross-country instrumental variables regression they use can control for the potential reverse causality from growth to financial development, but it does not control for the unobserved country-specific effects from biasing the outcomes.

Saci et al. (2009), employing one-step generalized- method- of- moments estimator on annual data from 30 developing countries over the period 1988-2001, analyze the joint contribution of stock market and banks development to economic growth. They find that while stock market variables (market turnover ratio and total value traded to GDP ratio) have positive and significant effect on growth, in their presence the financial intermediary variables (credit to the private sector and liquid liabilities) have insignificant or even negative effect on growth. The authors, however, do not include the control variables in the growth equation and only use them as instruments to correct problems of simultaneity and endogeneity of the explanatory variables. This runs against the theoretical prediction that the control variables can have independent effects on economic growth. The authors also use annual data and do not attempt to minimize the potential effects of business cycle phenomena from masking the proper relationship between stock markets and bank development and long-term economic growth. Moreover, the one-step GMM estimator assumes homoscedastic errors and is asymptotically inefficient relative to the two-step estimator, even if the homoscedasticity assumption holds (Arellano & Bond, 1991; Blundell & Bond, 1998). There is also no indication that the authors try to reduce the instrument count that could potentially bias the coefficient estimates of dynamic panel GMM.

Rousseau and Wachtel (2011), using both pure cross-sectional and dynamic panel regression techniques with data for 84 countries during the period 1960-2004, demonstrate that the positive and significant impact of financial deepening on growth for 1960-1989, the same period covered in King and Levine (1993) and previous cross-country studies, is weakening in recent periods (1990-2004). Utilizing pure cross-sectional instrumental variable technique, where initial values of finance and control variables are used as instruments, they further test if the vanishing effect of financial deepening in recent period is due to financial crises, or financial liberalization, or the expansion of equity market in the same period. Their estimations suggest that the increased incidence of financial crises during the same period, which often is associated with excessive deepening, might be the major reason. The authors' effort is commendable in that they attempt to identify both the causal relationship between financial deepening and growth and the major factor deriving the relationship. However, they do not control for stock market development when they assess the causal effect of deepening on growth. The only time they include measure of stock market development in their regression is when they test if expansion of stock markets is leading to the vanishing relationship between deepening and growth. Even then, they use sum of M3 and stock market capitalization to GDP ratio, when data is available, as broad measure of finance and it is not clear why they use this gross measure rather than including both measures of financial deepening and stock market development separately in the regressions. Besides, the pure cross-sectional instrumental variable technique they employ does not address the potential bias due to country-specific effects and endogeneity of financial measures.

Arcand et al. (2012), utilizing simple cross-sectional, panel and semi-parametric estimators and both country-level and industry-level data for different sub-periods of 1960-2010, demonstrate that at intermediate level financial deepening promotes growth, but beyond a given threshold, very high levels of financial deepening (measured by private credit to GDP ratio) are associated with less growth.

Demirguc-Kunt et al. (2013), utilizing quantile regressions on data from more than 69 countries for the period 1980-2008, demonstrate that although both stock markets and banks are positively associated with economic growth, the role of markets increases significantly while that of banks diminishes as economies grow. They conclude, hence, that the importance of banks and markets evolve with economic growth. The study further highlights the weakness of those studies that pool together countries at different stage of development when investigating the roles of stock market and bank development in economic growth. However, the quantile regression it employs does not necessarily indicate a causal relationship between the stock markets and banks and economic growth.

Some related studies with evidence of positive effect of financial intermediaries and stock markets on overall economic performance include Bekaert, Harvey, and Lundblad (2005) and Rousseau and Sylla (2005). Some of the works that present positive effects of finance on growth using firm and industry level data from different countries include Demirguc-Kunt and Maksimovic (1998); Ilyina and Samaniego (2012); and Rajan and Zingales (1998).

In a nutshell, despite extensive evidence, some of which is presented above, the empirical literature on the roles of stock market and bank development in economic growth is far from reaching a consensus.

I.3 DATA AND MEASUREMENT

I.3.1 The Data

To assess the relationship between economic growth and both stock market and banking system development, we use a panel of 64 Countries for which we have stock market data for the period 1989-2012. The countries are divided into two, following the World Bank's income classification system, as High-income (31) and Middle-income (33) countries. The high-income countries (HICs) include both European and Non-European countries where as the Middle-income countries (MICs) are composed of upper and lower middle income countries. It is a common practice in the panel studies of the finance-growth relationship to rely on less frequent data set to minimize the effects of business cycle fluctuations from masking the true long-run relationship between growth and financial development. Taking into account the time dimension of the data and also to allow easy comparison with existing literature, the data are averaged over five-year and three-year non overlapping periods, data permitting. Annual data is also used for sensitivity analysis. The source of the financial system indicators is the World Bank's "Financial Structure and Development Data Base"[3] whereas all the control variables, with the exception of *schooling* which is from Barro & Lee's (2010) data base, are from the electronic version of World Bank's *World Development Indicators.*

I.3.1.1 Financial system indicators

Well-functioning financial systems mitigate market frictions and spur economic growth through provision of information about investment opportunities, monitoring of investments, diversification

[3]Whenever available, the financial system indicators are updated using the original sources: Standard & Poor's *Emerging Stock Markets/ Global Stock Markets Factbook* for stock market measures, and IMF's *International Financial Statistics Yearbook* for banking system measures.

and sharing of risks, pooling and mobilization of savings, and facilitation of exchange of goods and services. However, there is no one best indicator that shows the extent to which banks and stock markets provide these services across a number of countries. As a result, we rely on multiple standard measures of the size and activity of banks and stock markets.

To measure stock market development, we use three measures: TURNOVER RATIO, VALUE TRADED, and MARKET CAPITALIZATION. TURNOVER RATIO equals the value of the traded shares in domestic stock market divided by total value of listed shares, and it measures liquidity of the stock market relative to its size. TRADED VALUE equals the value of all (domestic) shares traded in the (domestic) stock market divided by GDP, and it measures how active the stock market is relative to the size of the economy. MARKET CAPITALIZATION equals the total value of listed shares in the stock market divided by GDP, and it measures the size of the market relative to the economy. Theory predicts that more liquid/active markets facilitate efficient allocation of resources and foster growth.

Table 1 presents summary statistics of the indicators. As we can see, there is a huge cross-country variation in these measures. For instance, the turnover ratio averages about 53% (72% in HICs and 34% in MICs), where Swaziland had the minimum value of 0.02% in 2004-2008 and Pakistan had the maximum value of 377% in 1999-2003. The traded value also varies from a minimum of 0.002% in Swaziland in 2004-2008 to a maximum of 621% in Hong Kong in 2009-2012, with the average equal to 38% for the full sample (62% in HICs and 15% in MICs). The average size of the stock market is about 58% of GDP (79% in HICs and 38% in MICs). In general, the HICs have the largest and most active stock markets while the lower MICs have the least active markets, relative to the total sample.

To measure banking system development, we use BANK CREDIT, PRIVATE CREDIT, and LIQUID LIABILITIES. BANK CREDIT equals total credit extended by deposit money banks to the private sector as a share of GDP. It excludes credits by other financial institutions and to the government and public enterprises. PRIVATE CREDIT equals credit issued by deposit banks and other financial institutions (excluding central banks) to the private sector divided by GDP. These two measures were almost identical until the late 1990s but they started diverging at the beginning of the new millennium (Arcand et al. 2012). Higher levels of each could represent higher levels of financial services to the private sector and thus greater financial intermediary development. However, it could also show over-lending, which could deter growth.

LIQUID LIABILITIES equals the ratio of liquid liabilities of financial system (currency plus demand and interest-bearing liabilities of banks and other financial institutions) to GDP or the ratio of broad money to GDP (M3/GDP). It measures the overall size of the financial intermediary sector. This measure is commonly used in the literature under the assumption that the size of the sector is directly correlated with the financial services it renders. However, it does not necessarily measure the degree to which financial institutions overcome the adverse effects of information asymmetry and transaction costs and provide effective service. All the financial system indicators are deflated by end-of-period prices and their average is divided by GDP that is deflated by annual CPI.

A look at Table 1 shows the variation in banking system measures across the sample. The bank credit, for example, averages about 66% of GDP (94% in HICs and about 40% in MICs), with the minimum credit of about 5% issued by deposit banks in Ghana in 1989-1993 and the maximum amount of about 224% extended by banks in Iceland in 2004-2008. The private credit also averages about 71% of GDP (101% and 43% in HICS and MICs, respectively). Liquid liabilities ranges from a minimum of 12% in Peru in 1989-1993 to a maximum of 354% in Luxembourg in 2004-2008, with the average being 72% (95% in HICs and 50% in MICs).

I.3.1.2 Other variables

As is standard in the literature on finance-growth nexus, we include the following control variables that have been shown empirically to have robust growth effects: Initial real GDP per capita to capture the tendency for growth rates to converge across countries and overtime; average years of schooling in population 25 years of age or older to control for human capital accumulation (both variables are commonly referred to as Simple Control Set); the ratio of total government final consumption expenditure (government size) & inflation rate-CPI (both measure macroeconomic stability); and sum of imports and exports as a fraction of GDP (trade openness). The last three variables are policy related and together with the Simple Control set form our Policy Control Set.

The correlations Tables 2 and 3 show that for MICs growth is positively and significantly correlated with all financial measures except market capitalization. On the other hand, credit measures are negatively and significantly correlated with growth while traded value and market capitalization are positively and significantly correlated with growth in case of the HICs.[4] Summary statistics for individual countries is given in Table 4.

[4] At the same time, the banking system and stock market measures are generally significantly correlated to each other for both sets of countries (especially in the case of MICs), implying that our model that controls for both bank and stock markets measures may offer conservative estimates of the role of banks and stock markets in economic growth than if only one measure is used as a regressor. We use a Wald test to examine if the indicators enter our regression jointly significantly.

I.4 METHODOLOGY AND RESULTS

I.4.1 OLS Regression Results

We start with the King and Levine's version of the Barro (1991) growth regression model of the form:

$$Y_{i,t} = \alpha_0 + \alpha' \; F_{i,t} + \beta' \; X_{i,t} + \epsilon_{i,t} \qquad (1)$$

Where,$Y_{i,t}$ is the growth rate of real per capita GDP of country i in period t, $F_{i,t}$ stands for financial measures (i.e., banking and stock market measures), $X_{i,t}$ represents a set of control variables, including initial /lagged level of real per capita GDP, average years of schooling, government consumption expenditure, inflation rate, and trade openness.

The OLS regressions on the full sample show that (Table 5, Panel A) while there is a strong positive association between all of the stock market measures and economic growth, none of the banking system measures enters all of the regressions with significant coefficient. However, when we sort out the data into the two income groups, the estimates differ. For MICs, all of the banking system and the stock market measures, except market capitalization, enter each of the regressions with positive and statistically significant coefficients. In the case of HICs, on the other hand, the bank measures are either insignificant or negatively significant whereas the stock market traded value and capitalization are positively and strongly correlated with growth.

These estimates are robust to the inclusion of policy related variables. Table 6, using bank credit and turnover ratio, demonstrates that the size of the credit issued to the private sector and the liquidity of the stock market remain strongly positively correlated to economic growth of MICs. For HICs, while liquidity of stock markets is generally directly associated with growth, the bank credits remain negative and even significant as more variables enter our regressions.

The OLS estimates, although do not establish a causal relationship between stock markets, banks, and growth, give us the first indication that the link between the financial development measures and economic growth depends, at least partly, on the stages of economic growth of countries.

I.4.2 Dynamic Panel GMM

I.4.2.1 The model

We examine the causal link between economic growth and both the stock market development and bank development using the dynamic panel generalized-method-of-moments (GMM) estimators[5] . The cross-country growth regression we estimate can be written as follows:

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)\ y_{i,t-1} + \beta'\ X_{i,t} + \mu_i + \epsilon_{i,t} \qquad (2)$$

where $y_{i,t}$ is the logarithm of real per capita GDP in country i at time t, $X_{i,t}$ is a set of explanatory variables, including measures of stock markets and bank development, μ_i represents time invariant country-specific effects, and $\epsilon_{i,t}$ is the idiosyncratic shocks. We also include time dummies to account for time-specific effects.

Note that we can rewrite (2) as:

$$y_{i,t} = \alpha\ y_{i,t-1} + \beta'\ X_{i,t} + \mu_i + \epsilon_{i,t} \qquad (3)$$

So that the model can equally be thought of as being for the increase or level of y.

Model (3) has a dynamic structure in that the lagged dependent variable enters as an explanatory variable in the same regression. Applying OLS estimator to this model results in biased and inconsistent estimates, since the lagged real per capita GDP is correlated with the country fixed effects in the error term. To remove this dynamic panel bias, Holtz-Eakin, Newey, and Rosen (1988) and Arellano and Bond (1991) propose the first-difference transform of (3) as follows:

[5]For detail description of the various GMM estimators, refer to Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998; Hansen, 1982; and Roodman, 2009.

$$y_{i,t} - y_{i,t-1} = \alpha\ (y_{i,t-1} - y_{i,t-2}) + \beta'\ (X_{i,t} - X_{i,t-1}) + (\epsilon_{i,t} - \epsilon_{i,t-1}) \tag{4}$$

Although the fixed effects are expunged, the lagged per capita GDP is still potentially endogenous, as the $y_{i,t-1}$ term in the $(y_{i,t-1} - y_{i,t-2})$ is correlated with the $\epsilon_{i,t-1}$ in the new error term. Moreover, any of the control variables in X may as well be related to the new error term and becomes potentially endogenous, unless it is strictly exogenous. To overcome this problem, Arellano and Bond (1991) uses the lagged levels of the explanatory variables as instruments under the assumptions that the error term,ϵ, is not serially correlated and that the explanatory variables are weakly exogenous (i.e., they are uncorrelated with future realizations of error terms). Specifically, this dynamic panel estimator commonly referred to as Difference GMM, uses the following moment conditions:

$$E\ [y_{i,t-l}\ (\epsilon_{i,t} - \epsilon_{i,t-1})] = 0 \quad \text{for} \quad l \geq 2; \;\; t = 3, ..., T \tag{5}$$
$$E\ [X_{i,t-l}\ (\epsilon_{i,t} - \epsilon_{i,t-1})] = 0 \quad \text{for} \quad l \geq 2; \;\; t = 3, ..., T \tag{6}$$

However, Blundell and Bond (1998) demonstrate that when explanatory variables are persistent over time, the untransformed lagged levels of these variables are weak instruments for transformed variables and this adversely affects the small- sample and asymptotic properties of Difference GMM.

To increase efficiency, Blundell and Bond develop a System GMM, originated in Arellano and Bover (1995), which augments the difference estimator by estimating simultaneously in differences and levels, with the two equations being distinctly instrumented. The addition of regression in levels also allows us to examine the cross-country relationship between our variables of interest. While the instruments for equation in differences are the same as above, the instruments for equation in levels are the lagged differences of the explanatory variables.[6] These are valid instruments under the following additional assumption: although there may be correlation between the levels of the explanatory variables and the country fixed effects in (3), there is no correlation between the differences of these variables and the country-specific effect.[7] This assumption results in the

[6]The new instruments seem more valid for variables that are very persistent over time, random walk-like variables, as past changes may be more predictive of contemporaneous levels than past levels are of current changes.

[7]Remember that we have assumed error term is not serially correlated.

following stationarity properties:

$$E[y_{i,t+p}\ \mu_i] = E[y_{i,t+q}\ \mu_i] \text{ and } E[X_{i,t+p}\ \mu_i] = E[X_{i,t+q}\ \mu_i] \text{ for all p and q} \quad (7)$$

The additional moment conditions for the regression in levels are:

$$E[(y_{i,t-l} - y_{i,t-l-1})\ (\mu_i + \epsilon_{i,t})] = 0 \quad \text{for } l = 1, \quad \& \quad (8)$$

$$E[(X_{i,t-l} - X_{i,t-l-1})\ (\mu_i + \epsilon_{i,t})] = 0 \quad \text{for } l = 1, \quad (9)$$

The dynamic panel GMM-sometimes referred to as System GMM-, thus, uses the moment conditions in Eqs. (5), (6), (8), and (9) to generate consistent and efficient estimates.

The consistency of dynamic panel GMM rests on the validity of the instruments and the assumption that the error terms do not exhibit serial correlation. In particular, the estimator can suffer from a potential instrument proliferation; where by the instrument count may become equal to or larger than the number of cross-sectional units and thereby over -fitting the instrumented variables they may fail to remove the endogenous components of the variables and result in a biased parameter estimates towards those from non-instrumenting estimators. We can reduce this instrument count problem by either restricting the instruments to certain lags instead of all available lags or by collapsing the instrument matrix. The latter can be formally expressed as:

$$E\ [y_{i,t-l}\ (\epsilon_{i,t} - \epsilon_{i,t-1})] = 0 \quad \text{for } l \geq 2, \quad (10)$$

$$E\ [X_{i,t-l}\ (\epsilon_{i,t} - \epsilon_{i,t-1})] = 0 \quad \text{for } l \geq 2. \quad (11)$$

In dynamic panel GMM, we replace the moment conditions of the standard difference GMM (5 and 6) with (10) and (11). The new moment conditions state the same orthogonality assumption between the lagged levels and the differenced error term as (5) and (6) but we only want the estimator to minimize the magnitude of the empirical moments $\sum_t\ y_{i,t-l}\ (e_{i,t} - e_{i,t-1})$ for each l, rather than separate moments $\sum_{t,l}\ y_{i,t-l}\ (e_{i,t} - e_{i,t-1})$ for each l and t (Roodman, 2009). This method, known as the Windmeijer correction, significantly minimizes the potential biases that arise due to over identification problem and boosts the efficiency of our estimates without losing information, as no lags are actually dropped.

We also use two specification tests. The first relates to instruments and includes Hansen-J test of the joint validity of the instruments and Difference-in-Hansen tests of exogeneity of instrument subsets (null hypothesis that the lagged differences of the explanatory variables are uncorrelated with the residuals). The second test examines the hypothesis that the error term is not second-order serially correlated (by construction, the differenced error term is likely first-order serially correlated even if the original is not).

I.4.2.2 Results and discussion

Table 7 Presents summary of the two-step panel GMM regression results for all possible combinations of bank and stock market measures, where coefficients of the simple control set (initial income and average years of schooling), time dummies, and constants are not reported for brevity.

Panel A shows that for all countries included in the study, none of the different banking system measures is statistically significant (being negative), whereas the stock market capitalization, in all cases, and the stock market traded value, in two of the three cases, being positive, are statistically significant. That is, the size of the stock market and its liquidity with respect to the overall economy, in general, exert strong positive effect on real per capita GDP growth, but banks do not.

However, separate regressions for the two income groups- MICs and HICs- show quite different outcomes. While coefficients of bank and private credits are positive and statistically significant in two of the three cases for MICs (Panel B), all of the coefficient estimates of bank measures are negative and statistically significant in all cases for HICs (Panel C). For both groups, however, stock market measures are statistically not significant. These results indicate that after controlling for liquidity of stock markets, bank and private credits strongly boost economic growth of the MICs but they (also bank's liquid liability to GDP ratio) negatively affect economic growth of the HICs. The regression results also indicate that stock market is not a major determinant of economic growth of both groups of countries.

Are these results robust to the inclusion of policy related variables to our regression? Table 8 (using Bank credit and turnover ratio) and Table 9 (using private credit and traded value) depict the findings. As can be seen in Table 8, in the case of MICs bank credit enters all of the regressions with positive and statistically significant coefficients and the turnover ratio is significant in three of the five regressions. The coefficients are also economically significant. For example, if Turkey's mean value of bank credit had been at the MICs' mean value of 40.3% of GDP rather than the actual 25%, the country's real GDP per capita would have grown 0.77% points faster per year.[8] This is large given that the country's average growth rate over the study period was about 2.4% per year. Similarly, if Colombia had moved from its mean value of bank credit of 30% of GDP to MICs' mean value of 40.3%, it's real GDP per capita would have grown almost half a percentage point faster per year, which is sizable considering the country's average growth rate of 1.95% per year over the study period.

In the case of HICs, the bank credit is negatively associated with growth and the coefficients are statistically significant in three of the five regressions. The same findings hold when different measures of bank and stock market are used, as illustrated in Table 9. For MICs, private credit is a major determinant of economic growth as its coefficient is positive and statistically significant in all of the regressions, whereas for HICs, it can lead to contraction of the economy. The stock market measures are overall statistically not significant for both country groups. The other control variables are also generally statistically not significant.

Although only bank measures enter the regressions statistically significantly, the Wald test for joint significance shows that, in general, both bank and stock market measures enter jointly significantly, supporting the inclusion of both measures in our regressions to examine if each exerts an independent effect on growth. The specification tests also confirm that we cannot reject the null hypotheses of no second-order serial correlation in the differenced error term and the overall validity of our instrument sets and subsets. These inference are made based on the two-step panel GMM that incorporates Windmeijer (2005) small sample correction.

On the other hand, the two-step estimator that does not incorporate the Windmeijer correction results in unreliable estimates as it suffers from instrumental proliferation. Table 10, columns (2) and (4) for MICs and (6) and (8) for HICs, for instance, show that when we control for all policy variables, the number of instruments (45) exceeds the number of cross-sectional observations

[8] (ln(40.3)- ln(25))* 1.608, the smallest significant coefficient of bank credit, gives us the value.

(countries) and this over-fitting problem causes the instruments to fail to expunge the endogenous component of the variables and results in downward biased standard errors and unreliable estimates (compare column (5) of Table 8 & 9 to columns (2) & (4) of Table 10 for MICs, and column (10) of Table 8 & 9 to columns (6) & (8) of Table 10 for HICs, respectively).[9] The two-step panel GMM that incorporates the Windmeijer (2005) correction, by reducing the over-fitting problem, results in consistent estimates and heteroskedasticity-consistent standard errors.

In addition to sorting out our sample countries into HICs and MICs and running separate regressions, we also run regressions on the full sample where we interact group dummy variable (MIC which takes on a value of 1 if the country is middle-income and 0 if the country is high-income) with bank and stock market measures. Although we implicitly assume coefficients of the control variables are the same for all countries, the interaction terms between the indicator variable and bank and stock market measures support our previous findings.

The coefficient of the interaction term between MIC dummy variable and bank measures (Tables 11 and 12) is statistically significant, indicating that the banking sector has a statistically significant positive effect on economic growth of MICs relative to that of HICs. However, the statistically insignificant coefficient of the interaction term between MIC dummy variable and stock market measures imply that stock markets do not boost economic growth of MICs relative to that of HICs. The model specification tests, again, fail to reject the null hypotheses of overall validity of our instruments and lack of second-order serial correlation in the differenced error terms.

Does the frequency of data indeed affect our regression results? We apply dynamic panel GMM method to three-year average data set. Table 13 shows that the results hold in general: While bank credit enters the MICs regression with positive and statistically significant coefficients, its coefficient is not significant for HICs. The turnover ratio is not significant for both groups. Regressions involving Private credit and traded value also produce similar results. When we estimate our model using annual data, the coefficient estimates show that (Table 14) both bank and stock

[9]Before the Windmeijer (2005) correction was made available, some researchers were relying on one-step estimator for inferences, but the one-step estimator assumes homoscedastic error terms, which we do not often assume in empirical studies.

market measures are insignificant for HICs and only bank measures are significant in some of the regressions for MICs. That is, the results break-down. Moreover, the specification tests reject the null hypotheses of no second-order serial correlation between the residuals and/or adequacy of our instruments. This confirms the importance of using less frequent dataset to assess the long-run causal relationship between financial development and economic growth, as the financial measures commonly have inertial from year to year and hence may suffer from serial correlation, and the frequent business cycle fluctuations can also mask the true relationship between variables of interest.

I.4.3 Traditional GMM

I.4.3.1 The model

We also apply iterative traditional GMM to the three-year average data set[10] , where we estimate the growth model given below, as a system of equations- one per each country- with cross-equation restrictions imposed on coefficients of financial measures and other controls.

$$\left.\begin{aligned} y_{1t} &= \boldsymbol{X_{1t}\beta} + \epsilon_{1t}, \\ y_{2t} &= \boldsymbol{X_{2t}\beta} + \epsilon_{2t}, \\ &(\ldots), \\ y_{Nt} &= \boldsymbol{X_{Nt}\beta} + \epsilon_{Nt} \end{aligned}\right\} \qquad (12)$$

Where y_{it} is the growth rate of real per capita GDP for country i at time t; $\boldsymbol{X_{it}}$ is a 1 x k vector of explanatory variables including stock market and banking sector measures, initial/lagged values of real per capita GDP, average years of schooling, government final consumption expenditure, inflation rate, trade openness, and constant; $\boldsymbol{\beta}$ is a k x 1 vector of unknown parameters; ϵ_{it} is a random error term; i= 1,2,...,N represents each equation (country in the sample); and t= 1989,...,2012-the time period the data covers.

GMM is based on moment conditions that have zero expectation in the population when evaluated at the true parameters:

[10] We use the three-year average data with traditional GMM as it allows us to use more observations and information to estimate our parameters in a system of equations.

$$E\left[\boldsymbol{g(Z_i;\beta)}\right] = E\left[\boldsymbol{Z_i'}\epsilon_i\right] = E\left[\boldsymbol{Z_i'}\ (y_i - \boldsymbol{X_i\beta})\right] = 0 \qquad (13),$$

Where, $\boldsymbol{g(Z_i;\beta)} = \boldsymbol{Z_i'}\epsilon_i = \boldsymbol{Z_i'}\ (y_i - \boldsymbol{X_i\beta})$ denotes the moment conditions and $\boldsymbol{Z_i'}$ a vector of instruments.

Hansen (1982) proposes minimizing the following quadratic form with respect to β, which brings the sample moments as close to zero as possible, to obtain the GMM estimator of the true parameter values[11] :

$$\min_{\boldsymbol{\beta}} \left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{g(Z_i;\beta)}\right]' \boldsymbol{.W.} \left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{g(Z_i;\beta)}\right] \qquad (14),$$

(1 x L) (LxL) (Lx1)

Where W is a positive definite LxL weighting matrix (L= number of instruments).

That is, as Hansen (1982) describes it, "A GMM estimator of the true parameter vector is obtained by finding the element of the parameter space that sets linear combinations of the sample cross products as close to zero as possible". For a positive definite weighting matrix (W), the value of the parameter that minimizes the above quadratic form is thus known as a minimum distance estimator.

Assuming that the moment conditions are continuously differentiable, the GMM estimator satisfies the first-order condition:

$$\left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{\nabla}_{\beta}\ \boldsymbol{g}\left(\boldsymbol{Z_i;\hat{\beta}}\right)\right]' \boldsymbol{.W.} \left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{g}\left(\boldsymbol{Z_i;\hat{\beta}}\right)\right] = \boldsymbol{0} \qquad (15),$$

(kxL) (LxL) (Lx1) (kx1)

Where,

[11] This is particularly true if the model is overidentified. Hansen (1982) and Hayashi (2000) provide detail analysis of GMM.

$$\boldsymbol{\nabla_\beta}\, \boldsymbol{g}\left(\boldsymbol{Z_i;\hat{\beta}}\right) = \begin{bmatrix} \frac{\partial}{\partial \beta_1}\boldsymbol{g}\left(\boldsymbol{Z_i}; \hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_k\right)' \\ \frac{\partial}{\partial \beta_2}\boldsymbol{g}\left(\boldsymbol{Z_i}; \hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_k\right)' \\ (\ldots) \\ \frac{\partial}{\partial \beta_k}\boldsymbol{g}\left(\boldsymbol{Z_i}; \hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_k\right)' \end{bmatrix} = \begin{bmatrix} -\boldsymbol{Z_i'}\, x_{1i} & -\boldsymbol{Z_i'}\, x_{2i} & (\ldots) & -\boldsymbol{Z_i'}\, x_{ki} \end{bmatrix} = -\boldsymbol{Z_i'}\, \boldsymbol{X_i} \quad (16)$$

The first-order condition becomes

$$\left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{Z_i'X_i}\right]' .\boldsymbol{W}. \left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{Z_i'}(y_i - \boldsymbol{X_i\hat{\beta}})\right] = \boldsymbol{0} \quad (17)$$

It follows that

$$\left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{Z_i'X_i}\right]' .\boldsymbol{W}. \left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{Z_i'}y_i\right] = \left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{Z_i'X_i}\right]' .\boldsymbol{W}. \left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{Z_i'X_i\hat{\beta}}\right] \quad (18)$$

Hence the solution for $\hat{\beta}$ is:

$$\boldsymbol{\hat{\beta}} = \left(\left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{Z_i'X_i}\right]' .\boldsymbol{W}.\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{Z_i'X_i}\right)^{-1} \left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{Z_i'X_i}\right]' .\boldsymbol{W}. \left[\sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \boldsymbol{Z_i'}y_i\right] \quad (19),$$

Which can be written in data matrices as:

$$\hat{\beta}^{\boldsymbol{GMM}} = \left(\left(\boldsymbol{Z'X}\right)' \boldsymbol{.W.Z'X}\right)^{\boldsymbol{-1}} \left(\boldsymbol{Z'X}\right)' \boldsymbol{.W.Z'}y \quad (20)$$

$$\boldsymbol{\hat{\beta}^{GMM}} = \left(\left(\boldsymbol{X'Z}\right) \boldsymbol{.W.} \left(\boldsymbol{Z'X}\right)\right)^{\boldsymbol{-1}} \left(\boldsymbol{X'Z}\right) \boldsymbol{.W.Z'}y \quad (21)$$

In finite samples, the choice of the weighting matrix (W) is important, as different W-matrices will lead to different point estimates. This is particularly true with one-step and two-step estimators. The iterative GMM, on the other hand, can remedy this drawback as it continually updates the weight matrix until some sort of convergence has been achieved.

Among all possible candidates, the best choice for the weighting matrix is the inverse of the covariance of the moments:

$$W = \left[Var\left(\boldsymbol{Z_i'} \epsilon_i \right) \right]^{-1} \tag{22}$$

That is, high-variance moments will be assigned lower weight in the criterion function-since they contain less information about the population parameter- than low-variance moments. This choice of the weight matrix produces efficient (or optimal) GMM estimators; that is, GMM estimators with the smallest variances, asymptotically, as shown by Hansen (1982) and Hayashi (2000).

Both the financial measures and other controls are likely to be correlated with the error term (that they are endogenous) and hence we use valid instruments in our regression. Specifically, we have instrumented bank credit (and private credit) by lags of liquid liability of the banking system, turnover ratio (and traded value) by lags of stock market capitalization, and the other controls by their respective lagged values, under the assumption that our instruments are exogenous and relevant. The motivation for the choice of instruments for our financial measures is as follows: both liquid liability of the banking system and the stock market capitalization measure the overall sizes of the banking sector and stock market, respectively, and we assume the larger the banking sector/ stock market, the better financial services- including credit service- it can render/ the more active and liquid the market becomes[12]. We then have tested both instrument exogeneity ($cov(\boldsymbol{Z_i}, \epsilon_i) = 0$) and relevance ($cov(\boldsymbol{Z_i, X_i}) \neq 0$) using both Hansen's J test and Stock and Yogo's weak instrument test, respectively.

Theoretically, when dealing with small sample data the iterative system GMM method applied to homogeneous countries produces more efficient estimates than panel GMM as it utilizes more information in the variance-covariance matrix of residuals; it also continuously updates the estimation procedure until our statistical estimates from successive steps converge and this can help remedy the drawback of one-step and two-step estimators, where different weighting matrices will lead to different point estimates. The traditional GMM is also more flexible than the panel GMM which is better suited to short but wide panels (panels with small T and large N).

[12] We also instrument the bank and stock market measures by their own respective lagged values and compare results.

I.4.3.2 Results and discussion

Tables 15 shows that financial measures, particularly bank credit, exert robust and positive effect on economic growth of MICs, as bank credit is positive and statistically significant in three of the four regressions and turnover ratio in two of the four regressions. In case of the HICs, on the other hand, these measures are overall not statistically significant. Both the dynamic panel GMM and iterative traditional GMM regression results imply that while bank credits and stock market liquidity (marginally) have a robust growth impact in the case of MICs, the same cannot be said of their effect on economic growth of the HICs.

A panel regression that does not address the heterogeneity in the cross-country units may conceal the likely differential effects of financial development that arise from differences in the stages of economic development of countries, among other factors. In order to attenuate this problem and obtain a more policy relevant outcome, we further sort out the countries into four more homogeneous income groups: Upper-and Lower-MICs and European- and Non-European-HICs and run separate regressions for these relatively more homogeneous sub-groups. We expect the more homogeneous the countries, the more representative the coefficient estimates are of each country in the group.

The traditional system GMM regression results (Table 16) depict that while coefficient estimates of both bank credit and turnover ratio are statistically significant for Upper-MICs, only bank credit enters the Lower-MICs growth regression with significant coefficients. This implies that bank credits are strong determinants of economic growth of both Upper- and Lower-MICs. The stock market liquidity, however, exerts a robust influence on economic growth of only Upper-MICs.

For HICs, the coefficient estimates of both bank credit and turnover ratio are found to be generally not significant (Table 15). Regressions involving the two sub-groups indicate that (Table 17) stock market liquidity is not statistically significant for European HICs and only statistically significant in two of the four regressions for the Non-European HICs. The bank credit is also found to be not robust in the case of Non-Europeans, although it enters the European HICs regressions with significant coefficients.[13] The fact that stock market measures are overall statistically not significant for HICs, except that they are marginally significant for Non-European HICs (includes countries such as the U.S.A., Canada, Japan, Hong Kong and others with most developed stock markets), is somewhat surprising as stock markets are regarded as having comparative advantage over banks in raising funds for innovative and high-tech investments that characterize these countries. The fact that the banking system explains economic growth better than the stock market does in European-HICs may be due to the strong common monetary policy adopted in the region. As some studies, including Rose (2014), indicate banks and bond markets, particularly those with long-term maturity, are more effective at influencing economic growth under inflation-targeting regimes.

For MICs, the lower-MICs in particular, the insignificant coefficient estimates of stock market measures perhaps imply that the already established stock markets may have not yet reached some minimum size and activity level beyond which they robustly influence economic growth, or that the stock markets may suffer from lack of transparency- limited firm-specific information in particular-which by hindering effective exercise of property rights and corporate governance by investors (shareholders) leads to poor performance of stock markets (Jin and Meyers, 2006), or that the banking system, by establishing and nurturing a long-run personal relationship with investors may have continued to be the major source of financial services in these countries.

The findings that for lower-MICs the banking system measures are statistically significant but the stock markets are generally not lends credence to the argument put forward by Singh & Weisse (1998) and Lin (2009) that developing countries should focus on making the banking sector the primary source of their financial services rather than diverting scarce resources to the promotion of sophisticated financial institutions, like stock markets, which not only rely on more sophisticated monitoring and infrastructure but also encourage short-term profits.

Our finding of lack of robust growth effect of financial sector, especially for HICs, is in line with the findings of some recent cross-country and panel studies: although financial deepening had a positive

[13] We have also used own lagged values to instrument for banking and stock markets and results are generally not statistically different from the major findings.

and significant effect on growth between 1960-1989 (a period covered by most of the early studies that established a positive relationship between financial development and economic growth), its effect vanishes during the later period, 1990-2004, a period characterized by recurrent financial crises (Rousseau & Wachtel, 2011); the prevalence of excess bank credit -credit boom-in many developed countries is dampening economic growth (Arcand et al., 2012); and there is no clear evidence that finance spurs growth, although the correlation between the two is well-established (Favara, 2003).

I.5 CONCLUSION

This paper examined the growth effects of stock market and banking sector development for 64 HICs and MICs. Dynamic panel GMM estimation results show that while bank credit and stock market liquidity-to a limited extent- exert strong positive impacts on economic growth of middle-income countries, their effect on growth of high-income countries is at best tenuous. The iterative traditional GMM applied to both high- and middle-income countries, where we run a system of growth equations, one for each country, also produces similar results. A closer look at smaller but relatively more homogeneous sub-groups indicate that bank credit spurs growth of both Upper-and Lower- MICs but stock market liquidity has a robust impact on growth of only the Upper-MICs. For HICs, the bank credit is found to be not robust and the stock market liquidity is only marginally significant in the case of Non-Europeans. In the case of European HICs, the stock market liquidity is found to be not a strong determinant of growth, although bank credit is.

The results imply that the effects of financial development on economic growth depend, at least partly, on the stages of economic development of countries. Hence, any study that aims at providing an empirical support to the competing theories and furthering our understanding of the finance-growth nexus is best served if focused on a more thorough examination of either homogeneous countries or individual country cases.

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APPENDIX I: Tables for Chapter I

Table I.1. Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.
All Countries (64)				
Economic growth	2.04	2.40	-8.38	10.39
Bank credit	66.02	47.33	4.84	224.01
Private credit	71.1	51.15	4.84	224.01
Liquid liabilities	71.62	53.26	11.94	353.89
Turnover ratio	52.62	55.43	0.02	376.85
Traded value	37.8	62.65	0.002	621.33
Mkt. Capitalization	58.22	60.76	0.033	478.67
Initial Income	15228.91	16424.59	366.23	85529.8
Schooling	7.94	2.52	1.97	13.25
Govt. size	16.37	5.18	5.49	30.72
Inflation	27.88	173.82	-2.97	2282.4
Openness	84.33	64.9	15.87	425.63
Middle-income countries(33)				
Economic growth	2.47	2.68	-8.38	10.39
Bank credit	40.3	29.67	4.84	147.28
Private credit	43.38	33.91	4.84	150.97
Liquid liabilities	50.02	30.31	11.94	169.08
Turnover ratio	34.26	51.68	0.021	376.85
Traded value	15.04	25.68	0.002	124.56
Mkt. Capitalization	38.17	42.69	0.033	236.37
Initial Income	2715.31	1916.14	366.23	8312.76
Schooling	6.31	2.02	1.97	11.69
Govt. size	13.84	4.03	5.49	28.62
Inflation	49.58	239.92	-0.01	2282.4
Openness	72.38	40.53	15.87	206.98
High-income countries(31)				
Economic growth	1.59	1.98	-5.65	6.76
Bank credit	93.75	47.23	18.48	224.01
Private credit	101	49.82	17.58	224.01
Liquid liabilities	94.77	62.21	30	353.89
Turnover ratio	71.82	52.8	0.20	325.73
Traded value	61.59	79.07	0.23	621.33
Mkt. Capitalization	79.44	69.39	1.10	478.67
Initial Income	28469.12	14490.2	4631.5	85529.8
Schooling	9.67	1.69	5.37	13.25
Govt. size	19.05	4.92	7.08	30.72
Inflation	4.78	15.57	-2.99	191.77
Openness	97.05	81.61	18.03	425.63

Note: Except Initial Income and Schooling, all variables are expressed as percentage values.

Table I.2. Correlations, Middle-income countries

	Econ. growth	Bank credit	Private credit	Liquid liab.	Turnover ratio	Traded value	Mkt. cap.	Initial income	Schooling	Govt. size	Inflation	Openness
Econ. growth	1											
Bank credit	0.284 (0.000)	1										
Private credit	0.222 (0.004)	0.947 (0.000)	1									
Liquid liab.	0.300 (0.000)	0.845 (0.000)	0.745 (0.000)	1								
Turnover ratio	0.246 (0.002)	0.244 (0.002)	0.215 (0.006)	0.248 (0.001)	1							
Traded value	0.296 (0.000)	0.576 (0.000)	0.627 (0.000)	0.532 (0.000)	0.592 (0.000)	1						
Mkt. cap.	0.122 (0.121)	0.571 (0.000)	0.684 (0.000)	0.511 (0.000)	0.123 (0.122)	0.745 (0.000)	1					
Initial income	-0.114 (0.148)	0.110 (0.160)	0.169 (0.031)	-0.03 (0.706)	-0.015 (0.846)	0.113 (0.153)	0.238 (0.002)	1				
Schooling	0.083 (0.291)	0.090 (0.249)	0.113 (0.148)	0.035 (0.659)	-0.167 (0.034)	0.075 (0.347)	0.262 (0.001)	0.484 (0.000)	1			
Govt. size	-0.154 (0.049)	0.144 (0.065)	0.213 (0.006)	0.159 (0.042)	-0.119 (0.134)	0.082 (0.300)	0.234 (0.003)	0.238 (0.002)	0.156 (0.043)	1		
Inflation	-0.300 (0.000)	-0.061 (0.436)	-0.064 (0.411)	-0.173 (0.027)	0.012 (0.881)	-0.071 (0.373)	-0.125 (0.112)	0.054 (0.495)	-0.006 (0.936)	-0.066 (0.398)	1	
Openness	0.079 (0.313)	0.442 (0.000)	0.381 (0.000)	0.444 (0.000)	-0.223 (0.005)	0.136 (0.085)	0.334 (0.000)	0.08 (0.307)	0.206 (0.008)	0.144 (0.064)	-0.195 (0.012)	1

Note: Significance levels are reported in parenthesis.

Table I.3. Correlations, High-income countries

	Econ. growth	Bank credit	Private credit	Liquid liab.	Turnover ratio	Traded value	Mkt. cap.	Initial income	Schooling	Govt. size	Inflation	Openness
Econ. growth	1											
Bank credit	-0.201 (0.012)	1										
Private credit	-0.218 (0.007)	0.881 (0.000)	1									
Liquid liab.	-0.036 (0.660)	0.583 (0.000)	0.561 (0.000)	1								
Turnover ratio	0.099 (0.224)	0.234 (0.004)	0.353 (0.000)	-0.071 (0.386)	1							
Traded value	0.14 (0.082)	0.387 (0.000)	0.479 (0.000)	0.31 (0.000)	0.626 (0.000)	1						
Mkt. cap.	0.206 (0.010)	0.45 (0.000)	0.456 (0.000)	0.615 (0.000)	0.149 (0.065)	0.755 (0.000)	1					
Initial income	-0.241 (0.002)	0.496 (0.000)	0.54 (0.000)	0.474 (0.000)	0.089 (0.274)	0.183 (0.023)	0.274 (0.001)	1				
Schooling	-0.119 (0.141)	0.18 (0.026)	0.356 (0.000)	0.044 (0.586)	0.307 (0.000)	0.199 (0.013)	0.07 (0.391)	0.386 (0.000)	1			
Govt. size	-0.292 (0.000)	-0.072 (0.375)	-0.101 (0.216)	-0.367 (0.000)	-0.006 (0.941)	-0.269 (0.001)	-0.44 (0.000)	0.153 (0.057)	0.16 (0.047)	1		
Inflation	-0.177 (0.026)	-0.204 (0.011)	-0.218 (0.007)	-0.144 (0.076)	-0.017 (0.831)	-0.114 (0.159)	-0.154 (0.056)	-0.215 (0.007)	-0.099 (0.219)	0.031 (0.701)	1	
Openness	0.177 (0.023)	0.208 (0.010)	0.088 (0.279)	0.533 (0.000)	-0.157 (0.052)	0.287 (0.000)	0.615 (0.000)	0.109 (0.176)	-0.182 (0.023)	-0.409 (0.000)	-0.065 (0.421)	1

Note: Significance levels are reported in parenthesis.

Table I.4. Bank & Stock market measures and economic growth, country average, 1989-2012

Country	Econ. Growth	Bank Credit	Private Credit	Liquid Liab.	Turnover ratio	Traded value	Market cap.
Argentina*	2.611	17.456	17.852	25.684	20.433	3.067	25.173
Australia	1.639	92.322	92.322	70.411	65.333	61.647	90.705
Austria	1.417	104.647	105.06	91.575	50.872	12.158	20.725
Belgium	1.012	75.885	75.913	88.437	31.524	18.724	56.51
Bolivia*	1.901	42.746	44.166	45.075	0.917	0.102	13.95
Brazil*	1.314	51.232	52.167	42.952	54.065	20.527	39.066
Barbados	0.563	57.376	57.57	78.712	3.688	3.316	72.795
Botswana*	2.91	18.043	18.084	29.85	5.286	0.806	21.79
Canada	1.132	96.867	122.867	93.622	62.036	59.658	93.559
China*	8.434	106.948	107.549	123.573	147.283	56.287	40.942
Cote d'Ivoire*	-0.646	19.515	19.754	27.952	2.201	0.355	15.832
Colombia*	1.95	29.988	33.852	22.923	9.946	2.91	27.571
Denmark	0.987	119.556	119.675	61.49	65.374	35.57	52.703
Ecuador*	1.282	20.227	20.564	23.882	5.41	0.347	6.402
Egypt*	2.608	39.034	39.034	79.317	27.322	11.748	33.033
Finland	1.377	74.367	75.262	57.183	78.518	72.556	82.297
France	1.044	95.299	95.354	68.533	75.447	72.556	63.258
Germany	1.508	105.988	105.988	92.169	120.738	45.744	39.104
Ghana*	2.967	10.586	10.759	22.21	3.468	0.372	12.605
Greece	0.63	63.137	63.242	77.145	47.891	22.746	39.827
Hong Kong	2.752	155.777	154.424	230.957	73.508	263.571	324.407
Hungary	0.966	43.633	43.682	48.777	60.776	13.477	17.793
Indonesia*	3.616	34.38	35.525	40.683	46.723	11.421	27.109
India*	4.545	33.556	33.556	54.45	98.709	42.471	48.051
Iran*	3.302	22.977	22.977	40.097	17.463	2.838	16.172
Iceland	1.015	105.62	105.664	56.778	41.876	44.072	61.937
Israel	1.866	77.558	77.558	83.846	59.655	31.162	58.783
Italy	0.561	80.77	81.028	65.166	101.33	33.214	30.684
Jamaica*	0.576	24.453	24.454	45.072	5.55	2.541	54.159
Jordan*	1.107	72.107	72.263	113.823	28.1	37.066	105.946
Japan	1.078	139.94	193.085	202.194	78.175	61.35	76.841
Kenya*	0.411	26.014	30.02	41.51	5.877	1.601	23.832
Korea	4.226	98.446	99.88	71.066	190.457	109.291	60.317
Luxembourg	2.124	127.235	127.296	320.509	1.328	1.886	149.121
Malaysia*	3.63	114.035	115.394	114.087	38.053	64.32	159.589
Mauritius*	3.546	62.329	62.357	80.689	5.606	2.249	39.291
Mexico*	1.287	18.418	20.558	25.235	32.451	8.396	27.899
Morocco*	2.334	44.514	45.67	79.584	16.616	7.718	38.452

Table I.4.... Continued

Country	Econ. Growth	Bank Credit	Private Credit	Liquid Liab.	Turnover ratio	Traded value	Market cap.
Netherlands	1.548	138.39	138.465	98.412	99.811	93.674	90.278
New Zealand	1.117	110.945	110.945	79.8	35.964	14.061	41.386
Nigeria*	2.98	16.31	16.406	22.272	8.286	1.667	14.487
Norway	1.604	67.945	67.997	53.574	85.595	41.295	42.162
Pakistan*	1.718	23.879	23.913	41.27	150.753	28.264	18.839
Panama*	3.998	74.939	81.001	68.75	2.352	0.455	22.286
Peru*	2.294	19.321	20.133	25.451	15.224	3.368	32.081
Philippines*	1.89	32.007	32.028	51.701	23.391	12.09	53.739
Poland	2.864	31.293	31.302	39.718	60.726	7.724	18.195
Portugal	1.422	118.112	118.271	98.945	52.968	18.68	31.55
Russia*	0.291	23.369	23.758	27.962	65.855	24.897	34.395
Saudi Arabia	1.656	28.707	28.526	48.534	77.813	64.67	58.066
Singapore	3.59	96.022	96.027	115.187	60.303	92.112	161.407
South Africa*	0.786	66.141	128.12	47.798	33.56	60.43	169.98
Spain	1.406	125.778	125.903	100.353	125.281	89.271	63.534
Sri Lanka*	4.391	25.619	25.645	38.246	15.32	2.785	18.37
Swaziland*	1.504	18.201	18.34	22.729	0.814	0.074	10.416
Sweden	1.545	82.326	110.367	54.778	85.378	83.245	90.961
Switzerland	0.763	159.845	159.852	152.614	84.26	159.645	183.563
Thailand*	3.904	109.459	116.638	95.203	84.012	44.557	59.547
Trinidad & Tobago	2.992	33.586	40.21	51.554	5.155	1.73	52.687
Tunisia*	2.804	56.139	62.698	54.272	12.106	1.663	13.116
Turkey*	2.428	24.999	24.999	32.64	131.858	32.005	24.33
UK	1.551	143.504	143.856	112.228	89.503	110.808	125.916
United States	1.422	50.694	161.113	65.014	149.065	166.063	108.146
Uruguay*	2.753	31.096	31.271	39.238	1.821	0.031	0.843

Note: * represents MIC, and the rest HIC. The values are based on 5-year average data.

Table I.5. Banks, stock markets, and economic growth: OLS regression

Dependent Variable: Per capita real GDP growth rate

		Banking System measures		
		Bank credit	Private credit	Liquid liabilities
Panel A. All Countries(64)				
Turnover ratio	Bank measure	0.478**	0.330	0.650***
		(0.219)	(0.218)	(0.235)
	Stock mkt measure	0.268***	0.282***	0.291***
		(0.088)	(0.089)	(0.085)
Traded value	Bank measure	0.254	0.070	0.395
		(0.231)	(0.232)	(0.247)
	Stock mkt measure	0.285***	0.309***	0.282***
		(0.070)	(0.071)	(0.067)
Capitalization	Bank measure	0.335	0.154	0.354
		(0.235)	(0.236)	(0.268)
	Stock mkt measure	0.427***	0.471***	0.423***
		(0.140)	(0.143)	(0.144)
Panel B. Middle-Income Countries (33)				
Turnover ratio	Bank measure	0.900***	0.711**	1.033***
		(0.289)	(0.281)	(0.346)
	Stock mkt measure	0.356***	0.379***	0.366***
		(0.122)	(0.123)	(0.122)
Traded value	Bank measure	0.856***	0.639**	0.957**
		(0.311)	(0.303)	(0.375)
	Stock mkt measure	0.202**	0.226**	0.209**
		(0.093)	(0.094)	(0.093)
Capitalization	Bank measure	1.168***	0.954***	1.344***
		(0.319)	(0.316)	(0.390)
	Stock mkt measure	-0.047	-0.013	-0.050
		(0.193)	(0.199)	(0.197)
Panel C. High-Income Countries(31)				
Turnover ratio	Bank measure	-0.288	-0.370	0.152
		(0.370)	(0.400)	(0.362)
	Stock mkt measure	0.204	0.215	0.191
		(0.132)	(0.134)	(0.131)
Traded value	Bank measure	-0.792**	-1.069***	-0.071
		(0.361)	(0.395)	(0.339)
	Stock mkt measure	0.521***	0.565***	0.440***
		(0.106)	(0.109)	(0.101)
Capitalization	Bank measure	-0.913***	-1.196***	-1.000***
		(0.333)	(0.361)	(0.344)
	Stock mkt measure	1.259***	1.331***	1.338***
		(0.181)	(0.183)	(0.189)

Notes: All the regressions are based on the 5 year average panel data and include Simple Control Set and constant, which are not reported. Robust standard errors are in parenthesis. *,**,& *** represent significance levels at 10%,5%,& 1% respectively.

Table I.6. Stock markets, banks, and growth: OLS regression, robustness

Dependent Variable: Per capita real GDP growth rate										
Variable	Middle-income countries(33)					High-income countries (31)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank credit	0.900**	1.019***	0.714**	0.793**	0.871**	-0.288	-0.753**	-0.471	-0.602*	-1.062***
	(0.351)	(0.372)	(0.320)	(0.384)	(0.391)	(0.356)	(0.340)	(0.356)	(0.362)	(0.340)
Turnover ratio	0.356***	0.328**	0.402***	0.400**	0.360**	0.204	0.286*	0.222	0.342**	0.388**
	(0.133)	(0.135)	(0.134)	(0.156)	(0.162)	(0.171)	(0.156)	(0.169)	(0.167)	(0.153)
Initial income	-0.896***	-0.796***	-0.762***	-0.880***	-0.626**	-0.615	-0.177	-0.962**	-0.514	-0.511
	(0.230)	(0.236)	(0.230)	(0.229)	(0.241)	(0.432)	(0.417)	(0.410)	(0.428)	(0.380)
Schooling	2.415***	2.428***	2.217***	2.308***	2.242***	-0.613	-0.271	-0.424	-0.217	0.127
	(0.706)	(0.702)	(0.702)	(0.722)	(0.718)	(0.909)	(0.806)	(0.933)	(0.870)	(0.839)
Government size		-1.134			-1.408*		-2.218***			-1.791***
		(0.759)			(0.759)		(0.519)			(0.501)
Inflation			-1.299***		-1.462***			-7.035***		-6.545***
			(0.402)		(0.446)			(1.100)		(1.012)
Trade openness				0.314	-0.096				0.803***	0.583**
				(0.396)	(0.453)				(0.241)	(0.226)
Constant	0.626	2.427	0.736	-0.323	3.277	9.778**	12.731***	13.864***	5.18	12.627***
	(1.621)	(2.082)	(1.629)	(1.939)	(2.607)	(3.780)	(3.627)	(3.592)	(4.059)	(3.854)
Wald test of joint sign. (P value)a	0.000	0.000	0.000	0.000	0.000	0.402	0.027	0.216	0.054	0.001
Observations	161	161	161	161	161	152	152	152	152	152
R2	0.193	0.207	0.232	0.196	0.254	0.073	0.164	0.160	0.128	0.267

Note: All the regressions are based on the 5 year average panel data. Robust standard errors are in parenthesis; *,**,& *** represent significance levels at 10%, 5%, & 1%, respectively. (a)Null hypothesis is bank and stock market measures enter the regressions with zero coefficients.

Table I.7. Banks, stock markets, and economic growth: Panel GMM regression

Dependent Variable: Per capita real GDP growth rate				
		Banking System measures		
		Bank credit	Private credit	Liquid liabilities
Panel A. All Countries(64)				
Turnover ratio	Bank measure	-0.235	-0.223	-0.233
		(1.260)	(1.524)	(3.097)
	Stock mkt measure	-0.513	-0.666	-0.680
		(1.980)	(1.744)	(1.602)
Traded value	Bank measure	-1.169	-1.451	-1.155
		(1.066)	(1.239)	(3.075)
	Stock mkt measure	1.068*	1.134*	1.004
		(0.629)	(0.666)	(0.692)
Capitalization	Bank measure	-1.649	-2.015	-0.085
		(1.578)	(1.662)	(2.018)
	Stock mkt measure	7.242***	7.016***	7.248***
		(2.701)	(2.567)	(1.912)
Panel B. Middle-Income Countries (33)				
Turnover ratio	Bank measure	2.602**	2.818**	3.310
		(1.181)	(1.253)	(3.731)
	Stock mkt measure	0.723	0.789*	0.321
		(0.439)	(0.447)	(1.330)
Traded value	Bank measure	2.715**	2.974**	7.619
		(1.251)	(1.248)	(4.829)
	Stock mkt measure	0.260	0.298	-1.760
		(0.573)	(0.574)	(1.785)
Capitalization	Bank measure	1.477	1.621	0.872
		(2.701)	(3.302)	(3.987)
	Stock mkt measure	5.709*	6.033	5.405
		(3.224)	(3.662)	(5.338)
Panel C. High-Income Countries(31)				
Turnover ratio	Bank measure	-3.481**	-4.137**	-4.009***
		(1.538)	(1.618)	(1.359)
	Stock mkt measure	0.027	0.061	-0.191
		(0.348)	(0.334)	(0.689)
Traded value	Bank measure	-3.410*	-4.009**	-3.774**
		(1.769)	(1.568)	(1.467)
	Stock mkt measure	-0.184	0.015	-0.559
		(0.477)	(0.428)	(1.028)
Capitalization	Bank measure	-2.057*	-2.833**	-2.980*
		(1.174)	(1.144)	(1.545)
	Stock mkt measure	0.910	1.042	0.790
		(0.804)	(0.686)	(0.816)

Notes: All regressions are two-step panel GMM, incorporating Windmeijer (2005) correction, with robust standard errors in parentheses. They include simple control set, time dummies, and constant, which are not reported. *,**, & *** indicate significance level at the 10%, 5%, and 1% , respectively.

Table I.8. Stock markets, banks, and growth: Panel GMM regression, robustness

Dependent Variable: Per capita real GDP growth rate										
Variable	Middle-income countries(33)					High-income countries (31)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank credit	2.602**	2.120**	2.646**	2.349*	1.608*	-3.481**	-1.229	-3.589**	-2.153*	-1.717
	(1.181)	(0.882)	(1.234)	(1.372)	(0.945)	(1.538)	(1.210)	(1.312)	(1.061)	(1.237)
Turnover ratio	0.723	0.825*	0.660	1.021**	1.085*	0.027	0.263	0.044	1.473	1.113
	(0.439)	(0.450)	(0.546)	(0.465)	(0.547)	(0.348)	(0.431)	(0.521)	(1.893)	(0.904)
Initial income	2.278	1.002	1.205	2.321	1.320	-0.313	-2.290	0.958	3.022	0.056
	(2.081)	(2.222)	(2.046)	(2.359)	(2.408)	(2.872)	(1.372)	(1.414)	(4.930)	(1.215)
Schooling	-3.767	-3.248	-3.070	-4.572	-3.215	0.579	4.681	0.647	6.394	5.635
	(4.054)	(3.904)	(3.663)	(4.383)	(3.469)	(8.608)	(6.765)	(5.368)	(8.864)	(7.139)
Govt. cons.		6.482			2.38		-3.287			-1.227
		(5.560)			(8.881)		(2.387)			(3.603)
Inflation			2.027		3.127			0.491		0.04
			(5.083)		(3.254)			(8.860)		(9.800)
Trade openness				0.635	1.896				6.422	3.456
				(1.459)	(2.101)				(7.658)	(2.251)
Dummy 1999-2003	-0.004	0.176	0.385	0.143	0.473	0.377	-0.263	0.173 (0.499)	-1.967	-1.145
	(0.483)	(0.455)	(0.489)	(0.536)	(0.675)	(0.504)	(0.519)		(2.626)	(0.973)
Dummy 2004-'08	2.648***	2.872***	2.892***	2.697***	2.903***	1.282	0.115	0.949 (0.743)	-3.114	-1.529
	(0.542)	(0.512)	(0.633)	(0.582)	(0.903)	(0.863)	(0.926)		(4.804)	(1.694)
Dummy 2009-'12	0.392	0.672	0.901	0.586	1.162	-1.120	-1.790	-1.362736	-5.613	-3.628**
	(0.705)	(0.623)	(0.852)	(0.755)	(0.826)	(1.155)	(1.144)		(5.000)	(1.596)
Constant	-19.185	-25.845*	-12.851	-20.647	-25.379	18.852	28.334**	6.469	-65.95	-19.216
	(12.578)	(13.599)	(12.345)	(16.472)	(16.602)	(17.945)	(12.518)	(12.779)	(97.928)	(24.195)
Observations	98	98	98	98	98	91	91	91	91	91
Instruments	11	13	13	13	17	11	13	13	13	17
AR(2) test[a]	0.174	0.131	0.153	0.166	0.164	0.155	0.162	0.145	0.293	0.218
Hansen J test[b]	0.318	0.558	0.342	0.342	0.706	0.314	0.31	0.594	0.879	0.792
Diff-in-Han. test[b]	0.251	0.400	0.313	0.217	0.640	0.446	0.623	0.568	0.864	0.698
Wald test of joint sig.	0.005	0.005	0.041	0.024	0.020	0.094	0.085	0.018	0.040	0.075

Notes: All regressions are two-step panel GMM, incorporating Windmeijer (2005) correction, with robust standard errors in parentheses. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. All variables are in log form. P-values of the post-estimation tests are reported;(a)The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation;(b)The null hypothesis is that the instruments used are not correlated with the residuals.

Table I.9. Stock markets, banks, and growth: Panel GMM regression, robustness

Dependent Variable: Per capita real GDP growth rate										
Variable	Middle-income countries(33)					High-income countries (31)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Private credit	2.974**	2.822***	3.206**	2.633*	2.328**	-4.009**	-1.252	-4.181***	-2.756**	-2.170
	(1.248)	(0.895)	(1.271)	(1.341)	(1.116)	(1.568)	(0.894)	(1.184)	(1.310)	(1.339)
Traded value	0.298	0.088	0.167	0.500	0.465	0.015	0.298	0.082	0.296	0.318
	(0.574)	(0.592)	(0.657)	(0.394)	(0.421)	(0.428)	(0.439)	(0.677)	(0.638)	(1.048)
Initial income	2.558	2.162	1.915	2.925	2.413	1.299	-1.951	1.613	0.769	0.664
	(2.401)	(2.679)	(2.151)	(1.913)	(1.842)	(2.839)	(1.354)	(1.584)	(1.886)	(2.002)
Schooling	-5.297	-5.414	-4.520	-5.473	-5.302	2.671	5.264	3.097	6.397	2.677
	(4.283)	(4.632)	(3.721)	(3.773)	(3.559)	(8.191)	(6.126)	(5.884)	(5.487)	(8.249)
Govt. cons.		0.087			-1.254		-3.907*			-0.667
		(5.734)			(4.917)		(1.960)			(3.787)
Inflation			3.556		3.044			1.712		6.290
			(5.953)		(3.427)			(7.393)		(10.907)
Trade openness				-0.85	1.182				1.743	1.923
				(1.561)	(1.600)				(1.220)	(1.954)
Dummy 1999-2003	0.138	0.111	0.354	0.413	0.597	0.105	-0.470	-0.012	-0.624	-0.474
	(0.658)	(0.728)	(0.552)	(0.492)	(0.568)	(0.589)	(0.530)	(0.718)	(0.985)	(1.501)
Dummy 2004-'08	2.462***	2.655***	2.879***	2.652***	2.736***	0.765	-0.175	0.56	-0.63	-0.449
	(0.522)	(0.547)	(0.711)	(0.522)	(0.598)	(0.862)	(0.882)	(1.030)	(1.593)	(2.406)
Dummy 2009-'12	0.262	0.564	0.83	0.242	0.815	-1.824**	-1.944**	-1.921**	-3.161**	-2.879*
	(0.676)	(0.644)	(0.956)	(0.623)	(0.590)	(0.866)	(0.833)	(0.880)	(1.185)	(1.656)
Constant	-18.232	-14.423	-16.123	-16.327	-17.358	0.612	25.734**	-2.938	-16.456	-8.734
	(13.46)	(16.271)	(12.025)	(10.932)	(13.274)	(13.409)	(12.371)	(10.691)	(15.875)	(22.700)
Observations	98	98	98	98	98	91	91	91	91	91
Instruments	11	13	13	13	17	11	13	13	13	17
AR(2) test[a]	0.170	0.199	0.193	0.127	0.183	0.130	0.168	0.120	0.096	0.228
Hansen J test[b]	0.402	0.520	0.698	0.518	0.730	0.618	0.299	0.837	0.670	0.796
Diff-in-Han. test[b]	0.249	0.418	0.721	0.358	0.689	0.948	0.479	0.816	0.511	0.695
Wald test of joint sig.	0.070	0.010	0.055	0.864	0.039	0.032	0.220	0.005	0.010	0.061

Notes: All regressions are two-step panel GMM, incorporating Windmeijer (2005) correction, with robust standard errors in parentheses. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. All variables are in log form.P-values of the post-estimation tests are reported;(a)The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation;(b)The null hypothesis is that the instruments used are not correlated with the residuals.

Table I.10. Stock markets, banks, and growth: Panel GMM regression, robustness

Dependent Variable: Per capita real GDP growth rate								
Variable	Middle-income countries(33)				High-income countries (31)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank credit	0.860	0.467			-1.771	-1.368*		
	(1.586)	(0.745)			(1.164)	(0.753)		
Private credit			1.089	0.503			-2.251*	-0.859
			(1.440)	(1.033)			(1.174)	(0.897)
Turnover ratio	0.368***	0.485**			0.267	0.620		
	(0.112)	(0.237)			(0.674)	(0.385)		
Traded Value			0.084	0.055			0.396	0.502
			(0.257)	(0.245)			(0.690)	(0.552)
Initial income	-1.21	-1.262	-1.433	-1.106	-2.43	-0.497	-1.092	-1.226
	(1.514)	(1.198)	(1.556)	(0.945)	(2.671)	(1.119)	(1.989)	(1.371)
Schooling	3.586	2.621	3.269	2.122	2.468	4.880*	3.681	4.279
	(2.901)	(2.314)	(3.075)	(2.715)	(8.472)	(2.598)	(5.804)	(3.648)
Govt. cons.		1.62		1.504		-1.361		-2.646
		(2.401)		(2.177)		(1.361)		(2.050)
Inflation		0.366		0.667		5.195		8.377
		(1.070)		(1.033)		(6.589)		(5.469)
Trade openness		0.044		0.081		2.171		0.567
		(1.053)		(0.886)		(1.604)		(1.475)
Constant	0.205	-0.93	2.719	0.16	27.848	-5.975	13.37	12.208
	(12.068)	(11.600)	(11.325)	(9.705)	(22.989)	(14.404)	(13.042)	(19.067)
Observations	98	98	98	98	91	91	91	91
No. of countries	33	33	33	33	31	31	31	31
Instruments	27	45	27	45	27	45	27	45
AR(2) test[a]	0.179	0.168	0.193	0.176	0.170	0.127	0.153	0.150
Hansen J test[b]	0.269	0.900	0.092	0.868	0.339	0.948	0.208	0.943
Diff-in-Han. test[b]	0.319	0.802	0.116	0.888	0.351	1.000	0.193	1.000
Wald test of joint sig.	0.005	0.136	0.734	0.862	0.281	0.005	0.167	0.465

Notes: All regressions are two-step panel GMM, without incorporating Windmeijer (2005) correction, with robust standard errors in parentheses. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. All regressions include time dummies which are not reported. All variables are in log form.P-values of the post-estimation tests are reported;(a)The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation;(b)The null hypothesis is that the instruments used are not correlated with the residuals.

Table I.11. Banks, stock markets, and growth: robustness check (Interaction terms)

Dependent Variable: Per capita real GDP growth rate

Variables	(1)	(2)	(3)	(4)	(5)
Bank credit	-7.177	-6.514***	-6.349	-7.915	-7.153***
	(7.573)	(2.300)	(3.980)	(7.247)	(2.064)
Turnover ratio	1.545	1.126	0.735	1.792	0.982
	(4.119)	(1.103)	(1.843)	(4.731)	(0.969)
MIC x Bank credit	12.435*	11.883***	11.536***	13.045*	12.179***
	(6.988)	(2.273)	(4.007)	(6.943)	(2.162)
MIC x Turnover ratio	-2.386	-1.714	-1.076	-2.863	-1.58
	(6.709)	(1.706)	(2.695)	(7.132)	(1.432)
Initial income	1.392	2.203	3.103	0.634	1.66
	(10.010)	(3.791)	(3.376)	(7.518)	(3.806)
Schooling	-2.908	-4.225	-5.672	-1.834	-3.284
	(16.912)	(5.244)	(7.596)	(11.426)	(5.31)
Govt. cons.		0.218			0.801
		(3.250)			(3.003)
Inflation			-2.044		-1.464
			(3.046)		(1.570)
Trade openness				0.075	-0.989
				(7.982)	(2.920)
Dummy 1999-2003	0.172	0.169	0.088	0.225	0.257
	(0.493)	(0.495)	(0.500)	(0.918)	(0.651)
Dummy 2004-'08	2.054**	2.025**	1.984**	2.19	2.341**
	(0.890)	(0.833)	(0.856)	(1.858)	(1.144)
Dummy 2009-'12	0.220	-0.010	-0.188	0.502	0.353
	(2.547)	(1.178)	(1.413)	(1.926)	(1.544)
Constant	20.012	13.045	8.937	27.034	22.247
	(78.687)	(28.031)	(28.577)	(58.549)	(39.250)
Observations	189	189	189	189	189
No.of countries	64	64	64	64	64
Instruments	12	14	14	14	18
AR(2) test[a]	0.171	0.159	0.233	0.259	0.215
Hansen J test[b]	0.756	0.947	0.907	0.933	0.985
Diff-in-Han. test[b]	0.756	0.988	0.734	0.722	0.85
Wald test of joint sig.	0.194	0.023	0.044	0.070	0.003

Notes: Notes: All regressions are two-step panel GMM for all countries, incorporating Windmeijer (2005) correction, with robust standard errors in parentheses. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. All variables are in log form.P-values of the post-estimation tests are reported;(a)The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation;(b)The null hypothesis is that the instruments used are not correlated with the residuals.

Table I.12. Banks, stock markets, and growth: robustness check (Interaction terms)

Dependent Variable: Per capita real GDP growth rate					
Variables	(1)	(2)	(3)	(4)	(5)
Private credit	-12.135*	-7.468***	-9.221**	-12.378*	-7.568***
	(6.562)	(2.203)	(3.806)	(6.417)	(1.974)
Traded value	3.447	1.055	1.701	3.598	1.038
	(3.741)	(1.108)	(1.659)	(3.187)	(1.009)
MIC x Private credit	15.867***	12.224***	13.415***	15.857***	12.127***
	(5.699)	(2.147)	(2.897)	(5.337)	(2.040)
MIC x Traded value	-4.849	-1.298	-2.154	-4.804	-1.333
	(5.416)	(1.436)	(2.125)	(4.521)	(1.208)
Initial income	-1.930	2.095	1.792	-0.499	1.967
	(6.015)	(3.411)	(2.213)	(5.122)	(2.991)
Schooling	4.827	-3.134	-1.044	2.460	-2.88
	(10.282)	(4.800)	(5.406)	(8.753)	(4.408)
Govt. cons.		-0.086			0.582
		(3.472)			(2.847)
Inflation			-1.324		-2.083
			(1.935)		(1.786)
Trade openness				2.189	-0.646
				(3.837)	(2.333)
Dummy 1999-2003	-0.557	0.066	-0.279	-0.799	0.032
	(0.949)	(0.524)	(0.722)	(1.087)	(0.586)
Dummy 2004-'08	1.574	1.830**	1.558	1.008	1.871*
	(1.174)	(0.884)	(0.942)	(1.569)	(1.041)
Dummy 2009-'12	1.122	-0.032	0.034	0.528	-0.012
	(1.982)	(1.097)	(1.125)	(1.956)	(1.192)
Constant	52.334	17.957	21.749	34.651	20.147
	(52.578)	(24.87)	(22.684)	(50.020)	(28.736)
Observations	189	189	189	189	189
No. of countries	64	64	64	64	64
Instruments	12	14	14	14	18
AR(2) test[a]	0.245	0.156	0.218	0.187	0.183
Hansen J test[b]	0.925	0.662	0.74	0.913	0.922
Diff-in-Han. test[b]	0.925	0.547	0.439	0.677	0.982
Wald test of joint sig.	0.049	0.002	0.009	0.033	0.0002

Notes: Notes: All regressions are two-step panel GMM for all countries, incorporating Windmeijer (2005) correction, with robust standard errors in parentheses. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. All variables are in log form.P-values of the post-estimation tests are reported;(a)The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation;(b)The null hypothesis is that the instruments used are not correlated with the residuals.

Table I.13. Stock markets, banks, and growth: Panel GMM regression, robustness (3-year average data)

Dependent Variable: Per capita real GDP growth rate										
Variable	Middle-income countries(33)					High-income countries (31)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank credit	5.484**	4.770**	5.567**	3.612	4.829***	-0.497	-0.204	-2.237	1.324	0.113
	(2.659)	(2.198)	(2.130)	(2.621)	(1.327)	(1.664)	(1.038)	(1.619)	(1.871)	(1.006)
Turnover ratio	1.291	1.380	0.915	1.461	0.292	-0.005	0.233	-0.349	1.800	0.964
	(1.394)	(1.437)	(1.225)	(1.335)	(1.161)	(0.588)	(0.658)	(0.478)	(1.826)	(1.307)
Initial income	3.102	4.676	0.812	1.813	-3.188	-2.609	-3.137*	-1.960	2.779	-2.375
	(4.985)	(5.195)	(4.064)	(5.594)	(3.216)	(2.874)	(1.821)	(2.327)	(9.425)	(1.960)
Schooling	0.647	-0.169	1.164	2.148	5.995	8.108	4.349	1.916	0.031	4.680
	(8.782)	(8.350)	(7.799)	(9.767)	(4.515)	(16.069)	(5.249)	(8.848)	(11.792)	(7.035)
Govt. cons.		-2.388			-1.884		-6.015**			-5.410
		(6.166)			(4.272)		(2.421)			(3.411)
Inflation			-1.367		-3.440			-12.340*		-7.365
			(4.477)		(2.625)			(7.102)		(11.307)
Trade openness				-3.626	-4.369				12.228	2.955
				(7.376)	(3.523)				(11.816)	(2.189)
Dummy 1995-'97	-0.211	-0.045	-0.429	-0.108	-1.248	0.946	0.816**	1.109**	-0.194	0.516
	(1.569)	(1.437)	(1.545)	(1.456)	(1.171)	(0.879)	(0.361)	(0.487)	(1.798)	(0.556)
Dummy 1998-2000	-2.413	-2.383	-2.538	-2.442	-3.298**	1.665	1.402***	2.010***	-1.545	0.536
	(1.892)	(1.663)	(1.755)	(1.598)	(1.321)	(1.072)	(0.422)	(0.573)	(3.723)	(1.251)
Dummy 2001-'03	-0.911	-0.860	-1.131	-0.596	-1.921	0.023	0.116	0.58	-4.213	-1.077
	(2.022)	(1.771)	(1.988)	(2.080)	(1.353)	(1.473)	(0.581)	(0.734)	(4.949)	(1.613)
Dummy 2004-'06	0.911	0.875	0.757	1.624	0.362	1.630	1.787**	2.292**	-4.005	0.139
	(2.483)	(1.918)	(2.410)	(2.815)	(1.373)	(1.980)	(0.703)	(1.028)	(6.658)	(2.024)
Dummy 2007-'09	-2.484	-2.425	-2.216	-1.481	-1.658	-1.362	-1.039	-0.377	-8.911	-3.291
	(2.765)	(2.120)	(2.288)	(2.909)	(1.272)	(1.946)	(0.641)	(1.055)	(7.912)	(2.207)
Dummy 2010-'12	-1.245	-1.163	-0.982	-0.126	-0.787	-0.267	0.358	1.042	-7.453	-1.645
	(3.054)	(2.368)	(2.687)	(2.829)	(1.472)	(2.648)	(0.918)	(1.639)	(7.808)	(2.348)
Constant	-43.565	-45.692	-26.254	-15.716	22.511	10.887	40.327**	27.964	-89.41	14.312
	(32.353)	(28.371)	(24.871)	(59.196)	(36.622)	(30.538)	(16.368)	(21.231)	(139.786)	(31.376)
Observations	195	195	195	195	195	182	182	182	182	182
Instruments	14	16	16	16	20	14	16	16	16	20
AR(2) test[a]	0.054	0.078	0.021	0.088	0.006	0.351	0.306	0.161	0.271	0.121
Hansen J test[b]	0.362	0.474	0.321	0.268	0.095	0.033	0.327	0.032	0.966	0.493
Diff-in-Han. test[b]	0.573	0.571	0.461	0.798	0.724	0.619	0.659	0.68	0.932	0.732

Notes: All regressions are two-step panel GMM, incorporating Windmeijer (2005) correction, with robust standard errors in parentheses. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. All variables are in log form.P-values of the post-estimation tests are reported;(a)The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation;(b)The null hypothesis is that the instruments used are not correlated with the residuals.

Table I.14. Stock markets, banks, and growth: Panel GMM regression, robustness (Annual data)

Dependent Variable: Per capita real GDP growth rate										
Variable	Middle-income countries(33)					High-income countries (31)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank credit	4.467	5.971***	3.645	3.069	4.335*	-4.981	-4.476	-3.048	-2.946	-0.496
	(3.061)	(1.947)	(2.707)	(2.771)	(2.549)	(4.183)	(3.539)	(2.936)	(4.953)	(4.348)
Turnover ratio	1.672	0.530	1.457	1.557	0.371	0.321	0.893	-0.225	0.441	-0.639
	(1.229)	(1.261)	(1.082)	(0.958)	(0.670)	(1.462)	(0.941)	(1.271)	(0.998)	(1.381)
Initial income	8.644	7.605	5.797	1.570	1.772	5.402	1.986	-3.849	8.500	-7.552
	(7.127)	(7.572)	(5.589)	(6.617)	(4.004)	(8.684)	(5.328)	(0.321)	(9.520)	(5.965)
Schooling	-6.919	-10.759	-5.54	1.007	-6.764	-33.348	-27.161*	-2.383**	-27.733	-1.306
	(12.334)	(11.385)	(9.071)	(11.531)	(10.419)	(27.471)	(14.298)	(0.871)	(18.160)	(29.995)
Govt. cons.		-8.642**			-11.589**		-12.118**			3.534
		(4.157)			(5.417)		(5.826)			(8.006)
Inflation			-2.964**		-4.102**			-36.22		-48.197
			(1.092)		(1.810)			(21.586)		(43.739)
Trade openness				0.618	0.703				13.578**	-1.628
				(7.552)	(3.136)				(6.643)	(18.012)
Constant	-66.666	-32.759	-42.8	-26.195	16.982	43.091	93.894	61.820**	-66.677	86.1
	(44.566)	(51.749)	(30.126)	(53.771)	(36.535)	(61.501)	(68.684)	(28.191)	(101.986)	(79.016)
Observations	697	696	697	697	696	657	656	657	655	655
Instruments	30	32	32	32	36	30	32	32	32	36
AR(2) test[a]	0.719	0.634	0.848	0.804	0.792	0.013	0.125	0.014	0.535	0.233
Hansen J test[b]	0.726	0.953	0.6	0.179	0.437	0.183	0.663	0.167	0.78	1
Diff-in-Han. test[b]	0.628	0.914	0.42	0.282	1.000	0.087	1.000	0.081	0.395	1.000

Notes: All regressions are two-step panel GMM, incorporating Windmeijer (2005) correction, with robust standard errors in parentheses. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. All regressions include time dummies which are not reported. All variables are in log form.P-values of the post-estimation tests are reported;(a)The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation;(b)The null hypothesis is that the instruments used are not correlated with the residuals.

Table I.15. Stock markets, banks, and growth: Iterative traditional GMM regression

Dependent Variable: Per capita real GDP growth rate								
Variable	Middle-income countries(31)				High-income countries (30)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank credit	0.958	1.535***	6.168*	1.243*	-0.203	-0.394	0.410	-0.086
	(0.625)	(0.343)	(3.283)	(0.673)	(1.247)	(1.993)	(1.595)	(1.182)
Turnover ratio	0.761***	0.288	-0.115	0.625***	-0.156	-0.122	-0.717	-0.189
	(0.144)	(0.316)	(0.722)	(0.237)	(0.307)	(0.365)	(1.034)	(0.313)
Initial income	-2.298**	-3.412***	-2.091*	-2.451***	-1.183	-1.012	1.157	-1.320
	(0.677)	(1.254)	(1.169)	(0.670)	(1.221)	(1.873)	(3.301)	(1.172)
Schooling	4.052*	6.428**	-4.485	4.290**	-5.735**	-5.855*	-4.069	-4.101
	(2.226)	(3.249)	(4.685)	(2.187)	(2.490)	(2.647)	(5.163)	(3.254)
Government size		-0.368				-0.613		
		(1.851)				(1.499)		
Inflation			24.459				35.843	
			(18.221)				(48.772)	
Trade openness				-0.558				0.445
				(0.514)				(0.283)
Constant	6.880**	11.218***	2.183	9.246**	28.955***	29.962***	-0.227	24.239***
	(3.485)	(3.730)	(5.297)	(4.003)	(6.557)	(6.011)	(44.860)	(8.445)
Hansen J stat	7.711	6.760	4.732	7.733	3.685	3.788	3.882	3.147
Stock & Yogo test	260.64	233.85	226.42	284.31	41.84	21.54	32.42	27.95

Notes:Robust standard errors are given in parentheses; *,**,&*** represent significance levels at 10,5,& 1%,respectively. Bank credit is instrumented by lags of Liquid liability; Turnover ratio by lags of stock market capitalization, and other controls by their lagged values; P-values of the Overidentification tests are all greater than 0.90 indicating a failure to reject a null hypothesis of No overidentification issue (overidentifying restrictions hold); Stock & Yogo's tests of weak instrument (F-values) are also greater than 10, the rule-of-thumb, and the Stock & Yogo's critical value of 11.04 at 5% significance level, indicating rejection of the null hypothesis of weak instrument.

Table I.16. Stock markets, banks, and growth: Iterative traditional GMM regression

Dependent Variable: Per capita real GDP growth rate								
Variable	Upper-Middle-income countries(20)				Lower-Middle-income countries(11)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank credit	2.813***	2.815***	-1.248	2.775**	2.380**	1.199	5.575***	3.000*
	(0.844)	(0.609)	(0.976)	(1.378)	(1.017)	(1.497)	(1.116)	(1.711)
Turnover ratio	1.309**	1.311***	2.216***	1.614**	0.134	0.374	-0.468	0.373
	(0.552)	(0.341)	(0.455)	(0.813)	(0.402)	(0.462)	(0.388)	(1.036)
Initial income	15.472***	15.517***	-5.895***	14.096***	-3.560**	-1.995	-6.327***	-2.6
	(5.602)	(5.256)	(1.961)	(4.282)	(1.469)	(2.342)	(1.144)	(2.230)
Schooling	-5.379*	-5.405	4.192	-7.659**	2.613***	1.898	4.488***	3.579**
	(3.162)	(5.222)	(3.697)	(3.354)	(0.800)	(1.385)	(1.099)	(1.600)
Government size		-0.023				2.881		
		(3.727)				(3.786)		
Inflation			-16.367				-6.282	
			(16.668)				(8.937)	
Trade openness				0.077				0.605
				(1.652)				(5.673)
Constant	-127.434***	-127.703***	42.366***	-111.444**	13.938*	0.903	21.368***	0.769
	(46.491)	(30.915)	(12.774)	(43.751)	(8.024)	(18.454)	(7.729)	(13.81)
Hansen J stat	6.4e-5	1.1e-10	7.9e-14	1.3e-11	8.364	8.202	3.578	3.274
Stock & Yogo test	207.59	210.46	164.80	139.02	42.11	43.27	39.59	22.24

Notes:Robust standard errors are given in parentheses; *,**,&*** represent significance levels at 10,5,& 1%,respectively. Bank credit is instrumented by lags of Liquid liability; Turnover ratio by lags of stock market capitalization, and other controls by their lagged values; P-values of the Over-identification tests are all greater than 0.90 indicating a failure to reject a null hypothesis of No overidentification issue (overidentifying restrictions hold); Stock & Yogo's tests of weak instrument (F-values) are also greater than 10, the rule-of-thumb, and the Stock & Yogo's critical value of 11.04 at 5% significance level, indicating rejection of the null hypothesis of weak instrument.

Table I.17. Stock markets, banks, and growth: Iterative traditional GMM regression

Dependent Variable: Per capita real GDP growth rate

Variable	European-High-income countries(18)				Non-European-High-income countries(12)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank credit	1.747***	1.936***	-1.418	1.827***	0.909	-1.609	-0.445	0.052
	(0.560)	(0.634)	(1.587)	(0.619)	(0.779)	(2.508)	(0.932)	(0.973)
Turnover ratio	-0.291	-0.517	0.155	-0.324	0.494	0.919**	0.940***	-0.745
	(0.258)	(0.622)	(0.392)	(0.290)	(0.331)	(0.370)	(0.245)	(0.758)
Initial income	-1.258	-2.077	1.837	-0.012	-2.092	-2.648**	-1.512**	-0.132
	(1.421)	(2.519)	(2.382)	(2.535)	(1.618)	(1.247)	(0.735)	(1.752)
Schooling	1.455	0.973	-2.361	3.998	-2.835	4.702	-5.820***	0.194
	(1.687)	(1.960)	(3.422)	(3.540)	(2.456)	(5.224)	(1.622)	(2.071)
Government size		1.256				-3.598		
		(2.630)				(2.771)		
Inflation			26.846				20.722	
			(50.356)				(27.328)	
Trade openness				-0.998				0.852***
				(1.127)				(0.326)
Constant	3.900	9.962	-5.907	-11.141	23.585**	30.807***	28.891***	1.549
	(12.990)	(21.756)	(20.581)	(27.262)	(11.166)	(8.760)	(8.793)	(15.667)
Hansen J stat	5.608	5.359	4.885	4.963	5.382	5.243	0.283	0.859
Stock & Yogo test	16.74	16.83	12.89	19.42	70.35	34.29	73.30	27.57

Notes:Robust standard errors are given in parentheses; *,**,&*** represent significance levels at 10,5,& 1%,respectively. Bank credit is instrumented by lags of Liquid liability; Turnover ratio by lags of stock market capitalization, and other controls by their lagged values; P-values of the Over-identification tests are all greater than 0.90 indicating a failure to reject a null hypothesis of No overidentification issue (overidentifying restrictions hold); Stock & Yogo's tests of weak instrument (F-values) are also greater than 10, the rule-of-thumb, and the Stock & Yogo's critical value of 11.04 at 5% significance level, indicating rejection of the null hypothesis of weak instrument.

CHAPTER II

ESSAY 2: FINANCIAL DEVELOPMENT, ECONOMIC GROWTH, AND CONVERGENCE CLUBS

II.1 INTRODUCTION

This study attempts to re-examine the role of financial -both stock markets and banking system-development in economic growth for a sample of 40 countries and the period 1989-2012 using a system approach with more homogeneous country sub-groups.

The finance-growth relationship has been the subject of continuous debate since the pioneering works of Bagehot (1873), Schumpeter (1934), and the later works of Goldsmith (1969), McKinnon (1973), and Shaw (1973). In particular, the King and Levine (1993a, b) study into the effects of financial development on economic growth has rekindled the interest in the subject and ever since there have been voluminous studies that examine the relationship between finance and growth. However, there is no theoretical as well as empirical consensus regarding the role financial development plays in economic growth.

On the one hand, a substantial body of the theoretical literature argues that better functioning financial system plays a proactive role in economic growth through enhancement of resource allocation (e.g. Bencivenga & Smith, 1991; Bencivenga, Smith, & Starr, 1995; Bertocco, 2008; Greenwood & Jovanovic, 1990; Khan, 2001; King & Levine, 1993a; and Morales, 2003). On the other hand, some studies contend that financial sector develops merely in response to increased demand for financial services generated by economic growth (Robinson, 1952) or has no significant contribution to growth (Lucas, 1988)[14]. At the same time, the literature debates the comparative importance of banks and securities markets in economic activity. While some studies debate that banks are relatively better (e.g. Allen & Gale, 1997, Boot & Thakor, 1997; Stiglitz, 1985), others (including Boyd & Smith, 1998; Holmstrom & Tirole, 1993) argue well-functioning markets are better at improving resource allocation and hence fostering economic growth. Still others (e.g. Levine, 1997; Merton & Bodie, 1995; Song & Thakor, 2012) emphasize on creating well-functioning banks and markets rather than on making a choice between the two. Theory also stresses that the relative merits of banks and markets varies with the stages of growth of countries, where banks have a significant contribution to growth at early stages of growth and securities markets become relatively more important as countries grow economically (e.g. Boot & Thakor, 1997; Boyd & Smith, 1998; Song & Thakor, 2012).

Empirical evidence concerning the role of financial development in economic growth is also inconclusive. Many cross-country and panel data studies mainly assess the role of banks, without also including stock markets, in boosting economic growth (Beck, Levine, & Loayza, 2000; Bordo & Rousseau, 2012; Deidda & Fattouh, 2002; Favara, 2003; King & Levine, 1993a, b; Levine, Loayza, & Beck, 2000; Loayza & Ranciere, 2006; Rioja & Valev, 2004; Rousseau & Wachtel, 2002, among others). In the absence of control for stock markets, it is difficult to assess if financial intermediaries and markets have independent effects on growth and if the relationship between financial intermediaries and growth still holds after controlling for stock market development. A number of empirical works, including but not limited to Arcand, Berkes, and Panizza (2012); Beck and Levine (2004); Deidda and Fattouh (2008); Demirguc-Kunt, Feyen, and Levine (2013); Levine and Zervos (1998); Rousseau and Wachtel (2000, 2011); and Saci, Giorgioni, and Holden (2009) attempt to overcome this shortcoming by simultaneously examining the causal effects of stock markets and banks on growth. Although some of the studies employ better statistical techniques than others to identify the causal effect of banks and stock markets on growth, most of them pool together heterogeneous countries and assess the causal effects of banks and markets on growth in one pass. This may not be very informative as it is likely that financial intermediaries and markets may have

[14]Levine (1997, 2005) and Beck (2011, 2013) provide thorough review of the literature.

quite different impacts on growth depending on the structural characteristics, including stage of economic development, of the countries concerned.

Panel regressions that do not attempt to account for heterogeneity of cross-sectional observations conceal the likely differential growth effects of financial development that emanate from differences in the structural characteristics and stages of economic development of countries, among other factors. As a result, these studies will have less policy relevance. Few of the studies that find evidence of a differential effects of financial depth on growth include Arcand et al., 2012; Deidda and Fattouh, 2002; and Rioja and Valev, 2004. Rioja and Valev (2004), dividing countries into three regions-as low, medium, and high financial development regions depending on if the ratio of the private credit to GDP is below 14%, between 14-30%, and above 30%, respectively, show that while there is no statistically significant relationship between financial depth and growth in low regions, there is a positive and statistically significant, albeit declining, effect of financial depth on growth in the middle and high regions. Arcand et al. (2012) also show that intermediate levels of financial depth have positive effect on growth, but very high levels, measured by private credit to GDP ratio in excess of 80%, can lead to deterioration of growth[15]. These studies indicate the difficulty of setting clear cut threshold levels of financial development indicators in analyzing the non-monotone effects of financial development on growth (note that the highest level of private credit to GDP ratio for "high regions" is set at in excess of 37% in Rioja and Valev whereas the corresponding value is in excess of 80% in Arcand et al.)[16].

Against this backdrop, this study attempts to assess the possibly differential growth effects of financial- both stock markets and banking system- development for a panel of 40 countries over the period 1989-2012. Towards this goal, we proceed in two steps. First, we apply a regression based club convergence test, suggested by Phillips and Sul (Econometrica, 75(6): 1771-1855, 2007), to examine if countries can be sorted into more homogeneous subgroups based on the transitional behavior of their respective per capita real GDP. In the second part, we apply dynamic panel GMM

[15]Deidda and Fattouh (2002) also, using threshold regression, show that financial depth has a positive and statistically significant growth impact only beyond a certain threshold level.

[16]The challenge is more vivid if we have to use different indicators of financial development as there is no single best indicator of financial development in a country.

and traditional GMM to investigate the effects of stock markets and banks development on economic growth of each convergence club. Specifically, this study differs from others in three ways: (1) it controls for both stock markets and banks and employs the most recent available annual data set to a group of 40 countries over the period 1989-2012; (2) it employs regression based convergence test, suggested by Phillips and Sul (2007), henceforth PS, to test if subgroup of countries exhibit similar convergence patterns and hence form convergence clubs. This method has numerous advantages over other convergence tests. It can accommodate cases where a long-run co-movement between series exists irrespective of the existence of cointegration between the series, whereas the conventional cointegration and unit root tests will typically have low power in detecting the asymptotic co-movement between series; it is based on a general nonlinear time-varying factor model and can detect convergence even in cases of temporary divergence or heterogeneity unlike conventional stationarity tests; it does not rely on any particular assumption regarding trend stationarity or stochastic non-stationarity; even in cases of rejection of the null hypothesis of full panel convergence to a common steady state, the methodology allows us to identify if countries convergence to multiple steady states at the same time or if they diverge; (3) it applies both dynamic panel GMM and traditional GMM to a system of growth equations of more homogeneous convergence clubs identified in the study to produce more policy relevant findings. The dynamic panel GMM model controls for simultaneity, omitted variable bias and endogeneity issues. Econometric theory also shows that the traditional GMM applied to a system of growth equations of relatively homogeneous countries, with cross-equation restrictions, produces more efficient outcomes compared to panel regression methods as it utilizes more information in the variance-covariance matrix of the residuals; it continuously updates the estimates until some sort of convergence has been achieved; allows us to correct for both heteroscedasticity and autocorrelation in the error terms; and it does not depend on any strong distributional assumption.

The club convergence test identifies four convergence clubs, two each for HICs and MICs. Both dynamic panel and traditional GMM regression results show that financial development, particularly banking system development, has differential growth impact depending on the fundamentals and stages of development of the countries analyzed. The regression results show that (i) size of credits issued to the private sector and stock market liquidity have strong positive impacts on economic growth of the two clubs of MICs (Clubs 3 & 4); (ii) while stock market liquidity exerts robust and positive influence on both clubs of HICs, the effects of credits differ. For Club1 of HICs -mainly European countries- credit issued to private sector is found to strongly enhance economic growth. For Club2 of HICs, including some of the most advanced economies with most active and largest stock markets and banks- USA, Japan, Australia, and Great Britain, to mention a few-credits extended to the private sector can undermine economic growth.

Our finding of differential growth impact of financial development, particularly of banking system development, is in line with the findings of recent panel studies, including Arcand et al. (2012) and Rioja and Valev (2004) that also conclude that financial deepening has a non-monotone growth effect.

The rest of the paper is organized as follows: Section 2 provides information about the data and measurement, while section 3 presents concepts of panel unit-root tests and test results. Section 4 introduces Log t club convergence test and provides the test results. Section 5 discusses the empirical regression models and the results. Section 6 concludes the paper.

II.2 DATA AND MEASUREMENT

II.2.1 The Data

To examine the potentially different growth impacts of financial -both stock markets and banking system- development, we employ a panel of 40 Countries for which we have complete stock market data for the period 1989-2012. The dataset includes both High-income (19) and Middle-income (21) countries. We use annual data that allows us to exploit the time-series dimensions of the data and analyze both the high frequency relationship between financial development and economic growth and the long-run behavior of real per capita income of the countries. The source of the financial system indicators is the World Bank's "Financial Structure and Development data Base"[17] whereas all the control variables, with the exception of schooling which is from Barro & Lee's (2010) data base, are from the electronic version of World Bank's *World Development Indicators*.

II.2.1.1 Financial system indicators

Well-functioning financial systems mitigate market frictions and spur economic growth though provision of information about investment opportunities, monitoring of investments, diversification and sharing of risks, pooling and mobilization of savings, and facilitation of exchange of goods and services. However, there is no one best indicator that shows the extent to which banks and stock markets provide these services across a number of countries. As a result, we rely on multiple standard measures of the size and activity of banks and stock markets[18].

[17]Whenever available, the financial system indicators are updated using the original sources: Standard & Poor's *Emerging Stock Markets/ Global Stock Markets Factbook* for stock market measures, and IMF's *International Financial Statistics Yearbook* for banking system measures.

[18]Indicators employed by King & Levine (1993) and all major studies thereafter.

To measure stock market development, we use three measures: TURNOVER RATIO, VALUE TRADED, and MARKET CAPITALIZATION. TURNOVER RATIO equals the value of the traded shares in domestic stock market divided by total value of listed shares, and it measures liquidity of the stock market relative to its size. TRADED VALUE equals the value of all (domestic) shares traded in the (domestic) stock market divided by GDP, and it measures how active the stock market is relative to the size of the economy. MARKET CAPITALIZATION equals the total value of listed shares in the stock market divided by GDP, and it measures the size of the market relative to the economy. Theory predicts that more liquid/active markets facilitate efficient allocation of resources and foster growth.

Table 1 presents summary statistics of the indicators. As we can see, there is a huge cross-country variation in these measures. For instance, the turnover ratio averages about 60% (82% in HICs and 40.8% in MICs), where Luxembourg had the minimum value of 0.145% in 2011 and Pakistan had the maximum value of 497% in 2003. The traded value also varies from a minimum of 0.017% in Nigeria in 1989 to a maximum of 435% in USA in 2008, with the average equal to 40% for the full sample (63% in HICs and 19% in MICS). The average size of the stock market is about 61% of GDP (75.4% in HICS and 47.5% in MICS). In general, the HICS have the largest and most active stock markets while the lower MICS have the least active markets, relative to the total sample.

To measure banking system development, we use BANK CREDIT, PRIVATE CREDIT, and LIQUID LIABILITIES. BANK CREDIT equals total credit extended by deposit money banks to the private sector as a share of GDP. It excludes credits by other financial institutions and to the government and public enterprises. PRIVATE CREDIT equals credit issued by deposit banks and other financial institutions (excluding central banks) to the private sector divided by GDP. These two measures were almost identical until the late 1990s but they started diverging at the beginning of the new millennium (Arcand et al. 2012). Higher levels of each could represent higher levels of financial services to the private sector and thus greater financial intermediary development. However, it could also show over-lending, which could deter growth.

LIQUID LIABILITIES equals the ratio of liquid liabilities of financial system (currency plus demand and interest-bearing liabilities of banks and other financial institutions) to GDP or the ratio of broad money to GDP (M3/GDP). It measures the overall size of the financial intermediary sector. This measure is commonly used in the literature under the assumption that the size of the sector is directly correlated with the financial services it renders. However, it does not necessarily measure the degree to which financial institutions overcome the adverse effects of information asymmetry and transaction costs and provide effective service. All the financial system indicators are deflated by end-of-period prices and their average is divided by GDP that is deflated by annual CPI.

A look at Table 1 shows the variation in banking system measures across the sample. The bank credit, for example, averages about 69% of GDP (100% in HICs and about 41% in MICs), with the minimum credit of about 7% issued by deposit banks in Peru in 1991 and the maximum amount of about 224% extended by banks in Denmark in 2009. The private credit also averages about 76% of GDP (110.5% and 45.5% in HICs and MICs, respectively). Liquid liabilities ranges from a minimum of 8.6% in Peru in 1989 to a maximum of 399% in Luxembourg in 2008, with the average being 74% (100% in HICs and 51% in MICs).

II.2.1.2 Other variables

As is standard in the literature on finance-growth nexus, we include the following control variables that have been shown empirically to have robust growth effects: lagged values of real per capita GDP to capture the tendency for growth rates to converge across countries and overtime and also to control for serial correlation; average years of schooling in population 25 years of age or older to control for human capital accumulation; the ratio of total government final consumption expenditure (government size) & inflation rate-CPI (both measure macroeconomic stability); and sum of imports and exports as a fraction of GDP (trade openness).

The correlation tables (Tables 2 and 3) show that for MICs growth is positively correlated with all financial measures and the correlation is significant in the case of all stock market measures. On the other hand, all banking system measures are negatively and significantly correlated with growth while stock market traded value and market capitalization are positively and significantly correlated with growth in the case of the HICs[19]. Summary statistics for individual countries is given in Table 4.

[19] At the same time, the banking system and stock market measures are generally significantly correlated to each other for both sets of countries (especially in the case of MICs), implying that our model that controls for both bank and stock markets measures may offer conservative estimates of the role of banks and stock markets in economic growth than if only one measure is used as a regressor.

II.3 PANEL UNIT ROOT TEST

II.3.1 The Model

Before we analyze the presence of converging income clubs and a long-run relationship between financial development and economic growth, we first test for the presence of unit roots in the cross-sectional units of our panel using panel unit root test procedures. The panel unit root tests combine both the cross-sectional and time-series dimensions of the data and hence are superior to the univariate unit root test procedures, which suffer from low power.

Let y_{it} be the observation on the i^{th} cross-section unit at time t and assume it evolves according to:

$$y_{it} = \eta_i + x_{it} \tag{1}$$

$$x_{it} = \phi_i \; x_{it-1} + \mu_{it} \tag{2}$$

Where $i = 1, 2, ..., N$; $t = 1, 2, ..., T_i$. η_i represents deterministic component including any individual intercepts (or individual time-trends or both) and ϕ_i is the cross-section specific autoregressive coefficient.

Combining equations (1) and (2), we can have the expression for the observable variables:

$$y_{it} = \phi_i \; y_{it-1} + (1 - \phi_i)\eta_i + \mu_{it} \tag{3}$$

A test for the presence of a unit root in our panel is represented by the null hypothesis $H_0 : \phi_i = 1$ for all i against the possibly heterogeneous alternatives, $H_1 : \phi_i < 1$,$i = 1, 2, ..., N_1$;$\phi_i = 1$,$i = N_1 + 1$,$N_1 + 2, ..., N$.

The classical panel unit root tests, also known as the first generation panel unit root tests, assume independent units y_{it}; i.e; the individual time-series in the panel are assumed to be cross-sectionally independently distributed. If the panel features cross-section dependence, the first generation tests suffer from serious size distortions (Pesaran, 2007; Strauss & Yigit, 2003 demonstrate some examples). Economic variables, including real per capita GDP, are often characterized by co-movement and there are a number of causes for cross-section dependence in our panel: global common shocks with heterogeneous impact across countries, such as the global financial crisis from 2007 onwards, or local spillover effects between countries or regions. The ample empirical evidence on the presence of cross-section dependence led to the rejection of the first generation tests, which are based on restrictive assumptions particularly in the context of heterogeneous panels with cross-section dependence, in favor of what is termed as the second generation panel unit root tests that allow for cross-sectional dependence among units of our panel.

Pesaran proposes a panel unit root test procedure that accounts for cross-sectional dependence among the units of a panel as follows: He builds on the assumption that the error terms μ_{it} in equation (3) follow a single common factor structure:

$$\mu_{it} = \gamma_i \ \mathrm{f}_t + \epsilon_{it} \tag{4}$$

Where f_t, the unobserved common effect, is always assumed to be stationary and impacts the cross-section time-series with a fraction determined by the individual specific factor loading γ_i. ϵ_{it}, the individual specific (idiosyncratic) error are assumed to be i.i.d. across i and t with $E(\epsilon_{it}) = 0, E(\epsilon_{it})^2 = \sigma_i^2$ and $E(\epsilon_{it})^4 < \infty$. Furthermore, ϵ_{it}, f_t and γ_i are mutually independently distributed for all i.

Equations (3) and (4) can be written as:

$$\Delta y_{it} = \alpha_i + \beta_i \ y_{it-1} + \gamma_i \ f_t + \epsilon_{it} \tag{5}$$

Where, $\alpha_i(1-\phi_i)\eta_i, \beta_i = -(1-\phi_i)$ and $\Delta y_{it} = y_{it} - y_{it-1}$. The unit root hypothesis of interest, $\phi_i = 1$, can now be expressed as:

$$\mathcal{H}_0 : \beta_i = 0 \text{ for all i} \tag{6}$$

Against the possibly heterogeneous alternatives,

$$\mathcal{H}_1 : \beta_i < 0, i = 1, 2, ..., N_1; \beta_i = 0, i = N_1 + 1, N_1 + 2, ..., N \tag{7}$$

Thus, the cross-section dependence arises due to the common factor, which can be approximated by the cross-section mean $\bar{y}_t = N^{-1}\sum_{i=1}^{N} y_{it}$.

Pesaran (2007) proposes the cross-sectionally augumented Dickey-Fuller regression (CADF) based on the following equation:

$$\Delta y_{it} = \alpha_i + b_i y_{it-1} + c_i \overline{y_{t-1}} + \sum_{j=0}^{p} d_{ij} \Delta \overline{y_{t-j}} + \sum_{j=1}^{p} \delta_{ij} \Delta y_{it-j} + e_{it} \qquad (8)$$

That is, CADF asymptotically filters out the unobserved common factor by augmenting the standard ADF with the cross-section averages of lagged levels and first-differences of the individual series[20].

The test for the presence of a unit root can now be conducted on the basis of the t-values of b_i either individually or in a combined fashion. The first statistic is denoted as CADF$_i$ statistic while the latter resembles the familiar IPS statistic of Im, Pesaran and Shin (2003) and is constructed as:

CIPS= $\text{N}^{-1}\sum_{i=1}^{N} CADF_i$ (9)

That is, using the $\tilde{t_i}$ t-statistic for b_i, the cross-sectionally augmented version of the IPS test (known as CIPS) is constructed as:

CIPS(N,T)=$\bar{t}$ =$\text{N}^{-1}\sum_{i=1}^{N} \tilde{t_i}(N,T)$ (10)

Pesaran investigates the performance of the CADF$_i$ and CIPS tests by means of Monte Carlo simulations and shows that these tests have satisfactory size and power even for relatively small values of N and T, i.e., even in the case of N=T=10. Pesaran also provides critical values based on simulations for the CADF and CIPS-distributions for three cases (no intercept and no trend, intercept only, intercept and trend). Due to this small sample properties, we find Pesaran test appealing for application to the present study.

[20]The ADF test takes potential serial correlation in the error term into account by introducing lagged terms of the dependent variable.

II.3.2 Test Results

Table 5 depicts CIPS unit root test results, with IPS test results also included for comparison. As can be seen, the CIPS test-for the full sample and the two income groups- shows that all variables contain unit roots, with the exception of schooling variable[21] . The IPS test also shows presence of unit roots in all of the banking system and stock market measures for the full sample and the two income groups, with the exception of rejection of the null of unit roots in stock market capitalization for the full sample and MICs, and in turnover ratio for MICs. The IPS test also rejects the null of unit roots in inflation and trade openness for all country groups.

[21] The schooling data is only available for every five year period and does not show much variation over time.

II.4 Log t CLUB CONVERGENCE TEST

II.4.1 Concepts of Convergence

The growth literature identifies three complementary and competing hypotheses of convergence: σ-convergence (sigma), β-convergence (Beta), and club convergence (Barro & Sala-i-Martin, 1992, 2004; Galor, 1996; Sala-i-Martin, 1996). σ-convergence refers to the tendency for the dispersion of per capita real income across groups of economies to fall over time (Sala-i-Martin, 1996). This concept refers to the decline in cross-country inequality in per capita real income. β-convergence implies that in the long-run, independent of initial conditions, per capita incomes of countries converge to one another. This β-convergence can be absolute or conditional. Absolute β-convergence postulates that poor economies tend to grow faster per capita than rich ones, without conditioning on any other characteristics of economies. Conditional β-convergence, however, argues that convergence takes place only if we allow for heterogeneity across economies; i.e., convergence is conditional on the converging countries having similar structural characteristics (production technology, preferences, government policies, etc) (Barro & Sala-i-Martin, 2004). We say there is β-convergence in a cross-section of economies if we find a negative relationship between the growth rate of per capita income and the initial level of income. Hence, while σ-convergence studies how the distribution of income evolves over time, β-convergence studies the mobility of income within the same distribution (Sala-i-Martin, 1996).

Club convergence hypothesis, on the other hand, argues that per capita incomes of countries converge to one another in the long-run provided that the countries have both similar structural characteristics and initial conditions (Galor, 1996). This hypothesis implies that although economies are similar in their structural characteristics, they may however converge to different steady state equilibria if they differ in their initial conditions. In the words of Galor, "...countries with similar fundamentals that are in the same basin of attraction to a given steady-state equilibrium will converge in the long run". The economies that approach the same steady state equilibrium are said to form a convergence club. According to Galor, while conditional convergence imply a globally stable, steady-state equilibrium, club convergence implies multiple locally stable steady-state equilibria.

A number of econometric techniques have been used to test the club convergence hypothesis. In early studies, the conventional β-convergence was used with subsets of countries and estimates were compared against convergence rates of the full sample. For instance, Durlauf and Johnson (1995) cluster countries into subgroups based on the countries' initial level of income and human capital and compare the β-convergence tests of each group to the overall sample to identify existence of multiple regimes. The problem in attempting to test for club convergence in this manner arises from the difficulty of obtaining grouping criteria that are exogenous to the determinants of steady state as differences in the latter can also lead to differences in equilibrium (Islam, 2003). The conventional β-convergence, estimated using augmented Solow regression, also results in biased and inconsistent estimates in the presence of heterogeneous technological progress, as it treats technological change as part of the error term, which could be correlated with the explanatory variables and hence suffer from omitted variable and endogeneity biases (Islam, 2003; Phillips & Sul, 2009).

Recent developments in club convergence tests identify clubs via endogenized groupings, where factors that may have led to multiple steady states are left unspecified (e.g. Hobijn & Franses, 2000; Phillips & Sul, 2007). This way, we avoid the challenge of a priori identifying exogenous clustering criteria. This latter method also focuses on the cross-sectional distribution of per capita income levels, which is analogous to the notion of σ-convergence[22], and hence focus us on detecting if economies converge toward one another, unlike the β-convergence where we focus on within dimension of economy[23]. One such method involves the use of cointegration and unit-root tests, which is based on the examination of the time-series properties of log-level inter-economy differences in

[22]Phillips and Sul (2007) discuss that existing convergence tests based on the concept of σ-convergence claim under growth convergence the cross-sectional variance should be stationary; however, this cross-sectional variance can manifest non-stationary characteristics depending on whether the individual convergence rate is slower or faster than the divergence rate of the common growth factor.

[23]Quah (1996) also argues for methods that focus on the cross-sectional distribution of variable and suggests the distributional approach based on Kernel density estimation.

per capita income. Although these tests may not support cointegration between two series, it does not mean there is an absence of co-movement or convergence between the series. Specifically, the conventional cointegration tests (e.g. Hobijn & Franses, 2000) will typically have low power in detecting the asymptotic co-movement and hence may erroneously reject the convergence hypothesis[24].

The logt convergence test, a regression based convergence test suggested by Phillips and Sul (2007) (discussed below), on the other hand, accommodates cases where a long-run co-movement in series exists regardless of the existence of cointegration. This method can be interpreted as an asymptotic cointegration test that does not suffer from the small sample problems of conventional cointegration and unit-root tests (Panopoulou & Pantelidis, 2009). The methodology also has numerous other advantages over existing convergence tests. Given that it is based on a general nonlinear time-varying factor model, it can detect convergence even in cases of transitional divergence or heterogeneity, where as other methods like stationarity tests fail. The methodology also does not rely on any specific assumption regarding trend stationarity or stochastic non-stationarity. As we will see below, in case of rejection of the null of full panel convergence to a common steady state, the methodology allows us to identify if countries converge to multiple steady states at the same time or if they diverge.

II.4.2 Log t Convergence Test

II.4.2.1 The model

We analyze the transitional behavior of per capita real income among 40 countries for the period 1989-2012 by means of a regression based convergence test, developed by Phillips and Sul (Econometrica, 75(6): 1771-1855, 2007) (henceforth PS).

Let us represent log of per capita real GDP by the variable X_{it}, where $i = 1, 2, ..., N$ and $t = 1, 2, ..., T$ denote the number of countries and the time period, respectively. X_{it} is decomposed into two components, one systematic, g_{it}, and the other transitory, a_{it}, as follows:

$$X_{it} = g_{it} + a_{it} \tag{11}$$

[24]See Phillips and Sul (2007) for further detail.

Specification (11) may contain a mixture of both common and idiosyncratic components in the two elements and PS transform it so as to separate these common and idiosyncratic components in our panel as follows:

$X_{it} = (\frac{g_{it}+a_{it}}{\mu_t})\mu_t = \delta_{it}\mu_t$ for all i and t (12)

Where μ_t is a common component and δ_{it} is a time-varying idiosyncratic element. The idiosyncratic component, δ_{it}, measures the relative share in common trend component, μ_t, of country i at time t (or is a measure of economic distance between X_{it} and common trend component μ_t).

This representation enables testing convergence by testing whether the factor loading δ_{it} converges to a constant, δ, by taking ratios instead of differences and thus factoring out the common trend component. That is, PS construct the relative transition coefficient, h_{it}, as

$h_{it} = \frac{X_{it}}{N^{-1}\sum_{i=1}^{N} X_{it}} = \frac{\delta_{it}}{N^{-1}\sum_{i=1}^{N}\delta_{it}}$ (13)

h_{it} measures the transition path for real GDP per capita of country i relative to the panel average at time t. By construction, the cross-section mean of h_{it} is unity. Besides, if the factor loading coefficients δ_{it} converge to δ, then the relative transition parameters h_{it} converge to unity and the cross-sectional variance of h_{it} (H_t) converges to zero as $t \to \infty$:

$H_t = N^{-1}\sum_{i=1}^{N}(h_{it-1})^2 \to 0$ as $t \to \infty$ (14)

In order to specify the null hypothesis of convergence PS model δ_{it} in a semiparametric form that allows for heterogeneity over time and across countries as:

$\delta_{it} = \delta_i + \frac{\sigma_i \xi_{it}}{L(t)t^{\alpha}}$ (15)

Where δ_i is fixed, σ_i is an idiosyncratic scale parameter, ξ_{it} is iid (0,1) across i, L(t) is a slow varying function, such as log(t) for which $L(t) \to \infty$ as $t \to \infty$, and α is a decay rate, the rate at which cross-sectional variation over the transitions decays to zero over time. One role of L(t) in (15) is to ensure that convergence holds even when $\alpha = 0$, although likely at a slow rate.

The formulation ensures that δ_{it} converges to δ_i for $\alpha \geq 0$, which therefore becomes a null hypothesis of interest, which can be written as:

$\mathcal{H}_0 : \delta_i = \delta$ *and* $\alpha \geq 0$ against the alternative

$\mathcal{H}_A : \delta_i \neq \delta$ for some i and/or $\alpha < 0$ (16)

The null hypothesis implies convergence for all countries, which includes different transitional patterns- including temporary divergence and heterogeneity, for economies i and j[25] . The alternative hypothesis implies no convergence for some countries and can accommodate either overall divergence or club convergence. PS show that under convergence, H_t has the following limiting form:

$$H_t \sim \frac{A}{L(t)^2 t^{2\alpha}}, as \quad t \to \infty \tag{17}$$

Where A is a strictly positive constant.

To test for convergence, PS suggest first constructing the cross-sectional variance ratio (H_1/H_t), where H_1 (for $t = 1$) represents variation at the beginning of the sample and H_t, variation for every point in time $(t = 1, 2, ..., T)$. The authors take log of this ratio to measure the distance of the panel from the common limit and then test the null hypothesis in the context of the following regression, which they label 'log t' convergence test (as the t-statistic refers to the coefficient of the logt regressor in the equation):

$$log(H_1/H_t) - 2logL(t) = \hat{a} + \hat{b}logt + \hat{\mu}_t \tag{18}$$

For $t = [rT], [rT] + 1, ..., T$, where $L(t) = log(t)$ and $r > 0$.

r denotes a fraction of the initial sample that is removed before running the regression so as to minimize the effects of the initial conditions and hence focus on the latter part of the sample data[26]. Based on extensive Monte carlo simulations, PS suggest using $r = 0.3$ for sample sizes beneath T=50, as it is satisfactory in terms of both size and power properties of the test. The second term on the left, -2log L(t), plays the role of a penalty function and improves test performance[27].

Under the null hypothesis of convergence, the fitted coefficient on log t, $\hat{b}$, converges in probability to the scaled speed of convergence parameter $2\hat{\alpha}$, where $\hat{\alpha}$ is the estimate of α in $\mathcal{H}_0$. The t-statistic in our regression is constructed in the usual way using HAC standard errors and we apply a one-sided t-test to test the inequality of the null hypothesis $\alpha \geq 0$[28]. We reject the null hypothesis if

[25] That is, this method by PS enables to detect convergence even in case of temporary divergence, where other methods like conventional cointegration tests fail. For detail, refer Phillips and Sul (2007).

[26] Phillips and Sul (2007) argue that "This data trimming focuses attention on the latter part of the sample data, validates the regression equation in terms of the asymptotic representation of the transition distance, and ensures test consistency in growth convergence applications".

[27] Inclusion of the term, -2 log L(t), serves as a penalty that helps the test on the coefficient of the log t regressor to discriminate the behavior of the dependent variable under the alternative from that under the null.

[28] Since α is a scalar, the null can be tested using a simple one-sided t-test.

$t_{\hat{b}} < -1.65$ (5% significance level).

If the null of convergence is rejected for the overall sample, we proceed to examine if subgroups of countries form convergence clubs employing the club convergence algorithm suggested by PS. The algorithm has four steps, which are briefly described below (Appendix III.3 provides detailed description from Phillips & Sul, 2007). First, we order the countries in descending order due to the final income or the average of the last half period of incomes. Second, by means of the logt test, we form a core group of countries. Third, we sieve the data for new club members, where we add one country at a time to the core group and run logt test until we form a convergence club for which $t_{\hat{b}}$ is larger than -1.65. Fourth, we run the logt test for the countries not selected in step 3 and see if $t_{\hat{b}} > -1.65$ on this group. If so, conclude that there are two convergence clubs. If not, repeat steps 1 to 3 to see if the remaining countries can be subdivided into convergence clusters. If no convergence clubs are found, conclude that those countries diverge.

II.4.2.2 Test results

When applying the logt regression test[29]to the log of real GDP per capita of 40 countries over the period 1989-2012, the null hypothesis of full panel convergence is rejected at the 5% significance level. As can be seen in panel A of Table 6, the point estimate of b, -3.210, and the corresponding t-statistics show that the parameter is significantly less than zero, implying that countries do not converge to a single common steady state. As a result, we proceed to the implementation of the club convergence algorithm described above to examine if there are any subgroup of countries that converge. The results, presented in Panel A of Table 6, indicate two converging clubs and no evidence of diverging countries.

As can be seen, the two clubs consist of 22 & 18 member countries, respectively, and there is an apparent regularity in membership. The HICs tend to cluster with other HICs and the MICs with other MICs. 68% & 32% members of club1 are MICs and HICs, whereas 33% & 67% of members

[29]Given that our focus is the long run behavior of per capita real GDP, we first remove the business cycle component of our data using the Hodrick-Prescott smoothing filter (Hodrick & Prescott, 1997), as suggested by Phillips & Sul (2007).

of club2 are MICs and HICs, respectively[30]. Based on this, we first categorize our data set into two income groups- HICs and MICs, and then apply the logt regression to examine if convergence patterns appear under each income group. Grouping our data set into clusters with similar economic characteristics also makes sense given that we, in the next chapter, attempt to explore the possibly differential effects of financial development on economic growth.

Once again, we first employ the logt test to a panel of 19 HICs and 21 MICs to detect if all countries in each income group converge to their respective common steady states. The results, presented in Panels B and C of Table 6, indicate that full panel convergence does not hold for either income group. Subsequently, we proceed to the convergence club classification procedure, where the algorithm classifies each income group into two clusters with no country that diverges. For HICs, countries in Club1 converge at a higher rate than countries in Club2 and have a relatively smaller real GDP per capita than members of Club2. Club1 Members of MICs (which includes some of the fast growing countries like Brazil, India, and Republic of South Africa, which form part of the BRICS countries) also converge at a much higher rate and have a smaller real GDP per capita than their counterparts in Club2. Generally, the highest convergence rate belongs to the MICs (Club1).

Next, we examine whether neighboring members of each club for each income group exhibit a tendency for transitioning between clubs. For this purpose we apply logt test to λ_1 fraction of the lower income members in the upper club together with λ_2 fraction (we set $\lambda_1 = \lambda_2 = 0.5$, when feasible) of the higher income members in the lower club,following Phillips and Sul (2009). The results are presented in the last rows of Panels B and C. As indicated, there is no evidence of transitioning between clubs for the MICs ($\hat{b}$ = -0.557, $t_{\hat{b}}$ = -25.550). However, the results support transitioning between clubs for the HICs ($\hat{b} = 0.001$, $t_{\hat{b}} = 0.022$). This latter finding may imply either the tendency for some countries to move from one convergence club to the other or that the clubs are slowly converging to one another, a possibility which seems to be confirmed by the transition paths of the clubs (depicted in Figure 1). Phillips and Sul (2009) find similar results in their analysis of the transition behavior of per capita income of 152 countries over the period 1970 to 2003.

[30] We also test if the 31.8% of HICs in club1 can form a convergence club with the 33.3% of MICs in club2 to examine transitioning between groups and the logt coefficient, -0.770, and t-stat -45.091, reject the null of convergence between the two.

Figures 1 and 2 display the relative transition paths of log real GDP per capita for the two clubs of HICs and MICs, respectively, computed as the cross-sectional mean of the relative transition paths of the members of each club, after eliminating business cycle components[31]. As can be seen, there is a marked heterogeneity in the relative transition paths of these two groups of countries. In case of HICs, although there was heterogeneity between the two clubs at the start of the study period, there is a clear reduction in dispersion of the transition curves over time, as both curves narrow towards unity over time. In the case of MICs, however, the dispersion is continuously widening and there is evidence of further divergence in the transition paths of the two clubs.

[31] Following Phillips and Sul (2007), we employ Hodrick-Prescott smoothing filter which is suitable when the time series are short and is also flexible as it requires only the input of a smoothing parameter and no prior specification of the nature of the common trend in per capita real GDP.

II.5 METHODOLOGY AND EMPIRICAL EVIDENCE

II.5.1 The Model

To assess whether stock markets and banks have economically and statistically significant causal effects on economic growth, we employ a modified version of Barro (1991) growth model of the form:

$$y_{i,t} = \sum_{j=1}^{p} \alpha_j y_{i,t-j} + \mathbf{W}_{i,t}\gamma + \tau_t + \mu_i + \epsilon_{i,t} \quad ; \tag{19}$$

Where, $y_{i,t}$ is the logarithm of real per capita GDP in country i at time t, $\mathbf{W}_{i,t}$ is a set of explanatory variables, including measures of stock markets and bank development,τ_t stands for time-specific effects, μ_i represents time invariant country-specific effects, and $\epsilon_{i,t}$ is the idiosyncratic shocks. With some modification, (19) becomes:

$$\Delta y_{i,t} = (\alpha_1 - 1)y_{i,t-1} + \sum_{j=2}^{p} \alpha_j y_{i,t-j} + \mathbf{W}_{i,t}\gamma + \tau_t + \mu_i + \epsilon_{i,t}; \tag{20}$$

The lagged values of real per capita GDP ($y_{i,t-j}$) enter the right-hand side to control for serial correlation, with different lag length (p) for each country group[32]. To remove the unobserved common time effects, which are correlated with lagged real per capita GDP, we cross-sectionally demean all the variables.

We apply dynamic panel system GMM and traditional GMM models to (20) with cross-sectionally demeaned data. Although we remove the common time-effects from the model, the lagged per capita income and other controls could still be correlated with the error term. To overcome this

[32]The lag length for each country group is determined using General-to-specific decision criterion.

endogeneity issue, our regression models employ valid instruments.

II.5.1.1 Dynamic panel system GMM

After cross-sectionally demeaning the data, (20) can be rewritten as:

$$y_{i,t} = \alpha_1 y_{i,t-1} + \sum_{j=2}^{p} \alpha_j y_{i,t-j} + \mathbf{W}_{i,t}\gamma + \mu_i + \epsilon_{i,t}; \tag{21}$$

Dynamic panel system GMM removes the time-invariant country fixed effects by taking first difference of (21) as follows:

$$\Delta y_{i,t} = \alpha_1 \Delta y_{i,t-1} + \sum_{j=2}^{p} \alpha_j \Delta y_{i,t-j} + \Delta\mathbf{W}_{i,t}\gamma + \Delta\epsilon_{i,t} \;\; ; \tag{22}$$

The model, then estimates equations in differences (22) and in levels (20), after demeaning, simultaneously under the following moment conditions (with Windmeijer correction)[33]:

$$E\ [y_{i,t-s}\Delta\epsilon_{i,t}] = 0 \quad \text{for} \quad s \geq 2; \tag{23}$$

$$E\ [\mathbf{W}_{i,t-s}\Delta\epsilon_{i,t}] = 0 \quad \text{for} \quad s \geq 2; \tag{24}$$

$$E\ [\Delta y_{i,t-s}(\mu_i + \epsilon_{i,t})] = 0 \quad \text{for} \quad s = 1; \tag{25}$$

$$E\ [\Delta\mathbf{W}_{i,t-s}(\mu_i + \epsilon_{i,t})] = 0 \quad \text{for} \quad s = 1; \tag{26}$$

Where lagged levels of explanatory variables are used as instruments in differenced equations, lagged differences of them are used as instruments in level equations. The consistency of dynamic panel GMM rests on the validity of the instruments and the assumption that the error terms do not exhibit serial correlation.

We also use two specification tests. The first relates to instruments and includes Hansen-J test of the joint validity of the instruments and Difference-in-Hansen tests of exogeneity of instrument subsets (null hypothesis that the lagged differences of the explanatory variables are uncorrelated with the residuals). The second test examines the hypothesis that the error term is not second-order serially correlated (by construction, the differenced error term is likely first-order serially correlated

[33]For detail description of the various GMM estimators, refer to Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998; Hansen, 1982; and Roodman (2009).

even if the original is not).

II.5.1.2 Traditional system GMM

The traditional GMM, on the other hand, estimates growth equation (20) as a system of equations- one per each country- with cross-equation restrictions imposed on our coefficients. The moment condition of the model can be given as:

$$E[\mathbf{Z}_{i,t}\epsilon_{i,t}] = 0 \quad , \tag{27}$$

Where $\mathbf{Z}_{i,t}$ represents a vector of our instruments. The GMM estimator, also known as Minimum distance estimator, minimizes cross-products of the moment conditions, weighted by a positive definite weighting matrix (preferably inverse of the covariance of the moments) and it corrects for both heteroscedasticity and autocorrelation in error terms.

In this model, we have instrumented bank credit (and private credit) by lags of liquid liability of the banking system, turnover ratio (and traded value) by lags of stock market capitalization, and the other controls by their respective lagged values, under the assumption that our instruments are exogenous and relevant. The motivation for the choice of instruments for our financial measures is as follows: both liquid liability of the banking system and the stock market capitalization measure the overall sizes of the banking sector and stock market, respectively, and we assume the larger the banking sector/ stock market, the better financial services- including credit service- it can render/ the more active and liquid the market becomes[34]. We then have tested both instrument exogeniety ($\text{cov}(\mathbf{Z}_i, \epsilon_i)$=0) and relevance ($\text{cov}(\mathbf{Z}_i, \mathbf{W}_i) \neq 0$) using both Hansen's J test and Stock and Yogo's weak instrument test, respectively.

Econometric theory shows that, when dealing with small sample data the traditional GMM method applied to a system of equations of homogeneous countries produces more efficient estimates than panel GMM as it utilizes more information in the variance-covariance matrix of residuals, it iter-

[34]We also instrument the bank and stock market measures by their own respective lagged values and compare results.

ates the estimation procedure until our statistical estimates from successive steps converge, and also corrects for both heteroscedasticity and autocorrelation in error terms.

II.5.2 Empirical Evidence and Discussion

II.5.2.1 OLS regression results

As a benchmark regression we first estimate equation (20) using OLS and the results are given in Table 7. Although OLS does not establish a causal relationship and suffers from endogeneity and omitted variable bias, the regression results show that the correlation between financial development and economic growth depends, at least partly, on the cluster group of countries included in our regression.

II.5.2.2 GMM regression results

Both dynamic panel and traditional GMM regression results imply that stock markets and banking system development have differential effects on economic growth of countries, depending on the structural characteristics and stages of growth of countries involved. These results are robust to the inclusion of more control variables and to the measurement of stock market and banking system development using alternative indicators.

As Table 8 indicates, bank credit enters the full sample regression with either insignificant (panel GMM) or negative and statistically significant (Traditional GMM) coefficients. The stock market turnover ratio, however, enters the regressions (both models) with statistically significant positive coefficients. The results remarkably differ, particularly for bank credits, when we apply our models to the two income sub-groups, sorted following the World Bank's Income Classification. The coefficient of turnover ratio is positive and statistically significant in the regressions of both HIC and MIC. The coefficient of bank credit, on the other hand, is negative and statistically significant in the regressions of HICs, while it is robust and positive in the regressions of MICs.

Similar results are found when alternative indicators of stock market and banking system are employed. As can be seen in Table 9, while private credit enters the full sample regression with either insignificant (panel GMM) or negative and statistically significant (traditional GMM) coefficients, the stock market traded value enters the regressions with positive and statistically significant coefficients. In case of the two income sub-groups, the traded value enters regressions of both groups with positive and robust coefficients. Private credit, however, enters HICs regressions with statistically significant negative coefficients and the MICs regressions with positive and statistically significant coefficients.

The findings indicate that stock market liquidity considerably enhances economic growth of both HICS and MICs. The size of credits issued to the private sector, nevertheless, either have no discernible effect or can even dampen growth of HICs, while they can boost growth of the MICs.

Although both dynamic panel system GMM and traditional GMM regressions produce consistent estimates, econometric theory shows that the traditional GMM applied to a system of growth equations of more homogeneous countries yields sharper and more efficient estimates (evident in regression results) as it utilizes more information in the variance-covariance matrix of residuals, iterates the estimation procedure until some sort of convergence is achieved, and also corrects for both heteroscedasticity and autocorrelation in the error terms.

Analysis of the growth impacts of stock markets and banking system development leads to more meaningful outcomes when more homogeneous countries are involved. This is evident when we apply our models to the four convergence clubs identified in the previous chapter.

The results in Table 10 depict that stock market turnover ratio enters regressions of both clubs of HICs (Clubs 1&2) with positive and statistically significant coefficients. While coefficient estimate of bank credits is positive and statistically significant for Club1, it is negative and statistically significant for Club2. The table also shows that both turnover ratio and bank credits enter regressions of both clubs of MIC (Clubs 3 & 4) with robust positive coefficients. Similar, albeit sharper, results are obtained when traditional GMM is applied to the four clubs (Table 11).

When we employ both dynamic panel GMM (Table 12) and traditional GMM (Table 13) to alternative measures of stock markets (traded value) and banking system (private credit) development, we get very consistent outcomes. While the coefficient estimate of private credit is positive and strong for Club1, it is negative and statistically significant in the case of Club2. The coefficient estimates of traded value are positive and robust for both Clubs 1 & 2. For Clubs 3 & 4, both private credit and traded value enter the regressions with statistically significant positive coefficients.

To what extent are the results influenced by the Great financial crisis that started in the beginning of 2008? We run the regressions on data covering the period 1989-2007, excluding the post-crisis period of 2008-2012. As Table 14 depicts, the results remain intact, implying that the outcomes are not simply driven by the most recent financial crisis we experienced.

The results imply that while stock market liquidity plays a strong proactive role in promoting economic growth of Clubs 1 & 2 members, the size of credit issued to the private sector significantly boosts economic growth of Club1 member countries but can slow down growth of Club2 member countries. For Clubs 3 & 4, financial development in general significantly boosts economic growth.

Club1 is dominated by European countries (5 out of 7), which are historically bank-based (i.e., primarily depend on banking system for financial services) and use strong monetary policy, in the form of inflation-targeting regime. Of the other two members, Korea also pursues inflation-targeting monetary policy- the country adopted inflation-targeting policy in 1998 and completed its transition to a full-fledged regime in 2001 (IMF, 2005). As Rose (2014) argues, banks and bond markets work best under inflation-targeting regimes and this may partially explain the results.

Club2 includes some of the most advanced economies that also boost the largest and most active stock markets, including USA, Japan, Australia, and Great Britain. The finding that the size of credits issued to the private sector can undermine economic growth of this group of countries is in line with findings of recent panel studies, including Arcand et al. (2012) and Roussueau and Wachtel (2011). Arcand et al. (2012) show that many advanced economies are characterized by excess credit (over lending), which leads to slowdown in their economic growth. Rousseau and Wachtel (2011) also show that since 1990's the role of financial deepening in economic growth is vanishing as a result of the frequent financial crises associated with it.

For Clubs 3 & 4, the robust growth effects of credits extended to the private sector and stock market liquidity may give credence to the continued effort by policy makers to promote expansion of the financial sector in developing countries as a way to accelerate economic growth. Rioja and Valev (2004) also found that financial deepening positively and strongly influences economic growth at intermediate level of financial development.

The coefficient estimates of lagged real income per capita (t-1) are all negative (between 0 and 1 in absolute value) and statistically significant in all cases, indicating strong evidence of convergence to each group's long-run steady-state following temporary shocks.

In case of the control variables, while government size and inflation enter most of the regressions with negative coefficients, trade openness assumes positive estimates. Schooling, surprisingly, enters some of the regressions with negative coefficients[35]. In balance, the control variables enter the regressions with insignificant coefficients.

The post-estimation tests support our conclusions. For dynamic panel GMM, the tests show that there is no second-order serial correlation in the transformed error terms of differenced equation and Hansen tests support validity of our instruments.

In case of traditional GMM, in addition to Hansen J stat (and p values) showing that there is no over identification issue, Stock and Yogo tests of weak instruments (F-values) are greater than 10, the rule-of-thumb, and Stock & Yogo's critical values at 5% level, indicating rejection of the null hypothesis of weak instruments.

[35]Schooling data is available only at five year intervals and does not show much variation.

II.6 CONCLUSION

The study examined the possibly differential growth impacts of financial-both stock markets and banking system-development for a sample of 40 countries during the period 1989-2012. It applied both dynamic panel GMM and traditional GMM to a system of growth equations of four more homogeneous income convergence clubs, identified using regression based club convergence test suggested by Phillips and Sul (2007).

Regression results show that stock market liquidity plays a strong proactive role in promoting economic growth of both clubs of HICs. The size of credit issued to the private sector, however, significantly boosts economic growth of club1 members while it can slow down growth of club2 members. For the two clubs of MICs, financial development in general exerts a robust growth effect.

The results imply that stock markets and banking system development have differential growth effects depending on structural characteristics and development status of countries. Hence, any study that aims at providing an empirical support to the competing theories and furthering our understanding of the finance-growth nexus is best served if focused on a more thorough examination of either homogeneous countries or individual country cases.

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APPENDICES

APPENDIX II.1 Tables for Chapter II

Table II.1. Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.
All Countries (40)				
Real GDP per capita	16830.96	17046.26	389.8133	87716.73
Economic growth	1.996	3.44	-18.045	26.5
Bank credit	69.345	47.537	6.96	223.834
Private credit	76.358	52.471	8.71	227.752
Liquid liabilities	74.221	54.927	8.622	399.114
Turnover ratio	60.423	63.373	0.145	497.402
Traded value	39.781	54.21	0.017	434.87
Mkt. Capitalization	60.735	53.447	2.218	328.876
Schooling	7.618	2.663	1.68	13.27
Govt. size	16.098	5.308	2.976	29.789
Inflation	34.546	325.232	-1.347	7481.664
Trade openness	79.436	65.831	13.753	444.1
Middle-income countries(21)				
Real GDP per capita	2857.944	2052.762	389.813	8545.382
Economic growth	2.286	3.959	-18.045	26.501
Bank credit	41.355	30.249	6.958	165.719
Private credit	45.458	36.077	8.71	167.536
Liquid liabilities	51.239	29.512	8.622	130.419
Turnover ratio	40.861	58.137	0.406	497.402
Traded value	18.881	29.965	0.017	229.707
Mkt. Capitalization	47.454	52.305	2.218	328.876
Schooling	5.875	2.122	1.68	10.8
Govt. size	13.202	4.297	2.976	25.553
Inflation	63.252	447.13	-1.167	7481.664
Trade openness	67.414	39.811	13.753	220.407
High-income countries(19)				
Real GDP per capita	32274.82	12348.1	8125.747	87716.73
Economic growth	1.676	2.722	-9.403	12.015
Bank credit	100.281	43.867	27.92	223.834
Private credit	110.512	46.232	27.938	227.753
Liquid liabilities	99.622	64.533	35.195	399.114
Turnover ratio	82.045	61.936	0.145	404.067
Traded value	62.881	64.675	0.209	434.871
Mkt. Capitalization	75.414	50.843	4.471	323.656
Schooling	9.544	1.698	5.07	13.27
Govt. size	19.299	4.406	8.211	29.788
Inflation	2.818	2.438	-1.347	20.404
Trade openness	92.724	83.935	15.924	444.1

Note: Except real GDP per capita and Schooling, all variables are expressed as percentage values.

Table II.2. Correlations, Middle-income countries

	Econ. growth	Bank credit	Private credit	Liquid liab.	Turnover ratio	Traded value	Mkt. cap.	Per capita income,t-1	Schooling	Govt. size	Inflation	Trade openness
Econ. growth	1											
Bank credit	0.072 (-0.116)	1										
Private credit	0.048 (-0.289)	0.978 (0.000)	1									
Liquid liab.	0.059 (-0.194)	0.77 (0.000)	0.709 (0.000)	1								
Turnover ratio	0.252 (0.000)	0.336 (0.000)	0.319 (0.000)	0.255 (0.000)	1							
Traded value	0.23 (0.000)	0.548 (0.000)	0.554 (0.000)	0.48 (0.000)	0.854 (0.000)	1						
Mkt. cap.	0.133 (-0.003)	0.563 (0.000)	0.594 (0.000)	0.539 (0.000)	0.295 (0.000)	0.737 (0.000)	1					
Per capita income,t-1	-0.076 (-0.093)	0.212 (0.000)	0.267 (0.000)	-0.014 (-0.765)	0.252 (0.000)	0.254 (0.000)	0.335 (0.000)	1				
Schooling	0.076 (-0.094)	0.111 (-0.013)	0.142 (-0.001)	0.047 (-0.291)	0.048 (-0.279)	0.298 (0.000)	0.471 (0.000)	0.561 (0.000)	1			
Govt. size	-0.129 (-0.005)	0.443 (0.000)	0.481 (0.000)	0.375 (0.000)	-0.025 (-0.582)	0.177 (0.000)	0.345 (0.000)	0.381 (0.000)	0.121 (-0.007)	1		
Inflation	-0.164 (0.000)	-0.1 (-0.025)	-0.088 (-0.049)	-0.327 (0.000)	0.052 (-0.247)	-0.114 (-0.011)	-0.277 (0.000)	0.094 (-0.040)	-0.049 (-0.276)	-0.133 (-0.003)	1	
Trade openness	0.032 (-0.478)	0.452 (0.000)	0.416 (0.000)	0.59 (0.000)	-0.166 (0.000)	0.095 (-0.033)	0.374 (0.000)	0.041 (-0.372)	0.213 (0.000)	0.083 (-0.061)	-0.316 (0.000)	1

Note: Significance levels are reported in parenthesis.

Table II.3. Correlations, High-income countries

	Econ. growth	Bank credit	Private credit	Liquid liab.	Turnover ratio	Traded value	Mkt. cap.	Per capita,t-1	Schooling	Govt. size	Inflation	Trade openness
Econ. growth	1											
Bank credit	-0.218 (0.000)	1										
Private credit	-0.248 (0.000)	0.782 (0.000)	1									
Liquid liab.	-0.112 (-0.020)	0.556 (0.000)	0.493 (0.000)	1								
Turnover ratio	0.035 (-0.461)	0.022 (-0.644)	0.131 (-0.005)	-0.48 (0.000)	1							
Traded value	0.149 (-0.002)	0.172 (0.000)	0.333 (0.000)	-0.244 (0.000)	0.836 (0.000)	1						
Mkt. cap.	0.25 (0.000)	0.261 (0.000)	0.391 (0.000)	0.278 (0.000)	0.201 (0.000)	0.499 (0.000)	1					
Per capita income,t-1	-0.205 (0.000)	0.295 (0.000)	0.419 (0.000)	0.381 (0.000)	-0.366 (0.000)	-0.084 (-0.081)	0.407 (0.000)	1				
Schooling	-0.099 (-0.039)	0.072 (-0.123)	0.361 (0.000)	0.005 (-0.922)	-0.028 (-0.545)	0.371 (0.000)	0.332 (0.000)	0.478 (0.000)	1			
Govt. size	-0.307 (0.000)	0.098 (-0.037)	0.054 (-0.254)	-0.271 (0.000)	0.085 (-0.070)	-0.014 (-0.765)	-0.164 (0.000)	0.37 (0.000)	0.224 (0.000)	1		
Inflation	0.007 (-0.888)	-0.386 (0.000)	-0.437 (0.000)	-0.221 (0.000)	-0.133 (-0.005)	-0.335 (0.000)	-0.429 (0.000)	0.007 (-0.888)	-0.294 (0.000)	-0.189 (0.000)	1	
Trade openness	0.134 (-0.005)	0.204 (0.000)	-0.065 (-0.167)	0.319 (0.000)	-0.392 (0.000)	-0.178 (0.000)	0.275 (0.000)	0.134 (-0.005)	-0.215 (0.000)	-0.147 (-0.002)	-0.107 (-0.022)	1

Note: Significance levels are reported in parenthesis.

Table II.4. Bank & Stock market measures and economic growth, country Average, 1989-2012

Country	Econ. Growth	Bank Credit	Private Credit	Liquid Liab.	Turnover ratio	Traded value	Market cap.
Argentina*	2.548	17.547	17.937	25.516	21.092	3.17	25.698
Australia	1.671	90.998	90.998	69.34	64.436	60.593	89.969
Austria	1.476	104.186	104.588	91.126	50.682	9.975	20.769
Belgium	1.084	75.276	75.305	87.728	30.926	18.534	56.576
Brazil*	1.296	50.94	51.914	42.15	53.427	19.737	38.106
Cote dâIvoire*	-0.693	19.584	19.83	27.572	2.207	0.346	15.289
Colombia*	1.92	29.583	33.167	23.176	9.843	2.733	26.009
Denmark	1.084	115.65	115.772	60.73	65.102	35.255	52.198
Egypt*	2.646	39.312	39.312	79.607	26.644	11.593	33.077
Finland	1.493	74.068	74.378	56.656	77.741	73.508	83.571
France	1.103	94.395	94.451	67.702	75.415	73.508	63.008
Germany	1.541	105.985	105.985	90.919	121.222	45.919	39.077
Greece	0.892	61.031	61.132	75.839	47.56	23.222	40.743
Indonesia*	3.583	34.662	35.72	41.215	46.671	11.203	26.415
India*	4.502	32.895	32.895	53.807	99.636	42.007	46.898
Italy	0.666	79.138	79.397	64.266	98.439	33.282	31.19
Jamaica*	0.668	24.318	24.318	45.067	5.665	2.59	54.383
Jordan*	1.112	72.042	72.2	113.527	28.285	37.402	105.862
Japan	1.119	141.435	193.735	201.757	76.741	60.863	77.298
Korea	4.298	96.3	97.793	70.516	190.675	106.904	58.65
Luxembourg	2.31	125.1	125.155	321.274	1.375	1.951	148.529
Malaysia*	3.685	114.087	115.499	113.462	38.382	65.356	160.143
Mexico*	1.312	18.386	20.364	25.192	32.705	8.343	27.382
Morocco*	2.298	43.138	44.198	78.556	16.495	7.474	37.338
Netherlands	1.66	136.464	136.541	96.803	99.935	94.698	90.813
Nigeria*	2.955	15.898	15.994	21.905	8.198	1.65	14.264
Pakistan*	1.748	24.054	24.085	41.468	155.169	29.115	18.832
Peru*	2.208	19.091	19.932	25.103	15.641	3.403	31.248
Philippines*	1.845	32.049	32.071	51.546	23.48	12.051	52.792
Portugal	1.53	115.185	115.346	97.533	53.285	18.822	31.457
Singapore	3.636	95.56	95.565	114.514	59.651	91.571	161.809
South Africa*	0.792	65.879	127.163	47.992	32.591	58.907	169.639
Spain	1.539	122.401	122.511	97.888	125.417	88.949	62.843
Sri Lanka*	4.316	25.509	25.536	38.525	15.208	2.694	17.874
Sweden	1.59	80.056	109.266	53.648	85.082	82.992	90.306
Thailand*	3.956	109.667	115.99	95.037	83.633	43.815	58.676
Tunisia*	2.888	55.692	62.38	53.846	12.008	1.609	12.774
Turkey*	2.431	24.113	24.113	31.746	131.109	31.309	23.845
UK	1.672	141.47	141.827	109.762	88.741	110.154	125.937
United States	1.471	50.647	159.964	64.808	146.423	164.052	108.124

Note: * represents MIC, and the rest HIC.

Table II.5. Unit-root test results

	Full sample (40)		HICs (19)		MICs (21)	
Variable	CIPS	IPS	CIPS	IPS	CIPS	IPS
Income per capita	-1.461	-1.472	-1.544	-0.979	-1.47	-1.918
Bank credit	-1.603	-1.665	-1.652	-1.634	-1.763	-1.693
Private credit	-1.468	-1.675	-1.597	-1.624	-1.766	-1.722
Liquid liability	-1.571	-1.792	-0.886	-1.669	-0.941	-1.903
Turnover ratio	-1.384	-2.284	-1.45	-2.078	-1.955	-2.470**
Traded value	-1.739	-1.781	-1.781	-1.444	-1.688	-2.085
Market capitalization	-1.689	-2.466***	-1.887	-2.34	-1.541	-2.579**
Schooling	-2.132*	-4.132***	-2.288**	-3.907***	-2.164**	-4.335***
Govt consumption	-1.253	-2.07	-0.847	-1.855	-1.188	-2.265
Inflation	-1.936	-3.052***	-1.681	-3.040***	-2.07	-3.062***
Trade openness	-1.53	-2.470***	-1.472	-2.475*	-1.411	-2.466**
Critical values	-2.080 (10%)	-2.330 (10%)	-2.070 (10%)	-2.410 (10%)	-2.070 (10%)	-2.390 (10%)
	-2.160 (5%)	-2.370 (5%)	-2.150 (5%)	-2.480 (5%)	-2.150 (5%)	-2.450 (5%)
	-2.300 (1%)	-2.450 (1%)	-2.320 (1%)	-2.620 (1%)	-2.300 (1%)	-2.580 (1%)

Notes: All tests include intercept; maximum lag length is chosen based on general to particular method; the null hypothesis is All panels contain unit roots, and the alternative is Some panels are stationary; *,**,& *** represent rejection of the null hypothesis at 10,5,& 1%, respectively.

Table II.6. Convergence club classification

	Log t	(t-stat)	Income group of members (%)	
			HIC	MIC
Panel A.Full sample[40]	-3.210*	(-12.017)		
Club1 [22]	2.081	(8.100)	31.8	68.2
Club2 [18]	1.636	(8.321)	66.7	33.3
	Log t	(t-stat)	Real GDP per capta,average	
Panel B. HICs [19]	-0.532*	(-40.298)	32,276.82	
Club1 [7]	2.023	(10.341)	32,146.93	
Club2 [12]	1.139	(9.652)	32,349.42	
Club1 [lower 3] + Club2 [upper 6]	0.001	(0.022)		
Panel C. MICs [21]	-0.479*	(-18.629)	2,857.94	
Club1 [12]	3.525	(9.647)	2,751.34	
Club2 [9]	0.875	(6.135)	3,000.09	
Club1 [lower 6] + Club2 [upper 4]	-0.557*	(-25.550)		

Club1 includes Luxembourg, Sweden, Finland, Italy, Greece, Singapore, & Korea;

Club2 includes USA, Japan, Australia, Great Britain, Germany, Denmark, Netherlands, Belgium, France,Austria, Spain, & Portugal;

Club1 of MICs(Club3 from now on) includes Mexico, Republic of South Africa, Brazil, Jamaica, Peru, Tunisia, Jordan, Cote d'ivoire, Sri Lanka,Nigeria, Pakistan, & India;

Club2 of MICs (Club4 from now on) includes Turkey, Argentina, Malaysia, Columbia, Morocco, Thailand, Philippines, Egypt, & Indonesia.

Notes: * represents rejection of the null hypothesis of convergence at the 5% significance level; Number of club members is given in brackets and the t-statistics in parenthesis; countries are grouped into High-income (HICs) are Middle-income (MICs) following the World Bank's income classification.

Table II.7. Stock markets, banks, and economic growth: OLS regression results

Dependent Variable: Per capita real GDP growth rate							
Variable	Full Sample	HICs	MICs	Club1	Club2	Club3	Club4
Bank credit	-0.012***	-0.013**	0.001	-0.032***	-0.005	0.014	-0.006
	(0.005)	(0.005)	(0.008)	(0.011)	(0.004)	(0.012)	(0.011)
Turnover ratio	0.008***	0.004	0.012***	0.006	0.012***	0.007**	0.015**
	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.007)
Income per capita,t-1	-0.046***	-0.069***	-0.029*	-0.06	-0.099***	-0.014	-0.187***
	(0.014)	(0.022)	(0.017)	(0.047)	(0.017)	(0.020)	(0.046)
Schooling	0.039**	-0.025	0.025	-0.002	-0.039*	0.001	0.041***
	(0.017)	(0.033)	(0.022)	(0.102)	(0.022)	(0.023)	(0.011)
Government size	-0.01	-0.099***	-0.008	-0.066	-0.173***	-0.01	-0.024
	(0.013)	(0.033)	(0.015)	(0.056)	(0.025)	(0.016)	(0.022)
Inflation	-0.006	-0.25	-0.007	-0.307	-0.299**	-0.003	-0.061**
	(0.009)	(0.165)	(0.007)	(0.215)	(0.121)	(0.008)	(0.027)
Trade openness	0.019*	0.068***	0.017	0.091***	0.058***	0.011	0.012
	(0.011)	(0.017)	(0.013)	(0.034)	(0.011)	(0.013)	(0.020)
Constant	0.014***	0.013***	0.019***	0.016***	0.017***	0.016***	0.015***
	(0.001)	(0.002)	(0.002)	(0.003)	(0.001)	(0.003)	(0.004)
No. Obs.	800	380	441	147	240	228	189
R^2	0.105	0.265	0.103	0.211	0.466	0.127	0.206

Notes: Robust standard errors are given in parentheses; *,**,&*** represent significance levels at 10,5,& 1%, respectively; All variables are cross-sectionally demeaned and in log form.

Table II.8. Stock markets, banks, and economic growth: GMM regression results

Dependent Variable: Per capita real GDP growth rate

Variable	Full Sample (40)				HICs (19)				MICs (21)			
	Dyn. Panel GMM		Traditional GMM		Dyn. Panel GMM		Traditional GMM		Dyn. Panel GMM		Traditional GMM	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Bank credit	0.018	0.022	-0.011***	-0.011***	-0.017	-0.01	-0.010***	-0.008***	0.029*	0.036**	0.010***	0.013***
	(0.015)	(0.017)	(0.004)	(0.003)	(0.012)	(0.012)	(0.003)	(0.001)	(0.015)	(0.015)	(0.002)	(0.002)
Turnover ratio	0.020***	0.018***	0.003*	0.004***	0.010*	0.007*	0.010***	0.015***	0.019**	0.016*	0.007***	0.006***
	(0.007)	(0.006)	(0.002)	(0.001)	(0.005)	(0.004)	(0.002)	(0.001)	(0.009)	(0.008)	(0.001)	(0.001)
Per capita income,t-1	-0.105***	-0.107***	-0.020**	-0.037***	-0.052*	-0.066***	-0.058***	-0.063***	-0.044*	-0.043*	-0.038***	-0.046***
	(0.035)	(0.034)	(0.010)	(0.008)	(0.026)	(0.020)	(0.009)	(0.004)	(0.025)	(0.025)	(0.005)	(0.003)
Schooling	0.077**	0.056	0.011	0.017**	0.02	-0.045	0.074***	-0.070***	0.037	0.019	0.005	0.005
	(0.029)	(0.034)	(0.011)	(0.009)	(0.028)	(0.056)	(0.013)	(0.005)	(0.025)	(0.027)	(0.006)	(0.004)
Government size		-0.018		0.022***		-0.124***		-0.085***		-0.022		0.019***
		(0.026)		(0.007)		(0.042)		(0.004)		(0.017)		(0.003)
Inflation		-0.013		0.003		-0.280**		-0.501***		-0.017*		0.001
		(0.017)		(0.004)		(0.129)		(0.022)		(0.009)		(0.001)
Trade openness		0.021		0.014***		0.068***		0.037***		0.017		0.009***
		(0.023)		(0.004)		(0.017)		(0.003)		(0.023)		(0.002)
Constant	0.013***	0.013***	0.017***	0.016***	0.015***	0.016***	0.021***	0.015***	0.022***	0.022***	0.012***	0.011***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.003)	(0.001)	(0.000)	(0.005)	(0.004)	(0.001)	(0.001)
Observations	800	800			380	380			441	441		
AR(2) test[a]	0.206	0.214			0.178	0.627			0.681	0.6		
Hansen J test[b]	0.125	0.152	44.375 [0.992]	44.202 [0.997]	0.76	0.417	20.915 [0.999]	29.788 [0.999]	0.246	0.389	30.117 [0.999]	31.698 [0.999]
Diff.-in-Han. test[b]	0.086	0.103			0.524	0.185			0.201	0.173		
Stock& Yogo test			36.74	34.54			53.3	30.72			18.77	20.07

Note: All variables are cross-sectionally demeaned log values; All regressions include different lags of real income per capita for each group, determined based on General-to-specific criteria, to control for serial correlation, which are not reported for brevity; (1) controls for income per capia,t-1 and schooling, while (2) controls for those in (1) and government size, inflation, and trade openness; the dynamic panel system GMM regression incorporates Windmeijer (2005) correction, with robust standard errors in parentheses, and p-values of post-estimation tests; the Standard GMM reports HAC standard errors in parenthesis, where Bank credit is instrumented by lags of Liquid liability, Turnover ratio by lags of stock market capitalization, and other controls by their lagged values; for Standard GMM Hansen J stat (with P-values in parenthesis) and Stock & Yogo test of weak instrument (F-value) are reported; *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively; (a) The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation; (b) The null hypothesis is that the instruments used are not correlated with the residuals.

Table II.9. Stock markets, banks, and economic growth: GMM regression results

Dependent Variable: Per capita real GDP growth rate

Variable	Full Sample (40)				HICs (19)				MICs (21)			
	Dyn. Panel GMM		Traditional GMM		Dyn. Panel GMM		Traditional GMM		Dyn. Panel GMM		Traditional GMM	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Private credit	0.001	0.002	-0.014***	-0.024***	-0.031**	-0.012	-0.004*	-0.012***	0.034*	0.039*	0.014***	0.017***
	(0.016)	(0.018)	(0.004)	(0.004)	(0.012)	(0.010)	(0.002)	(0.001)	(0.020)	(0.020)	(0.002)	(0.001)
Traded value	0.020***	0.019***	0.003**	0.005***	0.024***	0.021***	0.008***	0.008***	0.020***	0.019***	0.006***	0.006***
	(0.003)	(0.003)	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)	(0.000)	(0.006)	(0.006)	(0.001)	(0.000)
Per capita income,t-1	-0.082**	-0.085**	-0.020**	-0.019**	-0.081**	-0.086***	-0.072***	-0.070***	-0.050*	-0.048*	-0.047***	-0.070***
	(0.034)	(0.036)	(0.009)	(0.008)	(0.036)	(0.027)	(0.008)	(0.004)	(0.026)	(0.028)	(0.005)	(0.003)
Schooling	0.026	0.014	-0.001	-0.006	-0.022	-0.063	0.019	-0.103***	0.013	0.001	-0.003	0.008*
	(0.028)	(0.031)	(0.010)	(0.007)	(0.044)	(0.054)	(0.013)	(0.005)	(0.028)	(0.030)	(0.006)	(0.005)
Government size		-0.007		0.012*		-0.087*		-0.046***		-0.015		0.004
		(0.021)		(0.006)		(0.042)		(0.004)		(0.021)		(0.003)
Inflation		-0.005		0.003		-0.087		-0.451***		-0.015		-0.004***
		(0.016)		(0.006)		(0.138)		(0.021)		(0.011)		(0.001)
Trade openness		0.014		0.017***		0.035		0.052***		0.008		0.016***
		(0.023)		(0.003)		(0.021)		(0.002)		(0.023)		(0.002)
Constant	0.014***	0.014***	0.016***	0.016***	0.016***	0.016***	0.019***	0.015***	0.018***	0.018***	0.011***	0.012***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.000)	(0.002)	(0.003)	(0.001)	(0.000)
Observations	800	800			380	380			420	420		
AR(2) test[a]	0.463	0.46			0.412	0.229			0.822	0.768		
Hansen J test[b]	0.109	0.126	45.766 [0.993]	45.141 [0.999]	0.36	0.47	21.9 [0.999]	30.464 [0.999]	0.287	0.341	30.416 [0.999]	31.798 [0.999]
Diff.-in-Han. test[b]	0.075	0.084			0.157	0.278			0.186	0.199		
Stock& Yogo test			34.47	30.71			57.91	35.76			28.73	28.79

Note: All variables are cross-sectionally demeaned log values; All regressions include different lags of real income per capita for each group, determined based on General-to-specific criteria, to control for serial correlation, which are not reported for brevity; (1) controls for income per capia,t-1 and schooling, while (2) controls for those in (1) and government size, inflation, and trade openness; the dynamic panel system GMM regression incorporates Windmeijer (2005) correction, with robust standard errors in parentheses, and p-values of post-estimation tests; the Standard GMM reports HAC standard errors in parenthesis, where Private credit is instrumented by lags of Liquid liability, Traded value by lags of stock market capitalization, and other controls by their lagged values; for Standard GMM Hansen J stat (with P-values in parenthesis) and Stock & Yogo test of weak instrument (F-value) are reported; *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively; (a) The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation; (b) The null hypothesis is that the instruments used are not correlated with the residuals.

Table II.10. Stock markets, banks, and economic growth: Dynamic Panel GMM regression results

Dependent Variable: Per capita real GDP growth rate								
Variable	Club1 (7)		Club2 (12)		Club3 (12)		Club4 (9)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Bank credit	0.064*	0.046**	-0.004	-0.003	0.027*	0.037*	0.034*	0.025**
	(0.035)	(0.020)	(0.016)	(0.012)	(0.014)	(0.020)	(0.020)	(0.011)
Turnover ratio	0.070***	0.024**	0.021***	0.017***	0.013*	0.017***	0.028**	0.022***
	(0.022)	(0.010)	(0.006)	(0.005)	(0.007)	(0.006)	(0.013)	(0.004)
Per capita income,t-1	-0.420***	-0.297**	-0.148**	-0.103**	-0.28	-0.375*	-0.263***	-0.198**
	(0.150)	(0.125)	(0.049)	(0.035)	(0.215)	(0.219)	(0.061)	(0.081)
Schooling	0.377	0.164	0.049*	-0.045*	0.062*	0.024	0.057***	0.040*
	(0.270)	(0.372)	(0.025)	(0.023)	(0.037)	(0.025)	(0.014)	(0.018)
Government size		-0.236**		-0.197***		-0.012		-0.026
		(0.108)		(0.017)		(0.019)		(0.027)
Inflation		-0.676**		-0.360***		-0.013		-0.057*
		(0.331)		(0.114)		(0.015)		(0.027)
Trade openness		0.135**		0.053***		0.023		0.015
		(0.057)		(0.012)		(0.024)		(0.044)
Constant	0.01	0.012*	0.012***	0.018***	0.017***	0.021***	0.015***	0.014***
	(0.016)	(0.006)	(0.003)	(0.002)	(0.005)	(0.005)	(0.004)	(0.002)
Observations	147	147	240	240	240	240	189	189
AR(2) test[a]	0.584	0.371	0.198	0.178	0.143	0.127	0.891	0.905
Hansen J test[b]	0.999	0.999	0.84	0.881	0.925	0.998	0.995	0.999
Diff.-in-Han. test[b]	0.999	0.999	0.709	0.999	0.53	0.998	0.974	0.999

Notes: All regressions are dynamic panel system GMM, incorporating Windmeijer (2005) correction, with robust standard errors in parentheses;(1) controls for income per capia,t-1 and schooling, while (2) controls for those in (1) and government size, inflation, and trade openness; *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively; All regressions include different lags of real income per capita for each group, determined based on General-to-specific criteria, to control for serial correlation, which are not reported for brevity; All variables are cross-sectionally demeaned log values; P-values of the post-estimation tests are reported;(a)The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation;(b)The null hypothesis is that the instruments used are not correlated with the residuals.

Table II.11. Stock markets, banks, and economic growth: Traditional GMM regression results

Dependent Variable: Per capita real GDP growth rate

Variable	Club1 (7)		Club2 (12)		Club3 (12)		Club4 (9)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Bank credit	0.010**	0.028***	-0.005**	-0.008***	0.011**	0.030***	0.026***	0.031***
	(0.005)	(0.006)	(0.002)	(0.001)	(0.005)	(0.003)	(0.006)	(0.005)
Turnover ratio	0.007**	0.007***	0.004**	0.005***	0.006**	0.010***	0.012**	0.021***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.003)	(0.001)	(0.006)	(0.003)
Per capita income,t-1	-0.043**	-0.073***	-0.044***	-0.022***	-0.062**	-0.039***	-0.125***	-0.138***
	(0.019)	(0.015)	(0.011)	(0.004)	(0.027)	(0.006)	(0.038)	(0.029)
Schooling	-0.115**	-0.457***	0.035***	-0.006	0.022	0.013***	0.161***	0.161***
	(0.045)	(0.039)	(0.010)	(0.005)	(0.017)	(0.005)	(0.043)	(0.033)
Government size		0.050***		-0.114***		-0.001		-0.034***
		(0.013)		(0.006)		(0.001)		(0.007)
Inflation		-0.106*		-0.554***		-0.026***		0.052***
		(0.062)		(0.029)		(0.002)		(0.013)
Trade openness		0.138***		0.001		0.034***		-0.011
		(0.009)		(0.000)		(0.003)		(0.010)
Constant	-0.001	0.004***	0.005***	0.017***	-0.019***	0.013***	-0.006	-0.016***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.003)	(0.001)	(0.005)	(0.002)
Hansen J stat	10.885	9.967	17.633	19.677	15.898	19.385	13.004	13.893
	[0.995]	[0.999]	[0.997]	[0.999]	[0.999]	[0.999]	[0.997]	[0.999]
Stock&Yogo test	25.6	19.95	48.15	37.24	20.9	17.38	15.84	27.99

Notes: (1) controls for income per capia,t-1 and schooling, while (2) controls for those in (1) and government size, inflation, and trade openness; HAC standard errors are given in parentheses; *,**,&*** represent significance levels at 10,5,& 1%,respectively. Bank credit is instrumented by lags of Liquid liability; Turnover ratio by lags of stock market capitalization, and other controls by their lagged values; Hansen J stat (p-values given in brackets) indicate a failure to reject a null hypothesis of No overidentification issue; Stock & Yogo's tests of weak instrument (F-values) are also greater than 10,the rule-of-thumb, and S&Y's critical value of 11.04 at 5% significance level, indicating rejection of the null hypothesis of weak instrument.

Table II.12. Stock markets, banks, and economic growth: Dynamic Panel GMM regression results

Dependent Variable: Per capita real GDP growth rate								
Variable	Club1 (7)		Club2 (12)		Club3 (12)		Club4 (9)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Private credit	0.061***	0.090***	-0.022	0.014	0.017*	0.019**	0.091***	0.042**
	(0.020)	(0.024)	(0.020)	(0.015)	(0.010)	(0.009)	(0.031)	(0.018)
Traded value	0.033***	0.023***	0.026***	0.019***	0.015***	0.016***	0.022*	0.016**
	(0.005)	(0.007)	(0.003)	(0.003)	(0.004)	(0.004)	(0.011)	(0.008)
Per capita income,t-1	-0.425***	-0.501***	-0.127**	-0.185***	-0.054***	-0.041**	-0.255**	-0.195**
	(0.100)	(0.119)	(0.056)	(0.042)	(0.018)	(0.020)	(0.099)	(0.096)
Schooling	0.386**	0.219	-0.053	-0.063*	0.002	-0.015	0.046**	0.039*
	(0.159)	(0.223)	(0.033)	(0.031)	(0.003)	(0.022)	(0.019)	(0.022)
Government size		-0.134		-0.132***		-0.009		-0.004
		(0.121)		(0.017)		(0.019)		(0.003)
Inflation		-0.172		-0.097		-0.007		-0.012**
		(0.181)		(0.083)		(0.009)		(0.005)
Trade openness		0.186***		0.048**		0.004		-0.001
		(0.070)		(0.020)		(0.021)		(0.001)
Constant	0.01	0.006	0.015***	0.015***	0.015***	0.015***	0.012***	0.014***
	(0.009)	(0.008)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)	(0.002)
Observations	140	140	252	252	228	228	180	180
AR(2) test[a]	0.506	0.864	0.775	0.634	0.112	0.133	0.262	0.706
Hansen J test[b]	0.999	0.999	0.316	0.879	0.999	0.999	0.999	0.999
Diff.-in-Han. test[b]	0.999	0.999	0.12	0.549	0.999	0.999	0.999	0.999

Notes: Same as Table 10.

Table II.13. Stock markets, banks, and economic growth: Traditional GMM regression results

Dependent Variable: Per capita real GDP growth rate								
Variable	Club1 (7)		Club2 (12)		Club3 (12)		Club4 (9)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Private credit	0.024***	0.011***	-0.007***	-0.011***	0.015***	0.004**	0.011**	0.013**
	(0.007)	(0.004)	(0.002)	(0.001)	(0.003)	(0.002)	(0.005)	(0.005)
Traded value	0.006***	0.006***	0.010***	0.006***	0.003***	0.004***	0.015***	0.016***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)
Per capita income,t-1	-0.026	-0.115***	-0.100***	-0.070***	-0.030***	-0.011***	-0.100***	-0.109***
	(0.025)	(0.009)	(0.011)	(0.005)	(0.006)	(0.004)	(0.026)	(0.021)
Schooling	-0.135**	-0.092***	-0.029**	0.005	-0.025***	-0.008*	0.069**	0.067***
	(0.054)	(0.016)	(0.011)	(0.004)	(0.007)	(0.004)	(0.032)	(0.026)
Government size		0.008		-0.056***		0.004***		-0.005
		(0.014)		(0.006)		(0.000)		(0.017)
Inflation		0.031		-0.264***		0.005***		0.031
		(0.079)		(0.031)		(0.001)		(0.026)
Trade openness		0.094***		0.003***		0.019***		0.009
		(0.008)		(0.000)		(0.002)		(0.007)
Constant	0.022***	0.017***	0.009***	0.013***	0.006***	0.009***	0.004	-0.002
	(0.007)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.005)	(0.003)
Hansen J stat	7.662	9.465	17.28	19.97	18.71	19.548	9.036	9.455
	[0.936]	[0.999]	[0.997]	[0.999]	[0.999]	[0.999]	[0.939]	[0.999]
Stock&Yogo test	42.54	32.62	48.42	34.06	14.66	21.28	12.94	18.52

Notes: Same as Table 11.

Table II.14. Stock markets, banks, and economic growth: Traditional GMM (1989-2007)

Dependent Variable: Per capita real GDP growth rate

Variable	Full Sample	HICs	MICs	Club1	Club2	Club3	Club4
Bank credit	-0.007***	-0.004***	0.002**	0.006***	-0.009***	0.053***	0.016***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.003)
Turnover ratio	0.005***	0.006***	0.009***	0.004**	0.019***	0.006***	0.020***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Per capita Income,t-1	-0.028***	-0.069***	-0.068***	-0.073***	-0.062***	-0.108***	-0.263***
	(0.008)	(0.005)	(0.003)	(0.011)	(0.006)	(0.008)	(0.018)
Schooling	-0.004	-0.050***	0.079***	-0.197***	0.001	0.070***	0.173***
	(0.010)	(0.006)	(0.004)	(0.028)	(0.004)	(0.004)	(0.018)
Government size	-0.01	-0.007	0.041***	-0.043**	-0.123***	-0.001	-0.030***
	(0.008)	(0.006)	(0.002)	(0.017)	(0.005)	(0.001)	(0.006)
Inflation	-0.105***	-0.468***	0.016***	-0.551***	-0.877***	-0.015***	-0.001
	(0.013)	(0.023)	(0.001)	(0.061)	(0.025)	(0.002)	(0.009)
Trade openness	0.032***	0.091***	0.015***	0.114***	0.001**	0.023***	0.057***
	(0.004)	(0.004)	(0.002)	(0.009)	(0.001)	(0.003)	(0.007)
Constant	0.016***	0.008***	0.012***	0.008***	0.006***	0.013***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Hansen J stat	43.047	28.09	31.503	9.448	17.86	19.133	14.037
	[0.9998]	[0.9999]	[0.9999]	[0.9979]	[0.9999]	[0.9999]	[0.9999]
Stock&Yogo test	18.48	31.46	13.99	20.82	34.43	20.9	16.14

Notes: HAC standard errors are given in parentheses; *,**,& *** represent significance levels at 10%,5%,& 1%,respectively. Bank credit is instrumented by lags of Liquid liability; Turnover ratio by lags of stock market capitalization, and other controls by their lagged values; Hansen J stat (p-values given in brackets) indicate a failure to reject a null hypothesis of No overidentification issue; Stock & Yogo's tests of weak instrument (F-values) are also greater than 10,the rule-of-thumb, and S& Y's critical value of 11.04 at 5% significance level, indicating rejection of the null hypothesis of weak instrument.

APPENDIX II.2 Figures for Chapter II

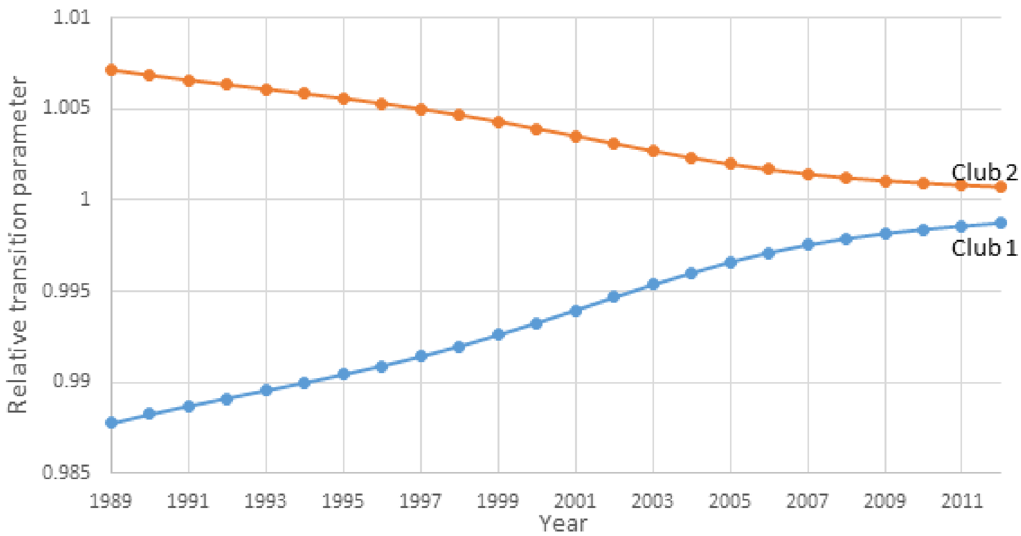

Figure 1. Relative Transition paths Across HICs Clubs

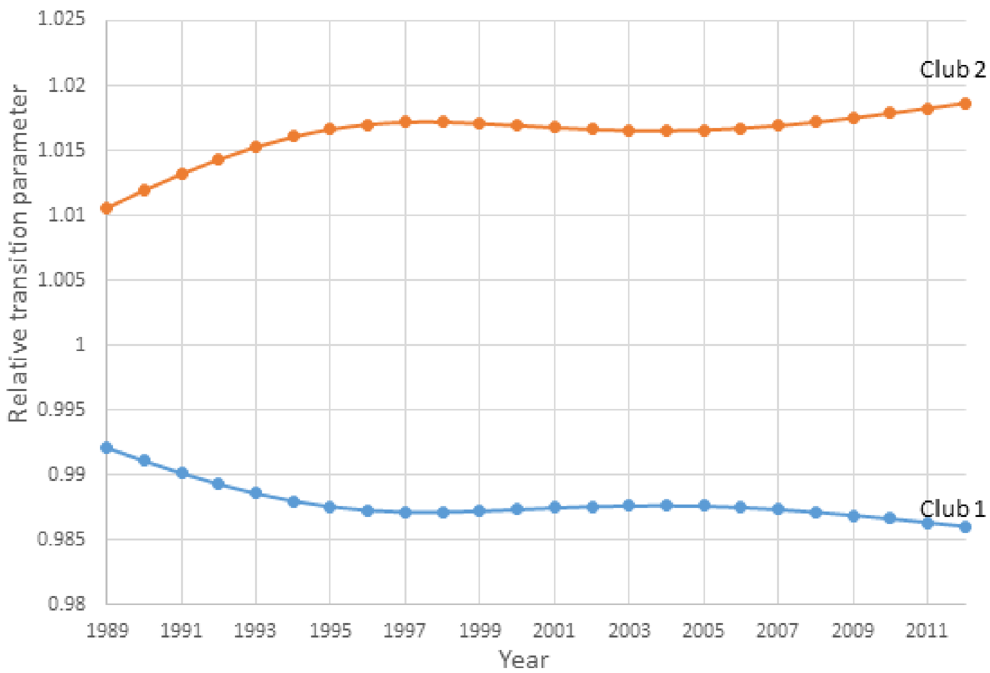

Figure 2. Relative Transition paths Across MICs Clubs

APPENDIX II.3 Club Convergence Algorithm

If the null hypothesis of full panel convergence is rejected, test for club convergence should be applied using club convergence algorithm, as presented in Phillips and Sul (2007). The algorithm has the following steps:

Step 1 (Ordering): Arrange the members of the panel in descending order according to the last observation or a time series average of the final observations. This is because evidence of convergence will, in general, be most apparent in the recent observations.

Step 2 (Core Group Formation): To form a core convergence group, select the first highest k members (Step 1) for some $2 \leq k < N$, and run the log t regression and compute the convergence t-statistic, $t_{\hat{b}}$, for this subgroup. Among the N-2 estimated t-statistics (one for each k), focus on the cases where $t_{\hat{b}} >$ -1.65 (so that convergence is certain for each subgroup) and choose the maximum one. This ensures a low false inclusion rate.

Step 3 (Sieve Individuals for Club Membership): Add one country at a time to the core group identified in Step 2 and calculate the convergence t-statistic from the log t regression. The new country satisfies the membership if the associated t-statistic is greater than a chosen critical value c^*,$c^* \geq 0$ (i.e.; $t_{\hat{b}} > c^*$). All countries that satisfy the criterion are added to the core group. Then, we run the log t test with this first subconvergence group (the core group plus the additionally selected members) and make sure that $t_{\hat{b}} >$ -1.65. If not, raise the critical value, c^*, to increase the discriminatory power of the log t test and repeat this step until $t_{\hat{b}} >$ -1.65 with the first subconvergence group.

Step 4 (Recursive and Stopping Rule): For a group of countries not selected in Step 3, run the log t and see if $t_{\hat{b}} >$ -1.65 and this cluster forms a second convergence club. If so, we conclude that there are two convergent subgroups in the panel. If not, repeat Steps 1-3 on this subgroup to determine if there are smaller subconvergence clusters. If no core group can be found (Step 2), conclude that the remaining countries diverge.

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