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Abstract

Recent empirical work on financial structure and economic growth analyzes multi-country dataset in panel and/or cross-section frameworks and conclude that financial structure is irrelevant. We highlight their shortcomings and re-examine this issue utilizing a time series and a dynamic heterogeneous panel methods. Our sample consists of fourteen countries. Tests reveal that cross-country data cannot be pooled. Financial structure significantly explains output levels in most countries. The results are rigorously scrutinized through bootstrap exercises and they are robust to extensive sensitivity tests. We also test for several hypotheses about the prospective role of financial structure and financial development on economic growth.

JEL Classification: O16; G18; G28

Keywords: Financial Structure, Economic Growth, Co-integration, Bootstrap, Dynamic Heterogeneous Panels.

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Financial Structure and Economic Growth

1. Introduction

The debate on the relative merits of bank-based *versus* market-based financial systems has a long history of over a century (Gerschenkron, 1962; Allen and Gale, 2000; Levine 2002). Nonetheless, there is hardly consensus at the theoretical level. Competing theoretical models posit the superiority of one type of financial system over the other or they simply relegate financial structure as irrelevant. On the one hand**,** Gerschenkron (1962), Diamond (1984), Stiglitz (1985), Boyd and Prescott (1986), Bencivenga and Smith (1991), Bhide (1993), Stulz (2002)**,** to name but a few**,** argue that the bank-based system is superior to the market-based one. On the other hand, Levine (1997), Boyd and Smith (1998), Holmstrom and Tirole (1993), Jansen and Murphy (1990), Boot and Thakor (1997), Wenger and Kaserer, (1998), among others, suggest the opposite. Still, Merton and Bodie (1995) and Levine (1997) maintain that it is neither the banks nor the markets; instead, it is the provision of overall financial services that is crucial in promoting growth. Similarly, Huybens and Smith (1999) underline the complementarities between banks and markets in the provision of financial services. The theoretical debate on financial structure culminates into four distinct views: the bank-based, the market-based, the financial services and the law and finance. We briefly discuss them in section 2.

A large body of empirical literature has attempted to evaluate this debate. Early studies focus on UK and the US as market-based systems versus Japan and Germany as bank-based systems (e.g. Goldsmith, 1969; Hoshi et al, 1991; Allen and Gale, 2000; Mork and Nakkamura, 1999; Weinstein and Yafeh, 1998; Arestis et al., 2001). They rigorously compare and contrast the country-specific financial structure, that is, an assortment of financial markets, instruments and intermediaries in operation, and conclude that financial structure is important for economic growth. However, Goldsmith (1969)**,** highlighting their shortcomings, argues that these four industrialized countries have resembling real per capita income levels and they historically share similar growth rates. Consequently, it is hard to attribute their analogous growth rates to alternative forms of either the bank-based or the market-based financial system. Similarly, Beck and Levine (2002) and Levine (2002) assert that although UK, US, Germany and Japan did experience periods of divergent growth rates**,** nonetheless, "it is very difficult to draw broad conclusions about bank-based and market-based financial systems from only four countries**"** (Beck and

Levine, 2002, p. 148). They argue that the empirical assessment of the role of financial structure should be based on broad dataset that encompasses wide-ranging national experiences.

Indeed, Beck and Levine (2002), Levine (2002) and an edited volume by Demirguc-Kunt and Levin (2001), among others, analyze multi-country dataset at firm-, industry- and aggregate-levels, employing different econometric methods under the panel and/or pure cross-country setup. They are some of the most influential work in recent years that directly investigate the role of financial structure in industrial expansion, economic growth and the sources of growth. Their broad conclusions are that the overall level of financial development (the financial services view) and legal system efficiency (the law and finance view) are important; however, financial structure (either the bank-based or the market-based view) is irrelevant. The overall financial development exerts significant and economically large effect on economic growth but there is no cross-country empirical support for financial structure. These results are shown to be robust to various sensitivity tests, namely, data, specifications and econometric methods.

These studies are immensely important because they offer broad insights on the issue. They are not without concerns however. Demirguc-Kunt and Levine (2001) concede that the result of economic performance being impervious to financial structure does not necessarily imply that institutional structure is of no consequence to growth. Instead, it may simply indicate that either there is not one optimal institutional structure, which fits everywhere and at all times, or the indicators used in the literature may not satisfactorily capture the roles of banks and markets. Likewise, Levine and Zervos (1996, p. 325) state that panel regressions mask important cross-country differences and suffer from 'measurement, statistical, and conceptual' problems. Quah (1993) shows the difficulties associated with the lack of balanced growth paths across countries when pooling data (see, also, Caseli et al., 1996). Pesaran et al., (2000) point out the issue of parameter heterogeneity across panel units (countries) and show that unless this (heterogeneity) is addressed panel estimates become biased and inconsistent. Luintel and Khan (2004) show lack of correspondence between panel and country-specific estimates, hence, the generalizations based on panel results, i.e., the very 'broad conclusions', may proffer incorrect inferences for several countries, industries or firms of the panel.

If the problems of information asymmetries, moral hazards and adverse selection were not acute in financial markets and financial institutions were operationally efficient (a feasible scenario if financial institutions are of sufficiently high quality) then either form of financial system (market-based or the bank-based) should, in principal, provide just about the same financial services for augmenting growth. Financial structure, in this scenario, would be irrelevant. However, the reality is far from it. Countries exhibit different 'states of the world', namely; they have different production structures, levels of banking, financial and capital market development. These structural makeups tend to be rigid requiring significant amount of time and efforts for any change. Thus, different 'states of the world' may require different financial arrangements to cater for the diverse financial needs.

All the above concerns imply that panel estimates may be misleading at country, industry and firm level; consequently, their policy relevance may be limited. The neglected parameter heterogeneity across firms, industries and countries may bias the estimates. Further, the panel regressions, which do not address the cross-country heterogeneity, may dilute the likely effects that emanate from different 'states of the world'. Our aim is to address these issues. We conduct country-by-country time series analyses for 14 countries by utilizing the World Bank dataset on financial development and financial structure, which is recently updated to 2005 (Beck et al., 2000). The number of countries is dictated by the availability of sufficiently long-time series (see section 5). Our sample consists of low- and middle-income countries with varied growth experiences.

This paper complements the existing empirical literature by way of new results based on rigorous country-by-country time series analyses. We also apply a dynamic heterogeneous panel estimator so that we can (i) compare our results with the existing empirical literature, and (ii) perform tests of equivalence between the time series and panel estimates. Our approach does not suffer from the 'measurement and conceptual errors', arising from different definitions and accounting and measurement practices across countries; nor does it mask 'important cross-country difference', issues raised by Levine and Zervos (1996). We also address the issue of cross-country parameter heterogeneity by explicitly testing for the poolability of cross-country data, a concern raised by Pesaran et al. (2000). The equivalence between the panel and the country-specific parameters for our sample countries is also examined, a concern raised by Pesaran et al. (op. cit.) and Luintel and Khan (op. cit.).

Our basic specification augments the Cobb-Douglas production function by measures of financial structure and financial development. The long-run relationship between real per capita GDP, per capita physical capital stock, and measures of financial development and financial structure is estimated through co-integration tests. We apply the Fully Modified OLS (FMOLS) of Phillips and Hansen (1990) for our time series analysis. FMOLS is shown to perform better in small samples. The Dynamic Heterogeneous Panel Estimator proposed by Pedroni (1999 and 2001) is used for panel estimates. To our knowledge, this is the first ever study of this kind, which (i) evaluates the debate both in time series and panel frameworks and tests whether the two sets of results (time series versus the panel) are equivalent; (ii) tests for the cross-country data poolability; (iii) sheds new light on a number of relevant hypotheses regarding the roles of financial development and financial structure when countries develop both financially and economically; and (iv) scrutinizes, through extensive bootstrap exercise, whether the asymptotic approximations are valid for the finite sample estimates and their distributions. We also conduct extensive sensitivity tests vis-à-vis data (measures of financial development and financial structure) and specifications.

Our results are quite revealing. First, for the majority of sample countries, financial structure appears significant in explaining economic growth. Second, we find significant heterogeneity in cross-country parameters and adjustment dynamics; tests show that data cannot be pooled for the countries included in our sample, which reinforces the use of time series approach. Third, tests also reveal that the panel estimates (parameters) do not correspond to country specific estimates. Fourth, our bootstrap results provide a new and interesting insight. Asymptotic approximations tend to remain valid for the finite sample results so long as the empirical models do not utilize impulse dummies and/or interacted regressors. However, when empirical models use impulse dummy and/or interacted covariate, the distributions of empirical tests statistics do not appear symmetric. This suggests that those empirical studies which utilize impulse dummies and/or interacted regressors should base their inferences on suitably computed (by way of bootstrap) finite sample critical values. Our results are robust to various sensitivity tests. Overall, our findings imply that the complete absence of cross-country support for financial structure, reported by panel or cross-section studies, may be because they do not sufficiently account for the cross-country heterogeneity.

The rest of the paper is organized as follows. In the section that follows we briefly discuss the theoretical arguments**;** this is followed by a discussion of the existing empirical evidence in section 3. Section 4 outlines our model specifications and the econometric methods employed. Section 5 discusses the dataset; section 6 discusses the results pertaining to cross-country heterogeneity, section 7 presents the main empirical results, and section 8 discusses sensitivity tests. Finally section 9 summarizes and concludes.

2. Theoretical Considerations

The relationship between financial structure and economic development can be examined on the basis of competing theories of financial structure. These are: the bank-based, the market-based, the financial services and the law and finance. We discuss them briefly in what follows.

The bank-based theory emphasizes the positive role of banks in development and growth, and, also, stresses the shortcomings of market-based financial systems. It argues that banks can finance development more effectively than markets in developing economies, and, in the case of state-owned banks, market failures can be overcome and allocation of savings can be undertaken strategically. This is particularly relevant in the early stages of economic development when the institutional background is weak to support market activities (Gerschenkron, 1962). Those banks that are unhampered by regulatory restrictions, can exploit economies of scale and scope in information gathering and processing; they can also be efficient in mobilizing resources and managing risks (for more details on these aspects of bank-based systems, see Levine, 2002, and Beck and Levine, 2004). Indeed, bank-based financial systems are in a much better position than market-based systems to address agency problems and short-termism (Stiglitz, 1985; Singh, 1997). The bank-based view also stresses the shortcomings of market-based systems. The latter reveal information publicly, thereby reducing incentives for investors to seek and acquire information. Information asymmetries are thus accentuated, more so in market-based rather than in bank-based financial systems (Boyd and Prescott, 1986). Banks can ease distortions emanating from asymmetric information through forming long-run relationships with firms, and, through monitoring, contain moral hazard. As a result, bank-based arrangements can produce better improvement in resource allocation and corporate governance than market-based institutions (Stiglitz, 1985; Bhide, 1993).

By contrast, the market-based theory highlights the advantages of well-functioning markets in promoting successful economic performance, and stresses the problems of bank-based financial systems. Big, liquid and well-functioning markets foster growth and profit incentives, enhance corporate governance, and facilitate risk management, diversification and the customization of risk management devices (Levine, 2002, and Beck and Levine, 2004). The inherent inefficiencies of powerful banks are also stressed, for they "can stymie innovation by extracting informational rents and protecting firms with close bank-firm ties from competition ….. may collude with firm managers against other creditors and impede efficient corporate governance" (Levine, 2002, p. 3). Market-based financial systems reduce the inherent inefficiencies associated with banks and are, thus, better in enhancing economic development and growth. A related argument is that developed by Boyd and Smith (1998), who demonstrate through a model that allows for financial structure changes as countries go through different stages of development, that countries become more market-based as development proceeds. An issue of concern, identified by a World Bank (2001) study in the case of market-based financial systems in developing countries, is that of asymmetric information. It is argued that "the complexity of much of modern economic and business activity has greatly increased the variety of ways in which insiders can try to conceal firm performance. Although progress in technology, accounting, and legal practice has also improved the tools of detection, on balance the asymmetry of information between users and providers of funds has not been reduced as much in developing countries as it has in advanced economies – and indeed may have deteriorated" (p. 7).

The third theory, the financial-services theory stresses the key financial services provided by financial systems (Merton and Bodie, 1995; Levine, 1997). Financial services are crucial to new firm creation, industrial expansion and economic growth. This theory is actually consistent with both the bank-based and the market-based views. Although it embraces both, it minimizes their importance in that the distinction between bank-based and market-based financial systems matters less than was previously thought; it is financial services themselves that are by far more important, than the form of their delivery (World Bank, 2001). In the financial-services view, the issue is not the source of finance. It is rather the creation of an environment where financial services are soundly and efficiently provided. The emphasis is on the creation of better functioning banks and markets rather than on the

type of financial structure. This theory suggests that it is neither banks nor markets that matter; it is both banks and markets. They are different components of the financial system; they do not compete, and as such ameliorate different costs, transaction and information, in the system (Boyd and Smith, 1998; Levine, 1997; Demirguc-Kunt and Levine, 2001). Under these circumstances, financial arrangements emerge to ameliorate market imperfections and to provide financial services that are well placed to facilitate savings mobilization and risk management, assess potential investment opportunities, exert corporate control, and enhance liquidity. Consequently, as Levine (2002) argues, "the financial services view places the analytical spotlight on how to create better functioning banks and markets, and relegates the bank-based versus market-based debate to the shadows" (p. 401).

There is, finally, the law and finance theory (La Porta et al, 1998; see, also, Levine, 1999). It maintains that the role of the legal system in creating a growth-promoting financial sector, with legal rights and enforcement mechanisms, facilitates both markets and intermediaries. It is, thereby, argued that this is by far a better way of studying financial systems rather than concentrating on bank-based or market-based systems. The World Bank (2001) view on the matter points in a systematic way towards "one direction: far from impeding growth, better protection of the property rights of outside financiers favors financial market development and investment" (p. 8). Indeed, Rajan and Zingales (1998) argue that although countries with poor legal systems benefit from a bank-based system, better legal systems improve market-based systems, and as such the latter are preferable. This theory also suggests that it is financial development, and not financial structure per se, that is critical to firm, industry and national economic success.

3. Existing Empirical Evidence

As mentioned in the introduction, a number of studies have concentrated on comparisons that view Germany and Japan as bank-based systems, while the US and UK as market-based systems. These studies employ rigorous country-specific measures of financial structure. Studies of Germany and Japan use measures of whether banks own shares or whether a company has a 'main bank' respectively (Hoshi et al., 1991; Mork and Nakkamura, 1999; Weinstein and Yafeh, 1998). They provide evidence that confirms the distinction between bank-based and market-based financial systems and their role in economic growth for the countries considered. However, reassessment of the role of Japanese financial system in view of the

economy's poor performance in the 1990s has concluded against the beneficial effects of bank-based system. Bank dependence can lead to a higher cost of funds for firms, since banks extract rent from their corporate customers (Weinstein and Yafeh, 1998). Studies of the US and the UK concentrate on the role of market takeovers as corporate control devices (Wenger and Kaserer, 1998; Levine, 1997), and conclude in favor of market-based financial systems. Goldsmith (1969), however, argues that such comparisons in the case of Germany and the UK for the period 1864-1914 does not contribute to the debate since "One cannot well claim that a superiority in the German financial structure was responsible for, or even contributed to, a more rapid growth of the German economy as a whole compared to the British economy in the half-century before World War I, since there was not significant difference in the rate of growth of the two economies" (p. 407).

Levine (2002) reinforces Goldsmith's (1969) argument by concluding that "it is difficult to draw broad conclusions about the long-run growth effects of bank-based and market-based financial systems based on only four countries, especially four countries that have similar long-run growth rates" (p. 399). He conducts a pure cross-section study of 48 countries over the period of 1980-95 and finds that the measures of financial structure are insignificant in explaining real per capita GDP growth, efficient allocation of capital and the individual sources of growth (viz. total factor productivity growth, physical capital accumulation and private saving rate); whereas indicators of overall financial development significantly explain all these variables.

Likewise, Beck and Levine (2002), using a panel of 42 countries and 36 industries, test the hypothesis of whether financial structure helps to grow disproportionately those industries that rely heavily on external finance. Their results do not support their main hypothesis. Measures of financial structure appear ineffectual in explaining industrial growth, new establishment formation and efficient capital allocation. Neither does financial structure explain sectoral industrial growth, i.e. the growth and the rate of new establishments of labor- and R&D-intensive industries. By contrast, measures of overall financial development and legal system efficiency significantly explain all these variables.

Demirguc-Kunt and Levine (2001) assemble a new cross-country database and compile a number of studies on financial structure and economic growth. This database is utilized throughout the book to analyze, among others, the state of financial structure across countries and its role in economic growth and the sources of

growth while controlling for the overall financial development. The main conclusions are: financial systems are more developed in richer countries; higher-income countries have more active and efficient stock markets relative to banks; countries with common law tradition as opposed to civil law tradition are associated with more market-oriented financial systems; countries with civil law tradition tend to be associated with underdeveloped financial systems. Cross-country, cross-industry, firm- and bank-level data and different econometric methods produce consistent results that support the proposition that different financial structure does not help explain differences in economic performance (see, also, Beck and Levine, 2002; Demirguc-Kunt and Maksimovic, 2002). Further, it provides country evidence where again the proposition that financial structure does not matter in economic performance is supported.[1]

Similarly, Demirguc-Kunt and Levine (1996), using data for forty-four industrial and developing countries for the period 1986 to 1993, conclude that countries with well-developed market-based institutions also had well-developed bank-based institutions; and countries with weak market-based institutions also had weak bank-based institutions; thereby supporting the view that the distinction between bank-based and market-based financial systems is of no consequence. Interestingly, however, Levine and Zevros (1998), employing cross-country regressions for a number of countries covering the period 1976 to 1993, conclude that market-based systems provide different services from bank-based systems. In particular, market-based systems enhance growth through the provision of liquidity, which enables investment to be less risky, so that companies can have access to capital through liquid equity issues (see, also, Atje and Jovanovic, 1993, and Harris, 1997). More recently, Beck and Levine (2004) also report that the development of stock market and of banks both have significant and economically large effect on economic growth. The World Bank (2001) reaches similar conclusions by stating that "both development of banking and of market finance help economic growth: each can complement the other" (p. 48). Arestis et al. (2001), though, provide evidence for the superiority of bank-based systems with clear implications for developing economies.

As stated above, it is conceded that the result of economic performance being obdurate to financial structure does not necessarily mean that institutional structure is of no consequence to growth (Demirguc-Kunt and Levine, 2001). It could also be that economic structure determines financial structure. More recently, Allen et al. (2006)

find that in fact it is economic structure that determines financial structure. The latter develops and prevails in response to the needs of the real economy. Economies dominated by physical-asset-intensive firms tend to have a bank-based financial system. Countries with knowledge-based industries and intangible-asset-intensive firms tend to have a market-determined financial system. In what follows we outline our empirical specifications and econometric methods thus setting a framework for testing the various propositions we put forward in section 1 above.

4. Specification and Econometric Methods

4.1 Specification

The standard econometric specification of growth models in cross-country studies regresses real per capita GDP growth on a number of growth determinants. Our approach is time series. Given the non-stationarity of data (see section 7), we estimate the co-integrating (long-run) relationship between output, physical capital stock, financial development and financial structure. Our basic specification is:

$$\log(Q/L)_t = a_0 + a_1\log(K/L)_t + a_2\log(F^S)_t + a_3\log(F^D)_t + e_1 \qquad (1)$$

where, Q is output, L is labor, K is physical capital stock, F^S and F^D respectively are measures of financial structure and financial development (both defined in section 5); e_1 is the error term. In empirical estimations we use real per capita output (Y^P) and real per capita capital stock (K^P), since consistent time series on labor force do not exist for most of our sample countries. A high value of F^S means a system that is more of a market-based variety; while a lower F^S means more of a bank-based system.

Equation (1) is our benchmark empirical model. From the theoretical perspective, this can be viewed as a generalized Cobb-Douglas production function where financial development and financial structure account for total factor productivity. Our specification controls for financial development when modeling the effect of financial structure. We are interested in the significance or otherwise of the coefficient a_2, rather than its sign. In either case a significant a_2 implies that financial structure matters. A positive and significant a_2 signify a market-based financial system while a negative and significant a_2 supports the bank-based system. The bank-based view on financial structure predicts a negative and significant a_2 (i.e., $a_2 < 0$) coupled with a positive and significant a_3 (i.e., $a_3 > 0$); the market-based view, on the other hand, predicts both positive and significant a_2 and a_3 (i.e., $a_2 > 0$ and $a_3 > 0$). The

financial services view forecasts an insignificant a_2 (i.e., $a_2 = 0$) accompanied by a positive and significant a_3.

It is common in cross-section studies to use several other determinants of growth - the years of schooling (human capital), black market premiums, indicators of civil liberty, revolutions and coups, assassinations, bureaucratic efficiency, corruptions etc. However, data on these variables are usually obtained from periodic surveys therefore consistent time series are unavailable. Nevertheless, our specification (1) compares quite favorably with the 'simple conditioning set' specified by Levine (2002) and Beck and Levine (2002). They use initial levels of income and schooling as their 'simple conditioning set' and examine the effect of financial structure on economic growth in a panel or cross sectional framework; whereas we specify a generalized Cobb-Douglas production function.[2]

Theoretical models (e.g., Boyd and Smith, 1998) predict that the bank-based system is more conducive to development and growth when countries are at low levels of development; however, as income rises the market-based system becomes more important. Levine (2002) finds empirical support for this proposition in cross-section framework. We test this proposition in time series framework through the following specifications:

$$\log(Q/L)_t = b_0 + b_1\log(K/L)_t + b_2\log(F^D)_t + b_3 \log(F^S) + b_4\log(F^S * Y^C)_t + e_2 \qquad (2)$$

$$\log(Q/L)_t = c_0 + c_1\log(K/L)_t + c_2\log(F^D)_t + c_3 \log(F^S) + c_4\log(F^S * Y^{US})_t + e_3 \qquad (3)$$

where Y^{US} is the US real per capita GDP; Y^C measures the real income convergence of a sample country vis-à-vis the US real income, computed as Y^{US} minus Y^P. A positive and significant b_4 supports the predictions of Boyd and Smith (1998). However, if $b_4<0$ and significant then evidence goes against their prediction, namely that the bank-based system becomes important as low income countries converge to the high income levels. We control both for the levels of financial development and financial structure while testing for the effect of financial structure when income goes up. Beck and Levine (2002) do not include financial structure on its own.[3]

Equation (2) is a reasonable specification provided that convergence takes place overtime. Indeed, a large body of cross-country empirical literature supports the convergence hypothesis. However, in real life, convergence is not a universal phenomenon. For example, countries like South Korea and Malaysia have shown tremendous degree of convergence vis-à-vis the industrialized countries during the

last 30-40 years; whereas countries like Zimbabwe and Sri Lanka have diverged. Several examples of this nature could be found. In order to allow for this possibility, we directly interact F^S with Y^{US} in equation (3). The inspiration and validity for this specification comes from Rajan and Zingales (1998) and Beck and Levine (2002). [4] The interpretation of c_4 is similar to that of b_4.

A related hypothesis that emerges from Boyd and Smith's (1998) analysis is the prospective role of financial development when countries develop and achieve high level of income. King and Levine (1993) report a larger growth effect of financial development on low- and middle-income countries than on developed countries. Earlier empirical studies (e.g., Beck and Levine, 2002) examine how the impact of financial structure on growth changes when countries become richer and more developed but, to our knowledge, no study has examined how financial development impacts in the face of rising income levels. We test this hypothesis while controlling for financial structure and financial development as follows:

$$\log(Q/L)_t = d_0 + d_1\log(K/L)_t + d_2\log(F^S)_t + d_3\log(F^D)_t + d_4\log(F^D{*}Y^C)_t + e_4 \qquad (4)$$

$$\log(Q/L)_t = f_0 + f_1\log(K/L)_t + f_2\log(F^S)_t + f_3\log(F^D)_t + f_4\log(F^D{*}Y^{US})_t + e_5 \qquad (5)$$

A positive and significant d_4 implies that the impact of financial development increases during the income convergence process. Likewise, a positive and significant f_4 signifies that, despite changes in financial structure, the impact of financial development on output levels increases when economies develop and achieve income level equivalent to that of US. However, if d_4 and f_4 appear negative then the implication is that the effect of financial development on growth wanes as economies develop. This will reinforce the findings of King and Levine (1993) from time series perspective. King and Levine (op. cit.) calculate this effect based on the mean level of financial development across countries while assuming (implicitly) homogeneity in cross-country parameters (this is because they use the parameter obtained from the whole panel). Our approach is more flexible for it allows both for the heterogeneity in parameters as well as for the levels of financial development across countries.

As countries develop, their financial sectors develop as well. Supporting evidence on this is provided by Demirguc-Kunt and Levine (2001) who report that financial systems are more developed in richer countries and that their stock markets tend to be more active and efficient relative to banks. Moreover, Demirguc-Kunt and Levine (1996) report that countries with well-developed market-based institutions

also have well-developed bank-based institutions; and countries with weak market-based institutions also have weak bank-based institutions. Economists have examined the role of financial structure as income rises but, to our knowledge, no empirical study has assessed the role of financial development and financial structure when countries become financially developed and their financial structures alter. Will the efficacy of F^S and F^D on growth and development vary when low- and middle-income countries develop financially and converge to the F^S and F^D of rich countries? Equations (6) and (7) test this proposition vis-à-vis the financial structure:

$$\log(Q/L)_t = g_0 + g_1\log(K/L)_t + g_2\log(F^D)_t + g_3\log(F^S)_t + g_4 log(F^S * S^C)_t + e_6 \quad (6)$$

$$\log(Q/L)_t = h_0 + h_1\log(K/L)_t + h_2\log(F^D)_t + h_3\log(F^S)_t + h_4 log(F^S * S^{US})_t + e_7 \quad (7)$$

where S^{US} denotes the financial structure of US; S^C is a measure of convergence to the US financial structure, computed as S^{US} minus F^S. If the effects of financial structure become prominent when low- and middle-income countries develop financially and their financial structure converges to that of US then g_4 and h_4 should appear positive and significant. Negative g_4 and h_4 imply that the effects of financial structure dwindle if financial system becomes more market oriented. This follows because the US financial system is viewed as more market oriented. [5] An identical proposition vis-à-vis the financial development is tested as:

$$\log(Q/L)_t = j_0 + j_1\log(K/L)_t + j_2\log(F^S)_t + j_3\log(F^D)_t + j_4\log(F^D * F^C)_t + e_8 \quad (8)$$

$$\log(Q/L)_t = k_0 + k_1\log(K/L)_t + k_2\log(F^S)_t + k_3\log(F^D)_t + k_4\log(F^D * F^{US})_t + e_9 \quad (9)$$

where, F^{US} is the financial development of US; F^C is a measure of convergence of F^D to F^{US}, computed as F^{US} minus F^D. Again, a positive and significant j_4 implies that the effect of F^D on output levels increases in the process of its convergence to F^{US} and vice versa. Likewise, a positive and significant k_4 signifies that the effect of F^D increases when low- and middle-income countries achieve financial development equivalent to that of the US; the opposite holds true if k_4 is significantly negative.

Panel studies (e.g., Levine, 2002, Beck and Levine, 2002) evaluate whether (i) the legal structure and the rule of law (law and finance view), (ii) the regulatory restrictions, (iii) the ownership structure of banks (La Porta et al., 1998), and (iv) the accounting standards strengthen the effects of financial structure and financial

development on economic growth. Typically measures of 'rule of law', 'shareholders' right', 'efficiency of the legal system', 'legal origin', 'regulatory restrictions' on commercial banking activities, and 'accounting standards' are entered as regressors by interacting with the measures of financial structure and the overall financial development. The general finding is that the measures of legal efficiency and legal origin, regulatory restrictions and transparent accounting standards are found to strengthen the effect of financial development on growth but their effect via the financial structure variable appears insignificant. This strand of analysis sheds important light on the preconditions required for the well functioning of financial systems. Unfortunately, the lack of sufficiently long time series data on these variables precludes us from analyzing them in time series framework. Nonetheless, our conjecture is that these pre-conditions are important; they should strengthen our results as well.

4.2 Econometric Methods

In view of the small sample size and the first order integrated properties of our data, we employ the Fully Modified OLS (FMOLS) of Phillips and Hansen (1990). FMOLS provides estimates of the long-run parameters from static level regressions when variables are first order integrated, I(1). It corrects for both short- and long-run dependence across equation errors hence the corrected t-ratios allow inference through the standard distributions. This estimator is super-consistent and it is shown to perform well in small samples. The downside is that its distributional assumptions rely on asymptotic theory. We rigorously examine the distributional properties of our parameters and the test statistics through bootstrap simulations. A brief outline of the FMOLS is as follows. Consider a linear static regression:

$$y_t = \beta_0 + \beta_1' x_t + u_t \qquad (12)$$

where y_t is a vector of dependent variable and x_t is the (kx1) vector of covariates. Both y_t and x_t are assumed I(1). Let $\Delta x_t = \mu + w_t$; where μ is a (kx1) vector of drift parameters and w_t is a (kx1) vector of stationary variables. Define the consistent estimates of u_t and w_t as $\hat{\xi} = (\hat{u}_t, \hat{w}_t)'$. The long-run variance-covariance of $\hat{\xi}$ ($\hat{V}$) is:

$$\hat{V} = \hat{\Gamma} + \hat{\Phi} + \hat{\Phi}' = \begin{bmatrix} \hat{v}_{11} & \hat{v}_{12} \\ \hat{v}_{21} & \hat{v}_{22} \end{bmatrix} \qquad (13)$$

further define,

$$\hat{\Delta} = \hat{\Gamma} + \hat{\Phi} = \begin{bmatrix} \hat{\Delta}_{11} & \hat{\Delta}_{12} \\ \hat{\Delta}_{21} & \hat{\Delta}_{22} \end{bmatrix} \quad (14)$$

$$\hat{Z} = \hat{\Delta}_{21} - \hat{\Delta}_{22}\hat{v}_{22}^{-1}\hat{v}_{21} \quad (15)$$

where $\hat{\Gamma} = \frac{1}{T-1}\sum_{t=2}^{T}\hat{\xi}_t\hat{\xi}_t'$; $\hat{\Phi} = \sum_{s=1}^{m} w(s,m)\hat{\Gamma}_s$; $\hat{\Gamma}_s = T^{-1}\sum_{t=1}^{t-s}\hat{\xi}_t\hat{\xi}'_{t+s}$; w(s, m) is the lag truncation window. The FMOLS estimator is:

$$\hat{\beta}_{fmols} = (W'W)^{-1}(W'\hat{y}^*) - TD\hat{Z}) \quad (8)$$

where $\hat{y}^*_t = y_t - \hat{v}_{12}v_{22}^{-1}\hat{w}_t$; $\hat{y}^* = (\hat{y}_1^*, \hat{y}_2^*, ..., \hat{y}_t^*)'$; $D = \begin{bmatrix} 0_{1xk} & I_k \end{bmatrix}'$ and $W_{(txk)}$ is a matrix of all covariates including a constant term. The variance-covariance matrix (ψ) is: $\Psi(\hat{\beta}_{fmols}) = \kappa_{11.2}(W'W)^{-1}$; where $\kappa_{11.2} = \hat{v}_{11} - \hat{v}_{12}\hat{v}_{22}^{-1}\hat{v}_{21}$. If the error term obtained through FMOLS proves stationary then the regressand and the regressors in equation (12) are co-integrated. The stationarity of the error term can be tested through any standard unit root test.

Typically researchers opt for either the blocks bootstrap on the dependent variable or the wild bootstrap on the residuals if they suspect that the econometric model is mis-specified. When there is no such suspicion about the econometric model, the non-parametric i.i.d. (identically and independently distributed) bootstrap, based on residuals re-sampling with replacement is used. Our econometric models are widely tested and well-established in the literature. Therefore, the issue of misspecification does not arise hence we implement the i.i.d. bootstrap. Specifically, we assess (i) whether our parameter estimates suffer from small sample bias; and (ii) whether the distributions of the parameters and the empirical t-ratios are normal. In this way, unbiasedness and normality ensure the validity of our results as well as their inferences. We generate 1000 bootstrapped samples of residuals and dependent variables in each case. The FMOLS regression is fitted in all these pseudo samples and 1000 parameter vector for each specification are obtained. The mean of these estimates, which indicates the extent of biasedness, as well as their distributions are derived. We compute the empirical t-ratios and their distribution under the null that the parameter in question is zero. Since the theory of bootstrap is well-known, for the sake of brevity, we refer the interested readers to Horowitz (2001) for a comprehensive discussion of the issues and Hall (1992) for a more technical exposition.

5. Data Sources, Measurement and Description

Our sample consists of 14 countries, viz., Argentina, Brazil, Chile, Greece, India, Indonesia, Jordan, South Korea, Malaysia, Mexico, Philippines, Portugal, Thailand, and Venezuela. Data on Gross Domestic Product (GDP), Gross Fixed Investment (GFI), GDP deflator and population are obtained from IMF and the OECD. Nominal GDP and GFI variables are deflated by the GDP deflator. Data on Stock Market Capitalization Ratio (value of listed shares / GDP), Stock Market Total Value Traded Ratio (total shares traded on stock market exchange / GDP), Stock Market Turnover Ratio (value of total shares traded / average real market capitalization) and Private Credit Ratio (Private credit by deposit money banks and other institutions / GDP) are directly obtained from the World Bank dataset.[6] Although this dataset covers well over 200 countries and territories, but the reported time series are very short for most countries, which precludes their time series analyses. There are only 17 countries with at most 27 (1979-2005) to 30 (1976-2005) observations (the latter is the longest time series reported in the database). Furthermore, these 17 countries are all low- and middle-income countries. For the rest of the countries, data span is very short; for few cases data starts from the late 1980s, but for most it starts only from the 1990s. Data series on industrialized high-income countries are reported from early to mid 1990s only. Of those 17 countries, we drop three because of other data problems; hence we analyze 14 countries only.

Measures of financial structures and financial development are computed following Beck and Levine (2002) and Levine (2002). Two measures of financial structure employed are: (i) Structure-Activity (SA), which is computed as the log of the ratio of Stock Market Total Value Traded to Private Credit, and (ii) Structure-Size (SZ), measured as the log of the ratio of Stock Market Capitalization to Private Credit. The structure activity measures the activity of stock market relative to banks and other financial institutions. This measure is important because stock market activity and size are entirely different issues. Stock markets could be sizable because of the large number of listings but it may have very little activity because of the lack of active trading. The structure size measures the size of stock market relative to the rest of the financial sector (bank and non-bank institutions). The aggregate measure of financial structure (F^S) is the weighted sum of all the principal components of the two variables SA and SZ, which captures their total variation.

The two underlying measures of financial development are: (i) Finance-Size (FZ), computed as the log of the product of Private Credit Ratio and Stock Market Capitalization Ratio; and (ii) Finance-Activity (FA), which is the log of the product of Private Credit Ratio and Stock Market Value Traded Ratio. Finance-Size measures the overall size of stock market, banks and non-bank financial institutions whereas Finance-Activity measures their total activities. The aggregate measure of financial development (F^D) is the weighted sum of all the principal components of FZ and FA. [7]

A consistent time series of total physical capital stock for the whole sample period is not available for our sample countries. Therefore, we construct it for each country in the sample from the respective real gross fixed investment series using the perpetual inventory method. Following Luintel and Khan (1999 and 2004), amongst others, a depreciation rate of eight percent and the sample-average growth rate of real investment, are used to compute the initial capital stock.

Table 1 near here

Table 1 reports some descriptive statistics of our data set. It is evident that our sample consists of countries with varying income levels and growth experiences. In our sample, India has the lowest real per capita income (359 US dollars) and Greece has the highest (9549 US dollars) measured in 2000 constant dollars. In terms of growth, Korea is the fastest growing economy (5.49% average annual per capita real income growth) while Jordan and Venezuela show negative average annual growth rates of -0.104%, and -0.62%, respectively, during the sample period. A striking feature, however, is that all sample countries have evolved towards a more market-based financial system over the last thirty years or so. The levels of private credit ratio have gone up in all but four (Argentina, Brazil, Mexico and Venezuela) sample countries. On average, the private credit ratio is 1.65 times higher in the last five years compared with the first five years of the sample. However, the rise in capitalisation ratios and value-traded ratios are by far greater, however. They have shot up, respectively, by 4.23 and 8.76 folds during the same period. Their low base may partly explain this huge rise in these relative market sizes and activities. Stock market capitalization and stock market value traded both show positive average annual growth rates for all countries, although their magnitudes vary across countries. The last column of Table 1 shows that the financial systems of all sample countries grew

towards a more market-oriented system; the average annual conversion rate is 0.7 % for Greece (lowest) and 22.2% for Indonesia (highest).

6. Heterogeneity

Our sample consists of low- and middle-income countries, which represent different stages of development and economic structures. They also share significantly different growth experiences (Table 1). It is, therefore, interesting to formally test if it is valid to pool the data set of these countries. This is important not least because there is a growing concern about the panel and cross-section tests, in that they neglect cross-country heterogeneity.

Formal tests of the cross-country dynamic heterogeneity are conducted as follows. First, we estimate a series of p^{th} (p=1,2,3) order autoregressive and distributed lag models, ADL(P), conditioning Y^P on K^P, F^S and F^D and test for the equality of parameters across sample countries. Second, we estimate ADL(P) on growth rates and perform the tests of parameter equality.

Table 2 near here

Chow-type F tests under the null of parameter equality across sample countries are reported in Table 2, where the tests reject the null under all specifications. Thus, the elasticity of Y^P with respect to K^P, F^S and F^D is heterogeneous across countries. Furthermore, as another measure of dynamic heterogeneity, we test for error variance homoskedasticity across groups. The LM-test of group-wise heteroskedasticity is reported in Table 2, which confirms that error variances across sample countries are significantly different and this also holds across all specifications. Thus, the elasticity of Y^P with respect to K^P, F^S and F^D as well as the error dynamics across sample countries are significantly heterogeneous. Consequently, the data set cannot be pooled. This raises concerns with respect to the validity of extant panel and cross-sectional tests that do not allow for cross-country heterogeneity.

7. Empirical Results

7.1 Integration and Co-integration Tests

We examine the integrated properties of each of the data series, country-by-country, by two unit root tests: the KPSS (Kwiatkowski et al., 1992) and the ADF (Dickey and Fuller 1979). The former tests the null of stationarity, whereas the latter tests the null of unit root. If the KPSS test rejects the null but the ADF test fails to do so, then both tests support the same conclusion, i.e. the series in question is a unit root

process. [8] Tests show that all the relevant time series: Y^P, K^P, FZ, FA, SZ, SA, F^D and F^S are unit root processes. [9]

Preliminary investigations show that in ten countries of our sample F^S and F^D (the two principal component measures) exhibit very high magnitude of correlation raising concern that their joint use in the estimation may contaminate the signs of the estimated parameters thereby affecting our inferences regarding the bank-based and the market-based financial systems.[10] Indeed, our suspicion appeared credible when the joint use of F^D and F^S produced large number significantly positive cases of F^S with comparatively few cases of F^D and some of them with negative signs. The latter is theoretically inconsistent. We circumvent this problem by using FZ instead of F^D in the empirical implementations of all models (1) through (9). However, we discuss the results of the joint use of F^S and F^D as well as a range of other specifications in our sensitivity analyses (section 8). FA and FZ are individually less correlated with F^S.

Table 3 near here

Table 3 reports results of our benchmark model [Equation (1)] estimated by FMOLS utilizing FZ as the measure of financial development. Results in Panel A show that Y^P, K^P, F^S and FZ are co-integrated; KPSS tests do not reject the null of stationary FMOLS residuals for any of the sample countries. The per capita capital stock appears positively signed and significant in all but two countries (Argentina and the Philippines). We identify that the insignificance of K^P for Argentina is due to the blips in the data during early 2000. Likewise, for the Philippines it is due to the oscillations during the mid-1980s. When these blips are controlled by impulse dummies, K^P becomes positive and significant for both countries. [11] The financial structure variable appears significant in seven countries and so does the financial development variable. In five countries (Argentina, Brazil, Greece, Mexico and the Philippines), both the financial structure and the financial development variables appear significant; this is consistent with the findings of Levine and Zervos (1996) and Beck and Levine (2004). Surprisingly, financial structure and financial development both appear insignificant in five countries (India, Indonesia, Jordan, Korea and Malaysia). We found some turning points in the underlying data of these five countries as well as Thailand and capture them by impulse dummies (see footnotes to Table 3) to spot if the results improve. Indeed, the results do improve. Now F^S and F^D both appear significant in further three and four countries,

respectively (where they were insignificant before). These results with dummy variables are reported separately in Panel B.

7.2 Bootstrap Tests

We assess through bootstrap (as discussed in section 3) if our results are contaminated by the small size of our sample. We generate 1000 pseudo samples and 1000 replications of each of our parameter estimates. The mean values of these replications are reported in panel C, which appear almost identical to the parameter estimates based on our actual sample. This proves that our parameter estimates do not suffer from small sample bias. To evaluate their distributions, we plot histograms of all the estimated parameters (a_0, a_1, a_2, a_3) pertaining to Greece in Panel A of Figure 1. These histograms are representative of the parameters of the rest of the sample countries because their distributions are alike. Apparently, these histograms are symmetric and bell-shaped clearly suggesting that the parameters are normally distributed. We report the simulated upper and the lower bounds of empirical t-ratio associated with a_3 in the last column of Panel C. The histograms of simulated empirical t-ratios pertaining to all these four parameters are shown in Panel B of the Figure. The simulated upper and lower bounds and the histogram confirm the normality of empirical t-ratios as well. [12]

The bootstrap results in Panel C as well as the histograms show that the asymptotic approximations work very well for specification (1) in our dataset, consequently, results of panel A are valid. However, when impulse dummies are used in the estimation, the unbiasedness and normality of parameters remain but the distribution of the test statistics (empirical t-ratios) appear asymmetric for most cases (see Panel D). Interestingly, the inferences remain qualitatively same even when simulated t-ratios are used. [13] Nonetheless, our results indicate that the usage of dummy variables, which is common in empirical literature, may have implications on the distribution of the test statistics.

Of the fourteen sample countries, overall, F^S appears significant in ten countries and FZ in eleven countries. In seven countries F^S and FZ both appear significant. All significant coefficients of financial development are positively signed; this is consistent with the theoretical predictions. Note this was not the case when F^S and F^D were jointly used in the estimation. Of the ten significant coefficients of financial structure, nine are positively signed implying that market-based financial system appears relatively more important in augmenting domestic output levels

(output growth) in the majority of sample countries; the bank-based financial system appears relatively more important only for Chile. Even if we ignore the results with dummy variables, F^S and F^D appear statistically significant in seven countries each (50% of the total sample of countries). Of these seven countries, the market-based system appears important over the bank-based system in six and the opposite holds true in only one case. The coefficients of financial development are positively signed in all the significant cases. However, it is perfectly normal and valid to use impulse dummy variables to capture blips in the data. Moreover, our inferences are based on bootstrap simulations which provide added statistical legitimacy to their use. On the whole, we find a long-run relationship between output, physical capital stock, financial structure and financial development. In the majority of sample countries, financial structure as well as the financial development variables appears significant in explaining per capita output levels.

The magnitudes of country-specific point estimates (elasticities) in Table 3 show a considerable degree of cross-country heterogeneity. The elasticity of capital stock exhibits a cross-country divergence of as high as three folds (compare 0.315 for Brazil and 0.967 for Jordan). The coefficients of financial development range between a minimum of 0.010 (Mexico) to a maximum of 0.109 (Malaysia). Likewise, amongst the positive elasticity of financial structure the magnitude ranges between a minimum of 0.018 (Mexico) to a maximum of 0.198 (India). Further, Chile shows a negative elasticity of financial structure indicating the relative importance of bank-based system.

These financial variables and their associated point elasticities seem to exert quite sizeable effects on output growth. For example, Jordan shows an overall negative growth of -0.104 percent per annum over the sample period and its mean level of Structure-Size (SZ) is 0.985. Assuming that Jordan's elasticity of Structure-Aggregate (0.041) applies to SZ, its growth rate would have been easily on the positive territory if Jordan had the SZ similar to that of Malaysia. [14] Likewise, Venezuela has a mean level of private credit ratio of 0.302. Its elasticity of Finance-Size [log (Private Credit ratio*Stock Market Capitalization ratio)] is 0.051. Assuming that this elasticity is applicable to Private Credit ratio, an average credit flow of around 40% would turn Venezuela's negative growth rate into a positive one. These growth effects are economically quite large, however, and one should be cautious because they are subject to Lucas Critique and they are also obtained from partial

analyses. As Beck and Levine (2002) point out, these results should be viewed as economically meaningful relationship rather than as exploitable elasticities.

7.3 Panel Results and Equivalence Tests

In Table 4 (Panel A) we report the results obtained from the 'between-dimension' dynamic heterogeneous panel estimator. Pedroni (1999 and 2001) derives the computational methods for these panel estimates under FMOLS. In effect, the 'between-dimension' panel estimates are just the mean of the country-specific estimates. In the Table, row G contains panel results when no impulse dummy is used in the estimation; whereas row H contains results when impulse dummies are used for the countries as defined in panel B of Table 3. The panel results show that financial structure and financial development both significantly affect output levels and so does the capital stock. The positive sign of the coefficient of financial structure variable indicates the relative importance of the market-based system. Both sets of panel results (reported in rows G and H) are very close and qualitatively similar. Overall, these panel results corroborate our time series findings that financial structure is significant in explaining output for this set of sample countries. However, these panel results conceal the cross-country parameter heterogeneity which has obvious implications on the relevance of bank-based versus the market-based financial systems. Our panel results are in contrast to the findings of Levine (2002), Beck and Levine (2002), and most other panel and/or cross-section based empirical literature discussed in sections 1 and 3.

The panel approach we use differs from those applied by Levin (2002), Beck and Levine (2002) and other studies reviewed above. In fact, the cointegration-based 'between-dimension' panel test that we apply may be statistically superior to the panel approaches used by the previous studies. This is because the Dynamic Heterogeneous Panel Approach addresses the issues of (i) cross-country heterogeneity and (ii) data non-stationarity, both of which remain unaddressed in much of the panel/cross-section literature discussed above. This difference in empirical methods may reconcile these distinctly different sets of results. However, we attach more importance to the country specific time-series results, and to the cross-country heterogeneity that they exhibit; this is one of the main focuses of this paper. The Dynamic Heterogeneous Panel results are important in that they enable us to compare our results with the extant literature and further allow us to assess the equivalence between panel and the time series estimates.

It is extremely important to establish the equivalence between the panel and the country-specific estimates of parameters as the latter inform economic policy making at the national level. We conduct equivalence tests in three ways. First, we impose each panel estimate (parameter) on the corresponding parameter of each sample country and test one parameter restriction at a time, through Wald tests, under the null that the restriction holds (i.e., panel and country-specific parameters are equal). They are country-by-country and parameter-by-parameter tests of restrictions which generate a 14x4 matrix of Wald statistics each of which is $\chi^2(1)$ distributed. We call them *individual tests*. Second, we impose all four panel estimates of a_0, a_1, a_2 and a_3 on the respective parameter of each sample country and jointly test, country-by-country, for the equality of country-specific and panel parameters under the null. This generates 14 Wald statistics (one for each country) each of which is $\chi^2(4)$ distributed. We call them *joint tests*. Finally, we compute the parameter equivalence tests proposed by Pesaran et al. (2000). This involves summing up all *individual* χ^2 statistics (computed above) separately for each regressor. This gives us one Wald statistic per regressor for the whole panel. Thus, for four regressors (including the constant term) we will have four Wald statistics each of which is $\chi^2(N)$ distributed, where N is the number of countries in the panel. Assuming that these tests are independent across countries, Pesaran et al. (2000) show that these χ^2 statistics tests for the null that country-specific coefficients are jointly equal to their respective panel estimate.

Results of equivalence tests are reported in panel B of Table 4. The country-by-country and variable-by-variable tests of parameter equality show: (i) all sample countries exhibit significantly different fixed effects (constant terms), (ii) the country-specific and panel estimates of the elasticity of capital stock are significantly different in all but two countries (Malaysia and Portugal), and (iii) the country-specific and panel parameters of financial structure appear significantly different in all but three countries (Brazil, Greece and Mexico) and those of finance size (SZ) variable is significantly different in all but one country (Thailand). The *joint tests* are reported in the last column of Panel B whereas the Pesaran et al.'s (2000) tests are reported in the last row; both reject the null of equality between country-specific estimates and their panel counterparts at a very high level of precision. All in all, we find that panel estimates do not represent country-specific parameters.

7.4 Further Results

Table 5 reports results of specifications (2) through (9) which test various hypotheses raised and discussed in section 2. The first two columns of results examine whether the financial system becomes more market-based when (i) countries' income level gradually converges towards the US income level; and (ii) countries achieve the US real income level, respectively. In the first column, nine countries show significant b_4 of which six are positive and three negative. This implies that Boyd and Smith's (1998) prediction proves true in six countries while the opposite holds in three. For the remaining five countries this effect is insignificant. The picture looks pretty similar when the financial structure variable is directly interacted with the US real per capita income level. Now, the financial system appears to become more market oriented with rising income levels in four countries while it is the other way round in three countries. The remaining seven countries show insignificant results. Overall, the evidence on Boyd and Smith's (op. cit.) prediction is rather mixed. There is some but not a clear cut support for the proposition that financial structure tends to be more market oriented when countries become more developed and get richer. This is in contrast to the empirical findings of Beck and Levine (2002).

In columns 4 and 5 we report results on the effects of financial development (measured by Finance-Size, FZ) on domestic output levels when countries are either converging to US income levels or they have fully converged (achieved) the income level equivalent to that of the US. Earlier evidence suggests that the effect of overall financial development should somewhat diminish when countries get richer and become more developed. Of the fourteen countries, five countries show significantly positive d_4; four countries show significantly negative d_4; and for the remaining five countries it is insignificant. This scenario does not improve when the FZ variable is directly interacted with the US real per capita income. In the majority (eight) of sample countries f_4 appears insignificant indicating no difference in the effect of FZ when countries achieve higher level of income. In four countries f_4 is negative and significant indicating a diminished effect of FZ on Y^P. By contrast, in two countries f_4 appears positive and significant indicating the opposite. Again, results are pretty mixed. There is no clear direction about the effects of the overall financial development on output levels when countries become more developed and get richer. Our results suggest that these issues are specific to the country and the economy.

In columns 6 and 7, we report results which exhibit the effects of domestic financial structure on domestic output levels when countries' financial structure changes either by converging to or by achieving the US financial structure. US financial system is regarded as more of the market-based type. Seven countries show significant parameters (g_4) when their financial structure is interacted with their respective convergence measure vis-à-vis the US financial structure. Of these seven, four countries exhibit an increased effect of market-based system whereas three show the opposite (i.e., a dwindling effect of the market-based system). Half the sample (seven countries) shows no significant changes in terms of the financial structure on output levels during their convergence to a more market-based system. However, this scenario alters when sample countries' financial structure directly interacts with the US financial structure. Now, ten countries become significant with five each having positive and negative coefficients. On balance, the evidence is mixed. Of the significant countries, one-half shows positive and the other-half shows negative output effects when financial structure becomes more akin to that of the US.

Finally, in the last two columns, we report the results which shed light on how the effect of financial development changes when countries become more financially developed. When financial development variable is interacted with its convergence measure, nine countries show significant coefficient of the interaction term (j_4) of which five are negative and four are positive. This implies that when countries' financial sector gradually converges to a highly developed one its effect on output levels depletes in five countries; increases in four countries; and does not change (appears insignificant) in five countries. The results appear paltrier when the sample countries' financial development variable is directly interacted with the US financial development measure. Majority of sample countries (nine) appear insignificant; only three countries show diminished effects and two countries show the opposite.

8. Sensitivity Tests

Two main set of sensitivity tests are conducted. First, we examine the robustness of our results reported in Table 3, obtained from our bench mark model (equation (1)). In the empirical implementations of models (1) through (9), Structure-Aggregate (F^S) is proxied by a weighted principal component measure but we use the Finance-Size (SZ) variable instead of the Finance-Aggregate (F^D, a weighted principal component) variable. This is because F^S and F^D are highly collinear. In this section we elaborate

on this issue in conjunction with other sensitivity tests. The robustness of the results of Table 3 is examined by estimating the following relationships by FMOLS:

$$Y^P = q_0 (C, K^P, F^S, F^D) \qquad (10)$$
$$Y^P = q_1 (C, K^P, F^S, FA) \qquad (11)$$
$$Y^P = q_2 (C, K^P SA, FZ) \qquad (12)$$
$$Y^P = q_3 (C, K^P, SZ, FZ) \qquad (13)$$

where 'C' denotes a constant term and other variables are as defined above. In equation (10) we replace the Finance-Size (FZ) variable by the Finance-Aggregate (F^D) to shed light on the issue of collinearity between F^S and F^D. The results of this specification reveal why it makes sense to use F^S and FZ rather than F^S and F^D in our data set. In equation (11) we replace Finance-Size (FZ) by Finance-Activity (FA) and re-estimate our benchmark model. This will reveal whether our results change when the Finance-Size variable is replaced by the Finance-Activity variable. Also note that FZ and FA are the constituent components of F^D. In equations (12) and (13) we unravel the underlying variables of Structure-Aggregate (F^S) and examine the significance of Structure-Activity (SA) and Structure-Size (SZ) separately. Specifications (10-13) not only reveal the robustness of our results of Table 3 vis-à-vis various measures of financial development and financial structure they also shed light on the effects of size and activities measures.

The results of specification (10) reveal that F^S is significantly positive in 7 countries; significantly negative in one country and insignificant in the remaining six countries. This result is similar to that of the Table 3. However, in this specification, F^D appears positive and significant in only four countries, negative and significant in two and insignificant in eight. The significantly negative coefficients of F^D are inconsistent with the theoretical predictions. A high degree of collinearity between F^S and F^D may be behind these poor results, which prompted us to use F^S and FZ in our basic specification. Nonetheless, in this section, we provide a complete picture by discussing results based on specifications (11-13) which incorporate, one-by-one, all measures of financial structure and financial development outlined in section 5.

The results from specification (11) appear marginally weaker compared to Table 3 because only five countries each show significant effect of Structure-Aggregate and Finance-Activity on output levels compared to seven countries each in

Table 3. However, results from specifications (12) and (13) appear stronger as more countries show significant effects. Specification (12) shows significantly positive coefficients of Structure-Activity in eight countries coupled with positive and significant effects of Finance-Size in nine countries. Likewise, specification (13) shows significant Structure-Size in nine countries coupled with significant Finance-Size in eight countries. The coefficient of K^P remains robust in all specifications. All sensitivity tests are carried out without any impulse dummy variable as the latter is likely to improve the results further. We also examine if results hold when F^S and FZ are entered individually without controlling for the other. [15] Indeed, Structure-Aggregate appears significant in seven countries and Finance-Size in nine countries. Overall, our basic findings of Table 3 that financial structure matters for the majority of sample countries are robust to alternative measures of financial development and financial structure. The evidence is there irrespective of the measures and specifications used.

The second set of sensitivity exercise examines the robustness of results reported in Table 5. Since Table 5 contains the results of models (2) through (9), we illustrate, using model (2) as an example, the alternative specifications utilized for their robustness checks. These specifications are:

$$Y^P = (C, K^P, FA, F^S, F^S*Y^C) \qquad (14)$$
$$Y^P = (C, K^P, FZ, SA, SA*Y^C) \qquad (15)$$
$$Y^P = (C, K^P, FZ, SZ, SZ*Y^C) \qquad (16)$$

Equation (14) replaces FZ by FA in equation (2). Equations (15) and (16) replace F^S by its constituent components: SA and SZ. Similar re-specifications are estimated for equations (4), (6) and (8). Thus, we run a total of 12 equations. [16] Overall, results of table 5 remain qualitatively similar vis-à-vis these sensitivity tests.

9. Conclusion and Implications

In this paper we have examined the hotly debated issue of whether financial structure matters for economic growth. Much of the recent empirical work analyzes multi-country dataset at firm-, industry- and aggregate-levels utilizing the panel and/or pure cross-section frameworks and concludes that financial structure is irrelevant. We summarize these influential studies, among others, in the paper.

However, doubts have been raised on these (multi-country) studies because (i) they cannot address the cross-country heterogeneity and thus mask important cross-country differences in the relationship under investigations, (ii) the panel and the country-specific parameters (estimates) may not be equivalent hence limiting the economic value of panel estimates, and (iii) various countries in the panel are unlikely to be on the balanced growth path raising concern on pooled regressions. All these concerns are important because of their economic and econometric implications which we elucidate in the paper. This paper addresses these concerns. We analyze 14 low-and-middle income countries using both time series and dynamic heterogeneous panel methods.

We find evidence of significant cross-country heterogeneity in the relationship between financial development, financial structure and economic growth. Tests show that data of our sample countries cannot be pooled, which reinforces our arguments as well as the concerns raised by many. This also underpins our focus on a time series analysis. Output level, capital stock, financial structure and financial development variables are co-integrated. For majority of sample countries, financial structure and financial development appear significant in explaining output levels; this holds under time series and panel estimates, both. Tests also reveal that the panel estimates (parameters) do not correspond to country specific estimates. This is robustly shown by the three tests employed. We assess the validity of our results through extensive bootstrap exercise. The asymptotic approximations appeared poor in most specifications; therefore, we report bootstrap results. Our bootstrap results reveal an interesting insight. They show that the asymptotic approximations remain valid for the finite sample results (parameters and test statistics) so long as the empirical models do not utilize impulse dummies and/or interacted regressors. However, when empirical models employ impulse dummy and/or interacted covariate, the distributions of the tests statistics (empirical t-ratios) tend to be asymmetric. The latter suggests that those empirical studies which utilize impulse dummies and/or interacted regressors should base their inferences on suitably computed (by way of bootstrap) finite sample critical values.

We also examine how the effects of financial development and financial structure change when (i) countries become economically more developed and get richer, (ii) countries' financial structure develops and converges to that of the US and

(iii) countries' level of overall financial development converges to that of the US. Unlike Beck and Levine (2002), we find only limited empirical support for Boyd and Smith's (1998) theoretical prediction that the importance of market-based financial system rises with the rise in income. We also found very limited support for the earlier assertion that the effect of financial development on growth tapers off as countries become economically more developed (King and Levine, 1993). Our tests of various hypotheses regarding the prospective role of financial development and financial structure when countries develop both economically and financially reveal mixed results which reinforces our arguments of a heterogeneous relationship cross countries. Our results are robust to various sensitivity tests. Overall, our findings imply that financial structure and financial development matter for output levels and economic growth. Our findings do not invalidate the findings of Beck and Levine (2002) and Levine (2002), instead we attribute this difference to our empirical approach, which allows for cross-country heterogeneity in parameters and adjustment dynamics. Our findings are more in line with Levine and Zervos (1998) and Beck and Levine (2004). The complete absence of cross-country support for financial structure, reported by panel or cross-section studies, may be because they do not sufficiently account for cross-country heterogeneity. The main policy message coming out of our analyses is that financial structure matters for economic growth.

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Table 1: Descriptive Statistics (1978-2005)

	Y^P	Y_G	PC_S	PC_E	PC_M	PC_G	SM_S	SM_E	SM_M	SM_G	SA_S	SA_E	SA_M	SA_G	SZ_S	SZ_E	SZ_M	SZ_G
ARG	7117	0.251	0.289	0.146	0.203	-3.190	0.033	0.651	0.184	0.141	0.038	0.304	0.166	0.131	0.115	4.257	1.089	0.179
BRA	3156	1.033	0.484	0.345	0.438	-1.587	0.042	0.411	0.190	0.087	0.033	0.392	0.251	0.105	0.087	1.191	0.523	0.104
CHL	3665	3.299	0.335	0.707	0.533	5.663	0.242	0.960	0.592	0.077	0.040	0.129	0.096	0.048	1.071	1.356	1.071	0.020
GRE	9549	1.548	0.347	0.663	0.409	4.418	0.099	0.624	0.283	0.051	0.010	0.364	0.349	0.104	0.322	0.967	0.632	0.007
IND	359	3.177	0.201	0.310	0.243	2.161	0.027	0.367	0.190	0.102	0.098	1.274	0.730	0.121	0.134	1.169	0.749	0.079
IDN	651	3.323	0.052	0.192	0.253	9.703	0.000	0.194	0.114	0.341	0.001	2.153	0.455	0.286	0.007	0.998	0.383	0.222
JOR	1844	-0.104	0.476	0.708	0.645	2.056	0.464	0.985	0.637	0.053	0.096	0.429	0.184	0.120	0.985	1.399	0.985	0.031
KOR	7501	5.487	0.486	1.285	0.935	4.626	0.076	0.496	0.294	0.065	0.100	0.934	0.474	0.056	0.292	0.387	0.292	0.018
MYS	2766	4.841	0.445	1.301	0.952	4.720	0.396	1.429	1.190	0.075	0.173	0.323	0.458	0.033	1.205	1.105	1.205	0.026
MEX	5132	1.196	0.173	0.166	0.175	-0.982	0.052	0.201	0.167	0.080	0.094	0.335	0.341	0.128	0.312	1.215	0.852	0.091
PHL	955	0.573	0.355	0.393	0.335	0.478	0.087	0.503	0.306	0.060	0.058	0.228	0.223	0.019	0.885	1.273	0.885	0.055
PRT	8344	2.345	0.755	1.454	0.852	2.499	0.004	0.400	0.187	0.210	0.000	0.137	0.098	0.387	0.005	0.276	0.203	0.180
THA	1509	4.532	0.381	0.980	0.830	3.796	0.042	0.531	0.314	0.120	0.123	0.565	0.273	0.051	0.109	0.545	0.322	0.079
VEN	5098	-0.619	0.510	0.096	0.302	-5.776	0.043	0.051	0.067	0.013	0.002	0.032	0.071	0.101	0.085	0.530	0.412	0.075

Y^P = GDP per capita in (2000) US Dollars. Y_G = average annual growth rate of GDP per capita. PC = Private Credit by Deposit Money Banks and Other Financial Institutions to GDP ratio. SM = Stock Market Capitalisation to GDP ratio. SA = Stock Market Total Value Traded to Private Credit by Deposit Money Banks & Other Financial Institution. SZ = Stock Market Capitalization to Private Credit by Deposit Money Banks & Other Financial Institution. Subscripts $_S$, $_E$, $_M$ and $_G$ are the average value of the first five years, the average value of the last five years, the mean value of the sample period and the average annual growth rate, respectively. The country mnemonics in this and subsequent tables are: ARG= Argentina; BRA=Brazil; CHL=Chile; GRE=Greece; IND=India; IDN=Indonesia; JOR=Jordan; KOR=Korea; MYS= Malaysia; MEX= Mexico; PHL= the Philippines; PRT = Portugal; THA= Thailand; VEN = Venezuela.

Table 2: Tests of heterogeneity of financial structure and growth dynamics across sample countries

	Specification: A			Specification: B		
	P=1	P=2	P=3	P=1	P=2	P=3
Parameter equality	38.926[a] (5, 316)	23.909[a] (9, 246)	20.371[a] (13, 176)	39.170[a] (9, 232)	14.637[a] (7, 147)	13.128[a] (13, 162)
LM Test	260.708[a]	128.037[a]	138.228[a]	91.923[a]	129.987[a]	166.77[a]

The specification A: $Y^P = \lambda_0 + \sum_{i=1}^{L} \lambda_{1i} Y_{t-i}^P + \sum_{i=1}^{L} \lambda_{2i} K_{t-i}^P + \sum_{i=1}^{L} \lambda_{3i} F_{t-i}^S + \sum_{i=1}^{L} \lambda_{3i} F_{t-i}^D + \varepsilon_{1t}$.

The specification B: $\Delta Y^P = \theta_0 + \sum_{i=1}^{L} \theta_{1i} \Delta Y_{t-i}^P + \sum_{i=1}^{L} \theta_{2i} \Delta K_{t-i}^P + \sum_{i=1}^{L} \theta_{3i} \Delta F_{t-1}^S + \sum_{i=1}^{L} \theta_{3i} \Delta F_{t-i}^D + \varepsilon_{2t}$.

Equality of θ and λ are standard (Chow type) F-tests of parameter equality across the sample (fourteen) countries. Numbers within parentheses, (.), are the degrees of freedom of F distribution. Lagrange Multiplier (LM) tests (see text) reject the null of homoskedastic error variances across the sample countries; they are $\chi^2(13)$ distributed. Superscript 'a' indicates rejection of the null at 1%; and this applies across all tests. Variable definitions are: Y^P = log of per capita real GDP; K^P = log of per capita real physical capital stock; F^S is Structure-Aggregate; and F^D = Finance-Aggregate. Results remain qualitatively same when F^D is replaced by FZ (Finance-Size).

Table 3: Results of Fully Modified OLS

	$\log(Y^P)_t = a_0 + a_1\log(K^P)_t + a_2\log(F^S)_t + a_3\log(FZ)_t + e_1$									
	Panel A: Asymptotic Results					**Panel C: Bootstrap Results**				
	a_0	a_1	a_2	a_3	η_μ #	a_0	a_1	a_2	a_3	$a_{3\ (UB\ /\ LB)}$ *
ARG	9.416 (0.000)	0.004 (0.980)	0.035 (0.029)	0.041 (0.000)	0.130	9.449	0.001	0.034	0.041	3.011 / -3.260
BRA	5.907 (0.000)	0.315 (0.000)	0.027 (0.000)	0.025 (0.034)	0.110	5.872	0.319	0.026	0.026	3.641 / -3.385
CHL	2.046 (0.000)	0.734 (0.000)	-0.034 (0.000)	-0.007 (0.698)	0.062	2.006	0.738	-0.034	-0.009	3.842 / -3.853
GRE	2.357 (0.026)	0.710 (0.000)	0.020 (0.001)	0.061 (0.000)	0.175	2.347	0.711	0.020	0.062	3.419 / -3.639
IND	2.019 (0.000)	0.693 (0.000)	0.022 (0.174)	0.007 (0.624)	0.252	1.996	0.696	0.022	0.007	3.718 / -3.753
IDN	3.375 (0.000)	0.557 (0.000)	0.009 (0.562)	0.015 (0.159)	0.082	3.386	0.556	0.009	0.015	3.358 / -3.226
JOR	-0.573 (0.778)	0.967 (0.000)	0.023 (0.153)	-0.009 (0.905)	0.200	-0.594	0.970	0.022	-0.007	3.498 / -3.120
KOR	2.180 (0.000)	0.710 (0.000)	-0.023 (0.213)	0.041 (0.196)	0.159	2.176	0.711	-0.024	0.040	3.493 / -3.534
MYS	3.496 (0.003)	0.575 (0.000)	-0.023 (0.570)	0.054 (0.416)	0.169	3.512	0.572	-0.023	0.055	3.785 / -3.881
MEX	2.588 (0.000)	0.672 (0.000)	0.018 (0.011)	0.010 (0.032)	0.213	2.577	0.673	0.019	0.010	3.748 / -3.426
PHL	7.723 (0.000)	0.074 (0.481)	0.054 (0.000)	0.066 (0.000)	0.121	7.747	0.072	0.054	0.066	3.652 / -3.727
PRT	4.324 (0.001)	0.515 (0.000)	-0.006 (0.635)	0.051 (0.002)	0.113	4.289	0.518	-0.006	0.051	3.377 / -3.298
THA	2.992 (0.000)	0.599 (0.000)	0.033 (0.000)	0.025 (0.158)	0.059	2.996	0.598	0.033	0.025	3.167 / -3.462
VEN	5.824 (0.000)	0.338 (0.041)	-0.007 (0.575)	0.051 (0.007)	0.179	5.867	0.334	-0.008	0.051	3.831 / -3.540
Panel B : Asymptotic Results (with dummies)						**Panel D: Bootstrap Results (with dummies)**				
IND	2.275 (0.000)	0.661 (0.000)	0.026 (0.061)	0.008 (0.496)	0.317	2.281	0.661	0.026	0.009	3.825 / -4.167
IDN	4.511 (0.000)	0.436 (0.000)	0.198 (0.000)	0.020 (0.000)	0.306	4.502	0.437	0.198	0.020	4.148 / -4.205
JOR	-1.463 (0.371)	1.059 (0.000)	0.041 (0.001)	-0.041 (0.475)	0.276	-1.379	1.050	0.040	-0.042	11.040 / 2.550
KOR	2.576 (0.000)	0.674 (0.000)	-0.023 (0.148)	0.059 (0.027)	0.107	2.569	0.675	-0.023	0.059	1.676 / -6.222
MYS	4.224 (0.000)	0.508 (0.000)	-0.062 (0.115)	0.109 (0.079)	0.188	4.274	0.503	-0.065	0.113	1.204 / -7.296
THA	3.083 (0.000)	0.591 (0.000)	0.034 (0.000)	0.032 (0.000)	0.062	3.084	0.591	0.034	0.032	3.922 / -4.087

The details of impulse dummies are: IND (83=1 & 03=04=1); IDN (2001=1 & 1998=1999=2000=1); JOR: (01=02=03=1); KOR: (89=90=1 & 99=00=1); MYS (83=1 & 98=99=00=1); THA (93=1 & 98=99=1). For example, for India (IND) there are two impulse dummies: one with 1983=1 and rest zero and the other where 2003 and 2004 take the value of unity and rest zero. Similar interpretation applies for the dummies of other countries. * UB and LB Denote the upper and the lower bounds of empirical t-ratios obtained from i.i.d. bootstrap with 1000 replications. # KPSS test under the null that the FMOLS residuals are level stationary. The critical values for η_μ are 0.739, 0.463 and 0.347 at 1%, 5% and 10%. Tests cannot reject the stationarity of FMOLS residuals in any case.

Table 4: Panel Results and Tests of Parameter Equivalence

	Panel A: FMOLS based Dynamic Heterogeneous Panel Results				
	C	K^P	F^S	FZ	
G	3.834(0.000)	0.533(0.001)	0.011(0.000)	0.031(0.000)	
H	3.956(0.000)	0.521(0.000)	0.023(0.000)	0.035(0.000)	
	Panel B: Tests of Parameter Equivalence				
	Country-by-country & parameter-by-parameter tests				Joint tests
	C	K^P	F^S	FZ	Joint
ARG	221580 (0.000)	1799 (0.000)	33.2(0.000)	2.8 (0.093)	223870 (0.000)
BRA	173440 (0.000)	1932 (0.000)	0.7 (0.414)	4.3 (0.038)	175380 (0.000)
CHL	298950 (0.000)	3707 (0.000)	262.4 (0.000)	142.4(0.000)	303060 (0.000)
GRE	100930 (0.000)	1410 (0.000)	0.4 (0.535)	27.6 (0.000)	102370 (0.000)
IND	97382 (0.000)	646 (0.000)	3.4 (0.066)	39.0 (0.000)	98349 (0.000)
IDN	28042 (0.000)	663 (0.000)	2795.8 (0.000)	20.4 (0.000)	94424 (0.000)
JOR	261770 (0.000)	2578 (0.000)	2.7 (0.098)	51.5 (0.000)	264520 (0.000)
KOR	71041 (0.000)	877 (0.000)	78.4 (0.000)	22.3 (0.000)	72159 (0.000)
MYS	201 (0.000)	0.440 (0.507)	20.1 (0.000)	15.5 (0.000)	292 (0.000)
MEX	147180 (0.000)	1786 (0.000)	1.8 (0.179)	47.2 (0.000)	149010 (0.000)
PHL	302940 (0.000)	4568 (0.000)	47.5 (0.000)	8.7 (0.003)	308220 (0.000)
PRT	2293 (0.000)	1 (0.407)	14.1 (0.000)	4.4 (0.036)	2312 (0.000)
THA	74949 (0.000)	484 (0.000)	12.2 (0.000)	1.0 (0.314)	77905 (0.000)
VEN	37689 (0.000)	362 (0.000)	9.8 (0.002)	2.9 (0.088)	38064 (0.000)
Pesaran et al.	1818387(0.000)	20812(0.000)	3283(0.000)	390(0.000)	

Results of Panel B are based on the model reported in row H in Panel A. The country-by-country and parameter-by-parameter tests are $\chi^2(1)$ distributed; the joint tests are $\chi^2(4)$ distributed; and Pesaran et al.'s tests are $\chi^2(14)$ distributed. The p-values are reported within parenthesis.

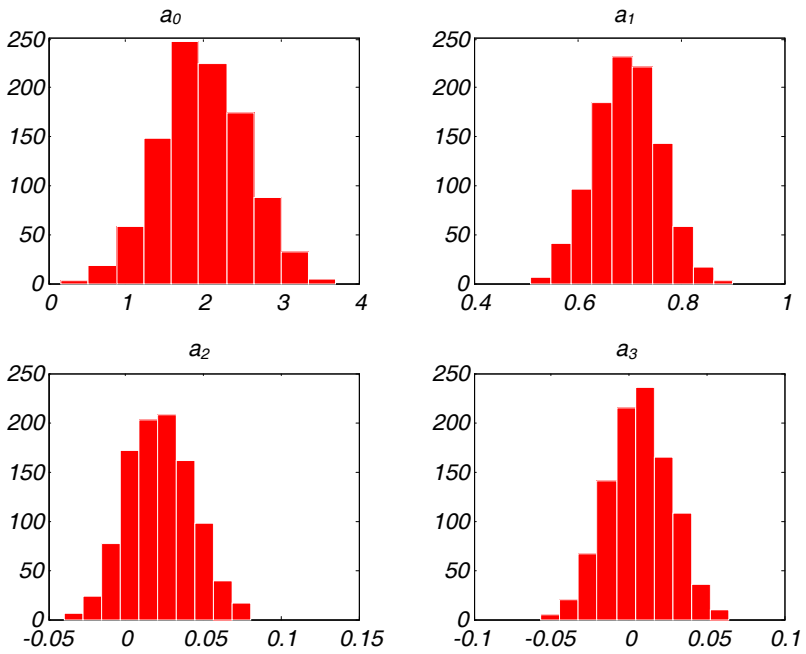
Table 5: Results of Fully Modified OLS (Bootstrap Results)

	$F^{S}{*}Y^{C}$ [2]	$F^{S}{*}Y^{US}$ [3]	$FZ{*}Y^{C}$ [4]	$FZ{*}Y^{US}$ [5]	$F^{S}{*}S^{C}$ [6]	$F^{S}{*}S^{US}$ [7]	$FZ{*}F^{C}$ [8]	$FZ{*}F^{US}$ [9]
	b_4	c_4	d_4	f_4	g_4	h_4	j_4	k_4
ARG	0.203 (0.084)	0.315 (0.216)	-0.007 (0.098)	-0.041 (0.006)	0.026 (0.000)	0.065 (0.298)	-0.006 (0.028)	-0.009 (0.004)
BRA	-0.019 (0.386)	-0.032 (0.230)	-0.022 (0.018)	-0.079 (0.000)	0.004 (0.046)	0.001 (0.082)	-0.006 (0.034)	0.006 (0.422)
CHL	0.119 (0.000)	0.091 (0.002)	-0.036 (0.032)	-0.083 (0.194)	0.006 (0.000)	0.010 (0.252)	0.018 (0.000)	-0.014 (0.644)
GRE	0.041 (0.110)	0.048 (0.328)	0.003 (0.002)	0.005 (0.024)	0.004 (0.210)	0.009 (0.000)	-0.015 (0.000)	0.002 (0.000)
IND	0.240 (0.000)[1]	0.224 (0.000)	0.082 (0.018)	0.083 (0.020)	0.016 (0.454)	0.002 (0.592)	-0.007 (0.000)	0.012 (0.160)
IDN	-0.789 (0.000)[1]	-0.792 (0.000)[1]	0.028 (0.984)	0.023 (0.904)	-0.074 (0.000)[1]	-0.095 (0.000)	0.001 (0.002)[1]	0.008 (0.012)[1]
JOR	0.121 (0.000)[1]	0.140 (0.002)[1]	0.297 (0.000)[1]	0.087 (0.632)	-0.012 (0.556)	0.016 (0.022)[1]	-0.134 (0.000)	-0.057 (0.384)
KOR	-0.268 (0.016)	-0.211 (0.034)	0.124 (0.142)	-0.048 (0.974)	0.002 (0.376)	-0.015 (0.008)	0.064 (0.000)	0.015 (0.468)
MYS	1.129 (0.006)	-0.058 (0.820)	0.045 (0.840)	-0.129 (0.704)	0.017 (0.492)	0.005 (0.484)	0.010 (0.260)	-0.023 (0.412)
MEX	-0.160 (0.000)	-0.179 (0.000)	0.022 (0.966)	0.021 (0.784)	-0.015 (0.000)	-0.022 (0.000)	-0.003 (0.148)	-0.003 (0.310)
PHL	-0.034 (0.372)	-0.023 (0.624)	0.006 (0.000)	-0.009 (0.000)	-0.001 (0.000)	0.006 (0.000)	0.020 (0.874)	-0.002 (0.000)
PRT	0.044 (0.470)	-0.004 (0.970)	0.032 (0.034)	-0.007 (0.634)	0.000 (0.722)	-0.002 (0.000)	-0.001 (0.674)	-0.007 (0.062)
THA	0.181 (0.000)	0.143 (0.004)	-0.042 (0.000)	-0.040 (0.000)	0.024 (0.002)	0.013 (0.106)[1]	0.002 (0.000)	-0.004 (0.224)
VEN	-0.206 (0.142)	-0.221 (0.250)	0.066 (0.246)	0.022 (0.472)	0.000 (0.958)	-0.032 (0.004)	0.002 (0.456)	0.003 (0.282)

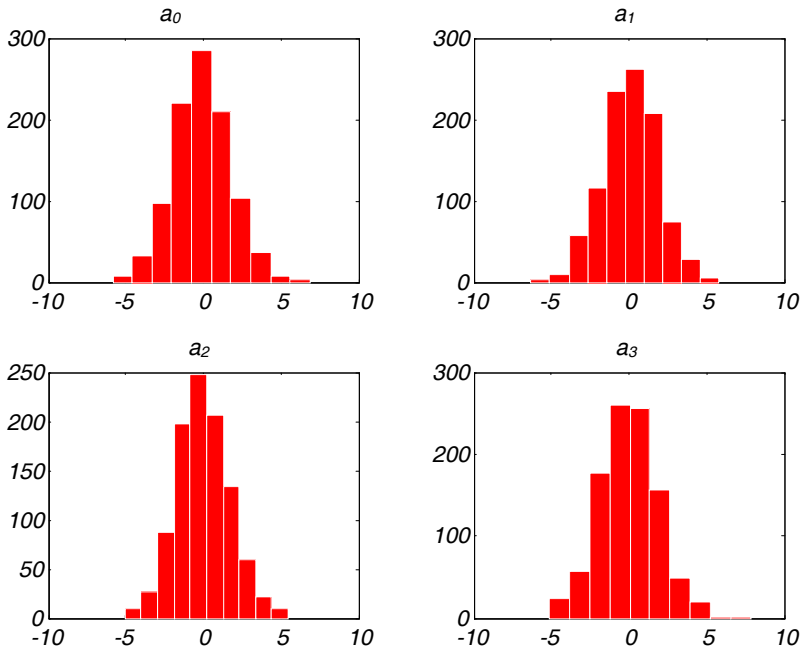
1. Impulse dummies, as defined in Table 3, are used only for these countries. Their parameters appeared insignificant without impulse dummies. No dummy is used for rest of the countries. Number within brackets, [.], indicates the relevant model (equation) in the text.

Figure 1

Panel A: Parameter Distributions



Panel B: T-statistic Distribution



[1] Utilizing panel data for 76 emerging and developed countries, covering the period 1990-2003, Yartley (2006) concludes that financial structure does not affect cross-country diffusion of information communication technology (ICT).

[2] Barro and Lee (2000) and Cohen and Soto (2007) provide periodic data, five yearly and 10 yearly respectively, on educational attainment for several countries of the world. We thought of interpolating annual series on educational attainments for our sample countries from these periodic observations. However, the owners of the respective data sets advised us strongly against interpolation, on the grounds of unreliability. We, therefore, decided not to pursue this matter any further.

[3] Beck and Levin (2002) use a panel framework whereas ours is a time series approach. Our specification directly shows the effect of F^S when income increases but this is not the case with the specification of Beck and Levine (op. cit.).

[4] Rajan and Zingales (1998) use US firms' dependence on external funds as proxy of dependence on external funds of other 41 countries' firms they analyse. Beck and Levine (2002) follow the same approach. Likewise, in our specifications, we treat convergence to US levels of income per capita, financial development and financial structure as indicator to a higher level of economic and financial development and/or sophistication.

[5] Note that the negatively signed j_4 and k_4 should not be interpreted as indicating to a bank-based system because interactions with F^C and F^{US} imply convergence of financial system to a more market-based variety, i.e., of US type.

[6] This is a New Database on Financial Development and Structure (see Beck et. al., 2000); we have used the latest revised version as at September 14, 2006.

[7] Beck and Levine (2002) and Levine (2002) utilize only the first principal component of the underlying data as their overall measures of financial development and financial structure. We utilize the weighted sum of all the principal components so that we capture the total variation in the underlying measures of financial development (F^D) and financial structure (F^S). The proportions explained by the first principal component of F^S ranges from a minimum of 62% (Argentina) to a maximum of 94% (Greece) across the sample countries. For F^D, it ranges between a minimum of 81% (Venezuela) to a maximum of 99% (Portugal). In all cases we have two eigenvectors and the proportion explained by each vector is used as weights.

[8] Kwiatkowski et al. (1992) show that KPSS tests are more powerful than the usual DF/ADF tests. However, Caner and Kilian (2001) warn against these power gains, especially for high frequency data. Our data are low frequency.

[9] These unit root tests are pretty standard so we do not report them to conserve space but they are available on request.

[10] The correlation coefficient in some cases is as high as 0.9.

[11] Argentina requires an impulse dummy of unity for the years 2000 to 2003 and zero otherwise. The dummy for the Philippines requires unity over 1983 to 1985 and zero otherwise.

[12] These empirical t-ratios are computed under the null that the parameter in question is zero. The distributions of the empirical t-ratios associated with other countries and parameters are very close to the one reported here.

[13] In other words, despite the asymmetry found in the distribution of empirical t-ratios in panel D, the inference remains qualitatively same even when bootstrap t-ratios (or p-values) are used. It should be noted that this invariance in inference between asymptotic and bootstrap results hold for Equation (1) only. For the rest of the specifications, (equations (2) to (9)), invariance in inferences does not hold therefore we report bootstrap results.

[14] This is calculated as: [(1.205/0.985)-1]*0.041*100. This gives Jordan an additional mean growth rate of 0.916% which is more than enough to supersede her negative growth rate of -0.104%.

[15] This essentially involves estimating the following models: $Y^P = f(C, K^P, F^S)$ and $Y^P = g(C, K^P, FZ)$ by FMOLS.

[16] These re-specifications pertain to the models reported in columns: 2, 4, 6, and 8 in table 5. We unravel the constituent parts of F^S and F^D which gives us 12 models.