FINANCE, GROWTH AND VOLATILITY

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Abstract

This dissertation makes three different contributions to the literature on financial development. Firstly, it examines the role of institutions in the relationship between finance and growth, using data from 72 countries during 1978 – 2001. The relationship between finance, institutions and growth is further analysed at four different stages of economic development. Secondly, it investigates empirically the hypothesis recently purposed by Rajan and Zingales (2003) that openness to trade and financial flows is one of the key determinants of financial development, using data from 43 developing countries during 1980 – 2000. Third, the dissertation examines the impact of financial market liberalisation on stock market volatility in the five East Asian emerging economies during pre- and post-financial liberalisation eras.

The empirical results indicate that both financial development and institutional quality have a positive significant impact on economic growth. Financial development has larger effects on growth when the financial system is embedded within a sound institutional framework. Both variables have the strongest positive impact on economic growth primarily in the upper middle-income economies. In the high-income and lower middle-income economies, financial development has a positive but smaller effect on growth compared to the upper middle-income economies, whereas institutions have a much more powerful impact on growth in the low-income economies.

With respect to the determinants of financial development, the empirical findings suggest that the combination of open product and capital markets promote greater financial development, even after controlling for real GDP per capita, real interest rate and institutional quality. This finding supports the Rajan and Zingales (2003) hypothesis – when the country's borders are open to both capital flows and trades, then it will deliver benefit to financial markets. The findings relate to all the indicators of financial development employed (both banking and capital market) and are robust to alternative measures of capital flows and trade openness, as well as estimation method and sample period.

Finally, the empirical evidence presented in this study suggests that stock market volatility has declined after financial liberalisation in the sample of East Asia emerging markets, but not in the case of Thailand. The endogenous structural break dates of stock market volatility, which are identified correspond closely to dates of official financial liberalisation reforms in these markets. The stock market volatility of these markets, however, becomes much higher during the 1997-98 East Asian financial crisis period.

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CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

During the last two decades world economic growth has been relatively high, fuelled by spectacular growth rates in the Asia Pacific region and creditable economic growth performances in both the United States and the European Union. At the same time, there has been a huge increase in global financial flows and a rapid rise in the size of the international financial sector. Within this international framework, there has been increasing speculation about the relationship between financial development and economic growth. Specifically, the question has been asked whether finance causes growth, or their relative growths are coterminous and whether rapid growth essentially forces the financial sector to respond to the real economy's needs and therefore expand.

Building on work by Schumpeter (1934), Goldsmith (1969) and McKinnon (1973), Greenwood and Jovanovic (1990), Bencivenga and Smith (1991) and Pagano (1993) many economists have extensively investigated the relationship between finance and growth using various econometric techniques, and the empirical results have been well documented in the literature. In recent revitalisation of this research, Levine (1997) demonstrates the critical causal relationship between financial development and economic development by explaining the purpose of financial systems within society, how they operate and the mechanisms by which they affect and are affected by economic growth. In the empirical studies, most of the results demonstrate that there is a strong, positive impact of finance on economic growth[1].

Over the last decade, the finance-growth literature has been concerned with the debate over whether financial development has led to economic growth in a Granger causality sense. The question is an important one and has clear policy implications for countries that have financial sectors that are comparatively underdeveloped. Financial development is expected to follow economic growth[2] elsewhere under most circumstances,

[1] Levine (1997, 2003) provides and excellent literature survey on the finance-growth nexus.
[2] Robinson (1952) contends that 'where enterprise leads finance follows', which means that the development of financial market is actually promoted by the economic growth.

since when there is economic growth, there should be more savings inject into the financial markets, which will allows it to extend new loans for investment. Nevertheless, financial development is also expected to lead to economic growth, assuming a well functioning financial system. Therefore, there is normally expected to be bi-directional causal effects between finance and growth[3].

Besides identifying that finance and growth has a positive link and causality patterns, the research agenda on this issue has turned to another important issue: does the financial structure matter for long-run economic growth? In order to answer this question, financial economists and policy makers have concentrated on the relative merits of intermediary versus market-based financial systems[4]. The intermediary-based view emphasises the importance of intermediaries in identifying good projects, mobilising resources, monitoring managers, and managing risk while stressing the deficiency of market-based economies[5]. According to this view, intermediary-based systems, especially in countries in the early stages of economic development, are more effective at fostering growth than market-based financial systems. On the other hand, the market-based view stresses the role of markets in diversifying and managing risks while arguing that financial intermediaries can extract information rents from firms; and market-oriented systems are superior to intermediary-based systems in encouraging long-run economic growth. In short, both views suggest that financial markets and intermediaries are substitute sources of financial services in influencing economic growth.

Although conclusions must be formulated cautiously, most of the empirical studies in the finance-growth literature suggest that there is strong evidence that financial structure – the mixture of financial markets and intermediaries – is not crucial for explaining differential growth rates across countries (Demirgüç-Kunt and Levine, 2001 and Levine, 2002). Countries do not grow faster, and firms' access to finance is not systematically easier in

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[3] For instance, Demetriades and Hussein (1996) find that there is a bi-directional causal effect (seven out of sixteen countries) between finance and growth but the causality patterns vary across countries. Luintel and Khan (1999) demonstrate that there is a bi-directional causality relationship between both variables for 10 developing countries by employing multivariate time-series analysis.

[4] The debate is commenced with reference to Germany, Japan (both are intermediary-based financial system), United Kingdom and United States (both are market-based economy). Numerous studies have conducted to examine the comparative advantages of intermediary- versus market-based financial systems [e.g. see Allen and Gale (2000); Demirgüç-Kunt and Levine (2001); Arestis *et al.* (2001); Levine (2002)].

[5] For example, it has been argued that financial intermediaries are effective at financing projects that are characterised by substantial asymmetric information (e.g. adverse selection and moral hazard) due to intermediaries have developed expertise in distinguishing between 'bad' and 'good' borrowers.

either intermediary or market-based systems. For example, Japan and Germany – major intermediary-based systems, and the United States and United Kingdom – the foremost market-based systems – have had different financial systems, but they have had similar growth rates over time. This might indicate that the most important factor is that a sound legal system effectively protects the rights of investors and enforces contracts efficiently (such as financial services view and law and finance view). This in turn would improve the operations of financial markets and intermediaries, with positive implications for long-run economic growth.

Subsequent to the intermediary- and market- based systems views, the financial services and law and finances view have emerged to discuss the relationship between finance and growth. Both views suggest that financial markets and intermediaries are complements in the provision of financial services. This means that both intermediaries and market-based systems are important to promote economic growth. The primary emphasis of the financial services view is the importance of the overall level and quality of financial services rather than the channels through which those services are provided. The issue is not intermediaries *versus* markets, but rather the creation of an environment for better-functioning intermediaries *and* markets. Demirgüç-Kunt and Levine (1996) use firm level data to show that increases in stock market development tend to actually increase the use of bank finance in developing countries. Thus, the two elements of the financial system may act as complements during the development process. It may be desirable to avoid viewing intermediary and market-based systems as representing a trade-off. A careful empirical study by Levine (2002) – the first cross-country examination of financial structure and growth that uses a broad data set of countries – is strongly supportive of the financial service view. This prompts the following question: what conditions are necessary to provide better financial services? We address this question partially by partially focusing on the legal system (law and finance view) and good institutional quality.

The law and finance view is an extension of the financial services view and it has been put forward by La Porta *et al.* (1997). This view suggests that it is not the debate between intermediary and bank-based systems that really matters, but rather the legal environment and the enforcement of contracts. La Porta *et al.* (1997) explore the contribution

of a country's legal origin in the formation of its financial structure and its corporate governance institutions, finding that legal origin – be it English common law, or French, German or Scandinavian civil law – partly determines the quality of investor protection and the size of the stock market versus the banking sector. Their findings conclude that English common law systems generally have the strongest investor protection enforcement, followed by Germany, Scandinavian states, and lastly, French civil systems. Demirgüç-Kunt and Levine (2001) and Levine (2002) employ a broad data set covering 48 countries from 1980 to 1993, finding that the distinction between intermediary- and market- based systems is not important in explaining the finance-growth nexus. Rather, elements of a country's legal system and the quality of its financial services are most important for fostering economic growth.

Though the law and finance is the leading explanation for the variance in the proficiency of the financial depth across countries, alternative rationales for financial systems development are gaining momentum. Rajan and Zingales (2003) analyse the importance of interest groups as opposed to legal origin and endowment in influencing financial development. They show that some progress on the determinants of financial development can be explained from the political economy view. According to them, politics, as driven by special-interest groups representing established business – can explain this uneven evolution of capital markets. Rajan and Zingales (2003) argue that financial underdevelopment may be a political choice – protecting the interests of a financial/industrial incumbents. Such incumbents may have little interest in developing well-functioning capital markets, as they are well served by relationship banking and the absence of arms' length finance restricts potential competitors' access to finance. They propose an "interest group" theory of financial development where incumbents oppose financial development because it produces fewer benefits for them than for potential competitors. Incumbents can finance investment opportunities mainly with retained earnings, whereas potential competitors need external capital to start up. Nevertheless, when a country is open to trade and capital flows, then it will deliver benefit to financial development due to breeding competition and thus threatening the rents of incumbents.

With respect to capital inflows, the increased financial liberalisation and openness in developing countries in the mid-to-late 1970s and early 1980s have motivated high rates of increase in cross-border capital and direct investment flows to these countries, especially in the 1990s. The inflows of capital have contributed to the developing countries, economic development and has promoted the domestic financial markets such as banking sectors and capital markets, as well as helping these economies 'emerge' from less-developed status and to join the group of developed countries, or known as convergence in development economics. In terms of the impact of financial liberalisation on economic growth, Bekeart *et al.* (2004) find that equity market liberalisation (allowing foreign investors to transact in local securities and vice versa) does increase economic growth. Galindo *et al.* (2002) demonstrate that financial liberalisation, mainly in the domestic financial sector, increases growth rates of economic sectors intensive in external funding relative to other sectors. Kaminsky and Schmukler (2002) point out that financial liberalisation is followed by more pronounced boom-bust cycles in the short-run but it leads to more stable markets in the long-run.

Besides the role of financial liberalisation in promoting growth, the emerging market finance issues also have attracted a lot of attention recently by the financial and development economists. In particular, the issue of emerging stock markets volatility after these markets opening up their stock markets to foreign investors. According to the International Finance Corporation (IFC), portfolio investment flows to emerging countries has kept rising since the early 1980s and the trend has continued even after a number of financial crises (IFC, 2000). The stock markets in these countries have also grown considerably in size. The aggregate market capitalisation of the countries classified by the IFC as emerging markets rose from US$488 billion in 1988 to US$3073 billion in 1999. This event has created an ideal laboratory for investigating the impact of increased foreign portfolio investment in emerging stock markets. From the theoretical point of view, Keynesian economics suggest that liberalisation could attract speculators and introduce volatility and economic instability. Thus, it is important to examine whether stock market volatility will increase following deregulation in emerging markets.

1.2 Objectives of the Study

The context of this dissertation is embedded in a large volume of literature examining the role of finance on growth as well as the issue of stock market volatility after the financial liberalisation process. This dissertation contributes to the literature by conducting three empirical investigations and the more specific objectives are as follows:

i. to examine whether the interaction between finance and institutions – that is to say, finance that is embedded within good institutions – promotes economic growth.
ii. to investigate the determinants of financial development from the capital inflows and trade openness perspectives.
iii. to evaluate the impact of financial liberalisation in terms of opening out domestic stock markets to foreign investors on stock market volatility.

1.3 Motivations

A great number of empirical studies have dealt with different aspects of finance and growth issues using both theoretical and empirical evidence. Even though much of the empirical results suggest that well-functioning financial markets and systems promote long-run economic growth (King and Levine, 1993b, 1993c; Levine, 1997), there are few studies that have failed to establish the link between finance and growth. For example, Ram (1999) finds that there is a weakly negative co-variation between financial development and growth of real GDP per capita for 95 individual countries and this raises the question whether the link between finance and development is as positive as is suggested. Dornbusch and Reynoso (1989) find that financial development does not seem to have a clear impact on economic growth. Shan and Morris (2002) find meagre evidence that financial development 'lead' to economic growth, either directly or indirectly. Lucas (1988) and Stern (1989) do not share the view that finance is significant in promoting growth and have long rejected any causal role for financial development in the growth process. According to Lucas, growth is mainly due to technological progress, leaving little role for finance. Roubini and Sala-i-Martin (1992) point out that repressive financial policies systematically harm the economic

performance, while Chandavarker (1992) notes '*none of the pioneers of development economics....even list finance as a factor of development*'. Nevertheless, from the International Monetary Fund (IMF) and World Bank point of view finance does matter because there are financial crises[6]. Therefore, the link between finance and growth still need to be address due to the mixed theoretical views and empirical findings in the literature.

There is extensive literature regarding the empirical investigations of the finance growth nexus that focuses more on the causality issue. The empirical evidence based on time-series Granger causality test suggests that causality patterns between finance and economic growth vary across countries. For instance, Demetriades and Hussein (1996), in their examination of the time-series relationship between finance and growth in 16 less-developed countries find, more often than not, causality running from growth to finance and not vice-versa. It is, therefore, not sensible to draw out any policy implications from the positive association obtained between finance and growth obtained from cross-country studies[7] that would be applicable to every country in the world. Arestis and Demetriades (1997) point out that 'it is by no means universal that financial development can lead to economic growth'. More finance may mean more growth in some cases but not in others. Thus, understanding why there is such variation across countries is an important next step for both policy makers and academics, since this knowledge may hold the key to successful financial development.

As mentioned earlier, there are a number of potential views that explain why financial development has been slow in a large number of economies such as financial services view, law and finance, endowment theory of institutions and interest group theory. However, the interest group theory proposed by Rajan and Zingales (2003) especially the determinants of financial development from trade openness and capital inflows still lack empirical evidence. Other authors have examined related questions but have not examined the Rajan and Zingales (2003) point of view directly. When the country's borders are open to both trades and capital inflows, then it will have a tendency to boost financial development. If

[6] For instance, the last decade-and a-half, when the wave of financial liberalisation in developing countries was unleashed, has witnessed a series of financial and currency crises such as the Tequila crisis of 1994-95; the Asian crisis of 1997-98; the Brazilian crisis of 1998-99; the Russian – LTCM affair and the Argentina crisis of 2001, the intensity of some of which has been severe.

[7] The cross-sectional analysis results normally indicate that finance has a positive statistically significant to explain economic growth.

this hypothesis is true, it will call for simultaneous trade and financial liberalisation. This would run contrary to the sequencing literature, which advocates that trade liberalisation should precede financial liberalisation and that capital account opening should be the last stage in the liberalisation process (e.g. McKinnon, 1991). Thus, the determinant of financial development from this point of view is another interesting issue to address. More recently, the research agenda of finance and growth has turned to identify what are the determinants of financial development? In addition, understanding the determinants of financial development is important because higher financial development would facilitate economic growth, as shown by the extensive empirical literature.

Financial markets and systems play a key role in the economy by channelling funds from savers to investors. Volatility in the prices of financial assets becomes a normal part of the process of allocating investable funds among competing uses. Nevertheless, excessive or extreme volatility of stock prices may be detrimental because such volatility may impair the smooth functioning of the financial system and adversely affect economic performance. Even though the issue of financial liberalisation, financial development and economic performance has naturally attracted the attention of many researchers, Arestis and Demetriades (1997) argue that there are still issues such as the relationship of financial liberalisation and stock market volatility that require further investigation. Numerous studies have been conducted to examine this issue, but the empirical evidence is mixed[8]. Therefore, the issue of financial liberalisation in terms of opening out the domestic financial markets is important and needs to be addressed.

1.4 The Contributions of this Dissertation

This dissertation attempts to contribute to the previous finance-growth literature in four ways. Firstly, this study attempt to fill out current literature by incorporating the institutions factor in examining the role of finance on growth, and investigating whether financial systems embedded within good institutions – have a separate positive influence on

[8] For instance, Grabel (1995), Levine and Zervos (1998) find that stock market volatility increased after liberalisation, whereas Bekaert and Harvey (1997), Nilsson (2002) and Kassimatis (2002) demonstrate that financial liberalisation significantly reduces stock market volatility.

economic growth using cross-country estimation and panel data analysis. The sample of this study is based on 72 countries. Given the substantial differences in economic development within the sample country, it is more appropriate to examine the growth effect of finance and institutions with respect to the income level[9]. Thus, the relationship between finance, institutions and growth is further analysed at four income level categories, namely high-income, upper middle-income, lower middle-income and low-income economies. By dividing the sample into different stages of economic development, this study also contributes to fill a gap in the empirical identification of the role of finance in influencing growth in low-income economies. This is because much finance-growth research has typically focused on high-income and middle-income countries.

Second, numerous studies have been conducted to examine the determinants of financial development with respect to the financial services, law and finance views and the endowment theory of institutions. So far there is no direct empirical work examining the interest group theory proposed by Rajan and Zingales (2003). In addition, the sample of countries used by Rajan and Zingales (2003) themselves, dictated by limited data availability in the interwar period, means that their conclusions are, at best, tentative. Therefore, this dissertation contributes to the literature on this issue by conducting an empirical investigation of the role of capital flows and trade openness on financial development in a group of developing economies. By examining this issue, this study tends to provide an improved understanding of the capital inflows and trade openness foundations of financial development. In short, this study aims to provide evidence on the causes of financial development, which will help policy- makers design reforms that indeed promote financial sector development enhancing growth.

Third, this study contributes to the literature on the impact of financial liberalisation on stock market volatility in five East Asian emerging markets, where these markets have increasingly integrated with the important international stock markets throughout. The empirical evidence is carried out using the Exponential Generalised ARCH (EGARCH) model, combined with sudden changes of unconditional variance. This is because the

[9] Recent studies have found that the growth-enhancing effect of financial development would have a larger effect on developed rather than developing countries (Deidda and Fattouh, 2002). On the other hand, Rioja and Valev (2004) demonstrate that financial development is most effective in promoting growth in middle-income economies and has positive, albeit smaller effect in high-income economies, and is ineffective in low-income countries.

EGARCH model itself may not be able to capture the all variance effects. Thus, this study includes the sudden changes of unconditional variance with respect to single and multiple breaks of the stock return volatility, where it has emerged in recent volatility literature. By investigating the structural break, this study is to ascertain when significant changes in the structure of East Asian stock market volatility have occurred and to place those changes in the context of financial liberalisation.

Finally, many empirical studies have used various econometric techniques such as cross-section, time series and panel data in examining the role of finance on growth. Nevertheless, this study uses a wide range of panel data techniques to empirically investigate the role of finance on economic growth and the determinants of financial development from trade openness and capital inflows perspectives. Mainly, this dissertation employs dynamic heterogeneous panel data analysis namely pooled-mean group estimations.

1.5 Outline of the Dissertation

This dissertation is concerned with the study of finance, growth and volatility issues in a group of countries. It revolves around three main empirical analyses found in Chapter 3, 4 and 5. In order to provide a context within which to consider these three empirical exercises, the dissertation also describes some of the relevant recent literature and this is carried out in Chapter 2. The organisation of the dissertation is as follows[10]:

Chapter 2 reviews the background literature, both theoretical and empirical evidence, on the issue of finance, growth and stock market volatility. In this chapter the material examined is classified into three broad sections. First, the literature concerned with finance and economic growth as well as the role of institutions in influencing growth. The empirical literature is split among those who advocate the use of cross-section estimation, time-series and panel data estimations. Second, the chapter reviews the literature on the determinants of financial development, it presents a more detailed account of three

[10] The dissertation contains some overlapping material between chapters such as the literature survey as well as the methodology employed in the empirical chapters. This is perhaps an inevitible consequence of writing chapters that can provide the basis for sel-contained academic papers.

theoretical views and empirical evidence, namely the law and finance view, the endowment theory of institutions, and the interest group theory. Finally, this chapter reviews the literature on the impact of financial liberalisation on stock market volatility, including the theoretical views, empirical evidence, and structural breaks in volatility model.

While Chapter 2 contains literature survey material, the novel contributions of this dissertation reside in Chapters 3 through 5. Specifically, Chapter 3 is the empirical test of the effects of financial development and institutions on economic growth. The empirical model in the analysis is based on the augmented Solow growth model framework, which incorporates finance and institutions variables over the period from 1978 - 2001. In view of this, the data set is sufficiently large, containing 72 countries, the empirical analysis in this chapter adopts the cross-country estimation and panel data analysis. The empirical estimations are carried out using various financial development indicators, ranging from banking sector development and capital market development, as well as different sample countries that categorised based on their income level. The last two sections of this chapter contain the empirical results and the conclusion.

Chapter 4 presents the empirical test of the determinants of financial development from capital inflows and trade-openness perspectives. A direct test of the Rajan and Zingales (2003) hypothesis using appropriately specified financial development equations are presented to examine the impact of trade openness and capital inflows on financial development. These equations not only control for the conventional determinants of financial development namely real GDP per capita and real interest rate, but also for institutions. The econometric methodologies that are employed in this chapter are similar to Chapter 3, namely cross-country estimations and panel data analysis. The data sets and sources are presented after the methodology section, which consist of various capital inflows and trade openness indicators. This is followed by the empirical results and the last section contains the conclusion.

Chapter 5 attempts an empirical exploration of the impact of financial liberalisation on stock market volatility in five East Asian emerging markets since these economies implemented the stock market liberalisation in the late 1980s and early 1990s. The econometric method in this chapter is based on the EGARCH model but taking into

consideration of structural breaks. The structural breaks in the volatility model not only focuses on single break, but also multiple structural breaks. The validity of EGARCH model is examined using sign bias and size bias tests. The news impact curves (Engle and Ng, 1993) suggested by the EGARCH model are employed to examine the impact of financial liberalisation on stock market volatility. After discussing the estimation techniques, the chapter presents the data and data sources. This is follow by the financial liberalisation date of these economies. The last two sections of this chapter are the empirical results and conclusion.

The last chapter is the conclusion. It provides a synopsis and discussion of the overall findings and implications as well as pointing to avenues for further research.

CHAPTER TWO
FINANCE, GROWTH AND VOLATILITY: A REVIEW OF THE LITERATURE

2.1 Introduction

This chapter reviews the related literature on finance, economic growth and stock market volatility. It is divided into three broad sections. First, it reviews the link between finance and economic growth as well as the role of institutions in influencing the finance-growth nexus. The empirical literature is split among those who advocate the use of cross-sections, time series, panel data and microeconomic-based studies[11]. Second, it presents the determinants of financial development with respect to three views, namely law and finance, endowment theory of institutions and interest group theory. Besides, the empirical evidence of the determinants of financial sector depth is also discussed in this section. Third, this chapter describes stock market volatility issues, especially the effects of financial liberalisation on volatility and modelling volatility with structural breaks. The last section of this chapter contains the conclusions.

2.2 Finance and Economic Growth

2.2.1 Traditional Literature

Economists, such as Schumpeter (1934), Gurley and Shaw (1955), Goldsmith (1969), and McKinnon (1973), view financial markets and systems as central in economic activity. According to them, differences in the quantity and quality of services provided by financial markets and systems partially explain why countries grow at different rates.

Schumpeter (1934) points out that banks facilitate technological innovation in their role of financial intermediaries. By assembling savings, evaluating investment projects, monitoring managers and facilitating transactions, banks are able to acquire detailed information about firms at a lower cost. They thus become the authorised agents of the society to allocate savings to entrepreneurs and to innovating and competitive firms. In short,

[11] Microeconomic studies of finance and growth in the literature refer to the industry-level and firm-level studies.

the Schumpeterian view is that the development of financial intermediaries has a direct impact on the pace of technical change and productivity growth, which feeds through to overall output growth.

Gurley and Shaw (1955) emphasize financial intermediation and its role in the credit supply process. They state that there exists a highly organised and broad system of financial intermediation in developed countries. Economic development appears to be hindered if self-finance and direct finance are assessable and financial intermediaries are not involved. Financial intermediaries aid in the flow of loanable funds by accumulating financial assets from surplus spending units (savers) then transmit the borrowed funds to deficit units (investors). Intermediaries improve the efficiency of inter-temporal trade, which is an important factor governing general economic activity. Banks help reduce liquidity, which accumulates in the form of direct debt. This helps lower the pressure on interest rates and, therefore, encourages individuals to forego investment. In other words, these systems made it feasible for certain classes of borrowers to obtain both greater quantities of credit and better credit terms than they could otherwise get from directly issuing securities to lenders. In their point of view, financial capacity, the borrower's ability to absorb debt without having to reduce either current or future spending commitments, is an important determinant of aggregate demand.

Goldsmith (1969) links finance and economic growth and states that development in financial intermediation accelerates economic growth and performance to the extent that it facilitates the migration of funds to the best users. According to Goldsmith, the commercial banks have commonly been the first financial intermediaries during the early stages of economic development. Then, new intermediaries, such as insurance companies, thrifts, and formal capital markets are expanded to provide services to particular classes of savers. Goldsmith (1969) studies the relation between the size of financial systems, as measured by the ratio of the value of intermediary assets to GNP, and economic growth in 35 countries over the period 1860 to 1963. He shows that there is a strong positive relationship between measures of financial intensity and aggregate output, especially during periods when the size of financial systems experience rapid growth. In addition, commercial bank assets

increase rapidly in the early phases while the growth rates of thrifts and insurance companies overtake those commercial banks as the financial systems mature.

McKinnon (1973) points out that less-developed countries rely heavily on self-financing. Also the relatively small household savings are tapped by organised business activities. The banks in those economies are always regulated in serving rural areas, highly protected manufacturing and large enterprise, and even on government deposits. Besides, most of the developing countries had interest rates that were fixed by administrative decision below their market equilibrium levels particularly deposit rates of interest. This phenomenon is defined as financial repression. McKinnon suggests that financial liberalisation requires breaking the confines of self-finance and channelling external funds to large and small investors who can earn high marginal and intra-marginal rates of return. An increase in the efficiency of bank lending is, therefore, a necessary condition for enlarging the real size of monetary system and for alleviating financial repression.

McKinnon (1973) demonstrates that monetary systems can stimulate growth in real output by raising saving propensities and the quality of capital formation. His analysis refers to the complementarity hypothesis, which states that money and real capital assets are complements in developing countries. This is because in the absence of deep financial markets and extensive financial intermediation, money balances have to be accumulated before relatively costly and indivisible investment projects can be undertaken. This hypothesis indicates that the demand for real money balance depends positively upon real income, the own real rate of interest on bank deposits and the real average return on capital. The positive association between the average real return on capital and the demand for money balances represents the complementarity between capital and money.

2.2.2 The Role of Finance in Influencing Economic Growth

Before we study the link between finance and growth, it is important to explain how finance can affect growth. Several studies have attempted to show how the operation of the financial sector may affect the rate of economic growth in the endogenous framework

(Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991; Roubini and Sala-I-Martin, 1992; Pagano, 1993; Bencivenga *et al.* 1996; King and Levine, 1993a).

The various roles that finance can play in influencing economic growth are exemplified in a strongly stylised form in the Pagano (1993) model. He describes how financial development can affect economic growth by using the simple *AK* production function, where aggregate output is a linear function of the aggregate capital stock as follows:

$$Y_t = AK_t \tag{2.1}$$

where Y_t is aggregate output, A is the social marginal product of capital, K_t is the aggregate capital stock and t is time. Equation (2.1) can be seen as a 'reduced form' resulting from one of two underlying frameworks. One is a competitive economy with external economies, as in Romer (1989), where each firm faces a technology with constant returns to scale but productivity is an increasing function of the aggregate capital stock K_t. Alternatively, the *AK* model can be derived assuming that K_t is a composite of physical and human capital as in Lucas (1988), and the two types of capital being reproducible with identical technologies.

For simplicity, Pagano (1993) assumes that the population is stationary and the economy produces a single good that can be reinvested or consumed. If invested, then the depreciation rate is δ per period. Gross investment then equals

$$I_t = K_{t+1} - (1 - \delta)K_t \tag{2.2}$$

In a closed economy with no government, capital market equilibrium requires that gross savings S_t equal gross investment I_t. However, we would assume that a proportion $1 - \phi$ of the flow of saving is 'lost' in the process of financial intermediation or absorbed by financial intermediation. If the financial market is well-developed, the rate of absorbing the flow of saving into investment would be close to a unity. On the other hand, if the financial market is not well-developed, the absorption rate could be substantially below one[12]. Hence,

$$\phi_t S_t = I_t \tag{2.3}$$

Define the capital absorption rate as:

$$\phi_t = \frac{I_t}{S_t} \tag{2.4}$$

[12] Note that ϕ can presumably be greater than one in an open economy where financial intermediaries may attract foreign funds.

From Equation (2.1), the growth rate at time $t + 1$ can be written as

$$g_{t+1} = \frac{K_{t+1} - K_t}{K_t} \tag{2.5}$$

Substituting Equations (2.1), (2.2) and (2.3) into the growth rate above:

$$g_{t+1} = A\phi_t \frac{S_t}{Y} - \delta \tag{2.6}$$

Dropping the time indices, the steady-state growth rate can be written as

$$g_{t+1} = A\phi s - \delta \tag{2.7}$$

Based on Equation (2.7), Pagano (1993) demonstrates that financial development can affect economic growth through s, the private saving rate[13]; can raise ϕ, the proportion of savings channelled to productive investment; and may increase A, the social marginal productivity of capital.

Greenwood and Jovanovic (1990) point out that financial intermediaries can economize the cost of acquiring and processing information about investments. Thus savings channelled through financial intermediaries are allocated more efficiently. The ability to acquire and process information leads to higher economic growth because financial markets and intermediaries can select to allocate funds to the most promising firms and managers. This produces a more efficient allocation of capital and faster growth. Moreover, financial markets and intermediations may also stimulate the rate of technological innovation by providing loans to entrepreneurs with the best chances of successfully initiating new goods and production processes.

The financial markets and intermediaries have an important role in improving management of liquidity risk[14]. Information asymmetries and transaction costs may inhibit liquidity and intensify the liquidity risk. Financial intermediaries enable investors to share these risks. The link between liquidity and economic development arises because some productive projects require a long-term commitment of capital. Nevertheless, savers do not like to relinquish control of their savings for long periods. With the liquid financial markets, savers can hold liquid assets such as equity, bonds or demand deposits that they can turn to the medium of exchange quickly and easily (Bencivenga and Smith, 1991). At the same

[13] An individual saver may be unable or unwilling to completely fund a borrower, financial markets and intermediaries pool the savings of diverse households and make these funds available for lending.
[14] Liquidity risk is defined as uncertainties in converting assets into a medium of exchange.

time, the markets transform those liquid financial instruments into long-term capital investments. In other words, with liquid stock markets, saver shareholders can sell their assets, while firms have permanent access to the capital invested by the initial holders.

However, theory suggests that enhanced liquidity has an ambiguous affect on saving rates and economic growth. In most models, greater liquidity (i) increases investment returns and (ii) lowers uncertainty. Higher returns affect saving rates but the effect is ambiguous because income and substitution effects work in opposite directions. Further, lower uncertainty ambiguously affects savings rate (Levhari and Srinivasan, 1969). Thus, saving rates may rise or fall as liquidity rises. Indeed, in a model with physical capital externalities, saving rates could fall enough, so that growth actually decelerates with greater liquidity (Jappelli and Pagano, 1994). Bencivenga *et al.* (1995) also point out that, although greater liquidity unambiguously raises the real return on savings, more liquidity may induce a reallocation of investment out of initiating new capital investment and into purchasing claims on ongoing projects. This may lower the rate of real investment enough to decelerate economic growth.

The financial system also exerts corporate control and monitors managers. Financial contracts, markets, and intermediaries may alleviate the information acquisition and enforcement costs of monitoring firm managers and exerting corporate control. As outside creditors to the firm, outsider investors do not manage firms on a day-to-day basis because it is too costly for outsider investors to verify project returns. These verification costs impede investment decisions and reduce economic efficiency. Verification costs imply that outsiders constrain firms from borrowing to expand investment due to higher leverage, which indicates greater risk of default and higher verification expenditures by lenders. In the mean-time, insiders have incentives to misrepresent project returns to outsiders. The outside creditors, however, can create financial arrangements to compel inside owners and managers to run firms in accordance with the interest of outside creditors. Furthermore, in the case that borrowers need to obtain funds from many outsiders, financial intermediaries can economise monitoring costs. That is, the borrower is monitored only by the financial intermediaries (Bernanke and Gertler, 1989 and 1990). The reduction in monitoring and acquisition costs can foster efficient investment and long-term economic growth.

Finally, the financial systems serve to facilitate exchange. Financial arrangements that lower transaction costs can promote specialisation, technological innovation and economic growth (Greenwood and Smith, 1997). Reduction in transaction and information costs helps facilitate exchange. The development of the financial institutions will facilitate the exchange of technology in the market and enable creative individuals to specialise in and become more productive at intervention.

2.2.3 Potential Causal Effects

Over the last decade, finance-growth literature has debated whether financial development has led to economic growth in a Granger causality sense. In the finance-growth literature, there are four theoretical views regarding the link between financial development and economic growth, namely: finance-led growth; growth-driven finance; hypothesis of feedback and interdependence between finance and growth.

The finance-led growth hypothesis also known as "supply-leading" as labelled by Patrick (1966). It posits a causal relationship from financial development to economic growth, which means the deliberate creation of financial markets and systems increases the supply of financial services leading to real economic growth. Patrick (1966) hypothesises that the supply leading pattern is more likely in early stages of development and the demand following pattern is more likely at later stages. Besides, demands on financial products and services by the economic agents are highly dependent on the growth of real output, commercialisation and the modernisation of agriculture and other subsistence sectors. As a consequence, the higher the real economic growth, the greater the demand on financial resources needed by entrepreneurs or high growth sectors in making their investments.

The second hypothesis is known as growth-driven finance or 'demand following' hypothesis (Patrick, 1966), which reveals that the lack of financial markets and systems in developing countries is an indication of lack of demand for their services. As the economy growth, it generates demand for financial services. According to Patrick, 'demand following' is a mechanism in transferring the resources from traditional sector (refers to low-growth sectors) to modern sector (high value added sectors). Moreover, it also acts as a catalyst in

expanding and promoting an entrepreneurial in these modern sectors. This implies that the existence of the financial sector and their services is resulting from the demands raised by entrepreneurs in the modern sectors.

The most interesting economic scenario suggests a bi-directional causal relationship between financial development and economic growth. It can be inferred as a combination of the supply-leading and demand-following hypotheses. Although the strong causality between financial and economic development could be the result of either finance-led growth or growth-driven finance, it is possible that two variables are linked together via feedback. A country with a well-developed financial system could promote a high economic expansion through technological changes, product and services innovation (Schumpeter, 1934). This in turn will create high demand on the financial arrangements and services (Robinson, 1952). In Robinson's (1952) view, financial development would follow growth or, perhaps, causation may be bi-directional. According to her, as the banking institutions effectively respond to these demands, then these changes will stimulate higher economic performance. Therefore, both financial development and economic growth are positively interdependent and could exhibit feedback causality.

Finally, there is still another group of well-known economists who maintain that financial development is almost totally irrelevant for economic growth. In his seminal recent survey of important literature in development economics, Stern (1989) completely ignored the role of financial development in the economic growth process. Concluding his survey, Stern listed several topics omitted from the survey that are worthy of future research, and financial development was not even mentioned in that list. Similar neglect of the role of financial development in economic development can also be found in Robert Lucas, the Nobel Laureate in economics, who seems to ascribe to this view. In a study describing the dynamics of economic development, Lucas (1988) argues that financial economists emphasise the role played by the financial intermediaries in economic development and that these markets play only a very minor role in the economic growth process at best.

2.2.4 Empirical Evidence

In this section, four types of econometrics analysis on the finance-growth issue are discussed, namely (i) cross-section analysis; (ii) time series analysis; (iii) panel data analysis and (iv) microeconomic-based studies.

2.2.4.1 Cross-Country Analysis

The cross-country analysis of finance-growth nexus normally aggregate economic growth and financial development indicators over long periods, a decade or more, and assess the relationship between both variables using the regression technique. Using the value of financial intermediary assets divided by GNP to gauge financial development under the assumption that the size of the financial system is positively correlated with the provision and quality of financial services, Goldsmith (1969) finds that there is a strong positive relationship between measures of financial intensity and aggregate output, especially during periods when the size of financial systems experience rapid growth. However, there are several obvious problems with Goldsmith's analysis. Firstly, while the period of study is long, the sample size is small; secondly, the direction of causation in unclear; thirdly, there is no control for other factors that might influence growth; and finally, it does not examine whether financial development is associated with productivity growth and capital accumulation.

King and Levine (1993b) build on earlier cross-country work by Goldsmith (1969) by examining the growth of 80 countries over the period 1960 to 1989, systematically controlled for other variables affecting long-term economic growth, investigating the capital accumulation and productivity growth channels, constructing additional measures of the level of financial development, and analysing whether the level of financial development predicts economic growth. They use four measures of financial development. The first measure, DEPTH, measures the size of financial intermediaries and equals liquid liabilities of the financial system divided by GDP. The second is the proportion of domestic credit outside of the central bank, which captures the development of a financial system beyond a central banking function. The third and fourth variables measure the allocation of credit to the private rather than the public sector (the ratio of claims on the non-financial private sector to

domestic credit control and the ratio of gross claims on the private sector to GDP). In separate equations, three measures of growth (real per capita GDP growth rate, real per capita capital stock growth rate, and total factor productivity growth[15]) are regressed on the average values of these variables over the period 1960 to 1989. The equations control for a range of other influences on growth, including initial incomes, education, government expenditure, black market exchange rate premia, inflation, political instability and trade propensities. Furthermore, they examine whether financial development is associated with productivity growth and capital accumulation, which are two channels through which finance may influence growth. Their empirical results show a strong positive relation between the three measures of growth indicators and four measures of financial development indicators. Not only are all the financial development coefficients statistically significant, the sizes of the coefficients imply an economically important relationship. Besides, they also investigate the extent to which financial development at the start of the period in 1960 predicts growth in the subsequent thirty years. They conclude that the initial level of financial development is a good predictor of subsequent rates of economic growth, physical capital accumulation and economic efficiency improvements over the next thirty years. Using alternative econometric methods and robustness check, King and Levine (1993c) confirm these findings that better financial systems improve the probability of successful innovation and thereby accelerate economic growth.

Even though King and Levine (1993b) have improved on past work, there are problems with methodology and interpretation in their analysis. For example, the proxy measures for financial development, DEPTH and the alternative measures, do not directly measure the ability of the financial system for (i) overall information asymmetries and funnelling credit to worthy firms, (ii) monitoring managers effectively and exerting corporate government efficiency, (iii) providing risk management services, or (iv) facilitating exchange and the pooling of savings. This lowers the confidence one has in interpreting the results establishing a link running from finance to growth. In addition, King and Levine (1993b) do not deal formally with the issue of causality – whether finance causes growth or vice versa. Finally, they only focus on one segment of the financial system, namely banks. They do not

[15] Total factor productivity in the King and Levine (1993b) study is defined as GYP – (0.3) x GK; where GYP = real per capita GDP growth rate, and GK = real per capita capital stock growth rate.

incorporate measures of other components of national financial systems as well as the capital market development (such as stock market[16]).

Recent finance-growth empirical studies that employ cross-sectional analysis have also discussed the possibility of endogeneity between both variables such as Levine (1998, 1999) and Levine *et al.* (2000). In econometric term, what needed are good instruments[17] that are correlated with financial development but uncorrelated with error terms. La Porta *et al.* (1997, 1998) make progress by providing plausible instruments; they show that legal origin – whether a country's commercial/company law derives from British, French, German and Scandinavian law – importantly shapes national approaches to laws concerning creditors and the efficiency with which those laws are enforced, and hence explain cross-country differences in financial development. Levine (1998, 1999), Levine *et al.* (2000) and Beck *et al.* (2000) use the legal origin indicators as instrumental variables for the measures of financial development to examine the relationship between finance and growth. For example, Beck *et al.* (2000) find a very strong connection between the exogenous component of financial intermediaries development (private sector credit) and long-term economic growth when using cross-country instrumental variables. They also demonstrate that the exogenous component of financial development is linked with both capital accumulation and productivity growth. Using various conditioning information sets, i.e. different independent variables, the results still hold. In addition, the data do not reject Hansen's (1982) test of the over-identifying restrictions and this indicates that the instrumental variables are valid. Thus, the exogenous component of financial development is positively associated with economic growth and these findings suggest an economically large impact of financial development on growth.

2.2.4.2 Time-Series Analysis

The cross-country analysis in finance-growth nexus tends to support the hypothesis that the causality runs from financial development to economic growth. In recent years, the

[16] In the literature, much research has been conducted to examine the role of the stock market and economic growth, among others, Atje and Jovanovic (1993), Levine and Zervos (1996, 1998) and Arestis *et. al* (2001).

[17] A good instrument is correlated with the endogenous regressor for reasons the researcher can verify and explain, but uncorrelated with the outcome variable for reasons beyond its effect on the endogenous regressor.

advancement of time-series analysis such as Granger causality and cointegration tests also contributes to fill out the literature. Arestis and Demetriades (1997) point out that cross-sectional analysis implicitly assumes that countries share similar economic structures, populations and technologies though this is simply not true. Demetriades and Hussein (1996) argue that 'causality patterns vary across countries and, therefore, highlight the dangers of statistical inference based on cross-country studies'. In addition, the cross-sectional studies are unable to examine causality in the Granger sense. Unlike cross-sectional analysis, time-series analysis makes it possible to examine lagged relationships between variables. Thus, the finance-growth empirical studies using time-series analysis, either single country or multi-country analysis also received much attention from the researchers.

Odedokun (1996) examines the role of the financial sector in economic growth for 71 less-developed countries (LDCs) over varying periods, generally spanning the 1960s and 1980s. The financial indicators he uses are the ratio of liquid liabilities as a fraction of GDP and M2 as a fraction of GDP. The empirical results based on OLS and GLS techniques indicate that financial intermediation promotes economic growth in about 85% of the countries. Odedokun (1996) demonstrates that financial intermediation is important factor to determine growth, which is practically at par with export expansion and capital formation, and superior to labour force growth. Finally, he points out that the growth promoting effects of financial intermediation are more predominant in low-income than in high-income LDCs.

On the other hand, Demetriades and Hussein (1996) employ more advanced techniques, namely Engle and Granger cointegration test, Johansen cointegration test and error correction models (ECMs) to analyse the link between finance and growth in 16 developing countries. The first financial proxy they use is the ratio of bank deposit liabilities to GDP and second is the ratio of bank claims on the private sector to GDP. Using annual data from 1965 to 1992, Demetriades and Hussein (1996) find that among the Asian countries covered under the study, only the case of Sri Lanka reveals evidence supporting the financial led growth hypothesis, whereas there is a causal effect running from economic growth to financial development in the case of Pakistan. Further, Demetriades and Hussein's study suggests that bi-directional causal relationships are evident for India, South Korea and

Thailand. Their results suggest in general, there is a bi-directional causal effect (seven out of sixteen countries) between finance and growth but the causality patterns varies across countries.

Arestis and Demetriades (1997) examine the finance-growth relationship using the Johansen cointegration analysis for Germany and the United States. Four variables are employed, namely a growth variable, stock market capitalisation, stock market volatility and a Levine type finance variable (M2 as a ration of GDP for Germany and bank credit as a ratio of GDP for the United states). The results highlight that the finance-growth relationship need not be similar across countries. For the United States it appears that there is a uni-directional causal effect running from economic growth to financial development, but the reverse seems to be true for Germany.

Rousseau and Wachtel (1998) undertake a time series analysis of the finance-growth relationship for five countries: the United States, the United Kingdom, Canada, Norway and Sweden. They believe disappointing evidence from existing time series studies are due to the recent time periods studied, when countries were already quite financially sophisticated. Thus, they examine the period 1870 – 1929, a time of a rapid industrialisation for all the countries in the study, reflected in the declining share of the agricultural sector. Standard proxies are employed for finance in the regression analysis. One innovation is that the monetary base in included as a benchmark so that movements in money are excluded from the measured finance-growth relationship. The causality results based on VECM and VARS in levels for the United States and the United Kingdom are in favour of finance causing growth.

Habibullah (1999) investigates the relationship between financial development and economic growth in seven Asian developing countries. The sample period under study covers the deregulation era of the 1980s and 1990s, in which interest rate liberalisation has been a prominent feature in these economies. Apart from using the traditional monetary aggregate as a ratio of GDP, he proposes Divisia monetary aggregate as alternative proxy for financial development indicator. The time series properties of the financial and real sectors indicators are investigated before conducting the cointegration and Granger causality within vector error-correction framework. The empirical results reveal that there is a strong

relationship between financial development and economic growth in the Asian developing countries. In addition, the proposed Divisia monetary aggregate does well in explaining the role of finance in promoting economic growth.

Most of the above time series literature is criticised by Luintel and Khan (1999) for its bivariate nature. They believe that a time series study in finance-growth relationship should include the real interest rate and the capital stock to avoid mis-specification. They employ a multivariate vector autoregressive (VAR) model to examine the long-term relationship between finance and growth, based on the Johansen cointegration technique. In the 10 countries analysed, they find a bi-directional causality relationship between both variables for all countries.

Shan *et al.* (2001), on the other hand, argue that the use of a VAR model to test causality between finance and growth could accommodate the possible effects of other variables that might impact on the focus variables. They employ the Granger No-causality procedure proposed by Toda and Yamamoto (1995), which is based on the modified Wald (MWald) statistic and regardless whether a series is I(0), I(1) or I(2), non-cointegrated or cointegrated of an arbitrary order[18]. The empirical results based on nine OECD countries and China give little support to the hypothesis that financial development 'leads' economic growth. However, Shan *et al.* (2001) find evidence of reverse causality in some countries and bi-directional causality in others. Thus, their results tend to support the findings of Demetriades and Hussein (1996) and Arestis and Demetriades (1997) that the relationship between financial development and economic growth may be country-specific, and the use of time-series data, as opposed to cross-sectional data, is more revealing. Nevertheless, when the stock market development indicator is included in the model, the results indicate that it is statistically significant to determine economic growth. This finding is consistent with Levine (1998) and Rajan and Zingales (1998), concerning the importance of stock markets in

[18] Toda and Yamamoto (1995), Rambaldi and Doran (1996) and Zapata and Rambaldi (1997), several alternatives method for detecting causality such as error-correction model (ECM) and vector error-correction model (VECM) are cumbersome and sensitive to the values of the nuisance parameters in finite samples and hence, the results are unreliable. In addition, pre-tests are necessary to determine the number of unit roots and the cointegrating ranks before proceeding to estimate a VECM. All one needs to do is to determine the maximal order of integration d_{max} that expect the model to incorporate and ascertain the lag structure, and then to construct a VAR with variables appearing in their levels with a total of $p = (k + d_{max})$ lags. However, at the inference stage, linear or non-linear restrictions should only be tested on the first k lags since the $p - k$ lags are assumed zero and ignored. Toda and Yamamoto point out that, for $d = 1$, the lag selection procedure is always valid since $k \geq 1 = d$. If $d = 2$, then the procedure is valid unless $k = 1$.

2.2.4.3 Panel Data Analysis

The recent advancement of panel data analysis also contributes to examine the relationship between finance and growth. Use of panel data techniques certainly has some advantages for growth studies. Most importantly is that it allows researchers to control for omitted variables over time and unobserved heterogeneity in the initial level of efficiency may be controlled. Previous finance-growth studies have employed either cross-country or time-series analysis but both techniques have their drawbacks. Using cross-section data leaves open the question of spurious correlation arising from non-stationarity, and does not permit an examination of the direction of causality. On the other hand, using time series data may yield unreliable results due to short time spans of typical data sets.

Beck *et al.* (2000) examine the relationship between financial development and sources of growth, i.e. productivity growth and physical capital accumulation using the panel data framework. Numerous financial intermediary indicators are employed in their analysis namely liquid liabilities, commercial-central banks[19] and private sector credit. The empirical results indicate that there is a positive relationship between exogenous components of financial development and economic growth, productivity growth and capital accumulation. The coefficient estimates for the panel data analysis are very similar to those obtained using pure cross-sectional instrumental variables. Therefore, the large, positive relationship between economic growth and private credit does not appear to be driven by simultaneity bias, omitted country-specific effects, or other problems plaguing cross-country growth regression.

On the other hand, Graff (2002) investigates the causal relationship between finance and growth based on the pooled cross-country analysis. He constructs a new proxy for financial development, which captures the share of resources a society devotes to running its financial system at any given time. In contrast to the usual indicators of financial repression/liberalisation and financial depth, which frequently suffer from ambiguity, the financial development proxy suggested by Graff (2002) here relied on real inputs and stands for a well-defined macroeconomic concept. Thus, it is possibly more adequate for

[19] Commercial-central banks equal the ratio of commercial bank assets divided by commercial bank plus central bank assets.

investigations into the sources of economic growth. The three financial development proxies are numbers of banks and branches per capita, the weighted share of manpower employed in the financial system, and the share of the financial system in GDP. The empirical results indicate that from about 1970 – 1990 finance obviously mattered for economic growth, where the causation ran mainly from financial to real development

Calderon and Liu (2003) point out that the causal relationship between financial development and economic growth remains unclear. They employ an innovative econometric technique namely the Geweke decomposition test on pooled data of 109 developing and industrial countries to examine the direction of causality between both variables. The advantage of this method enables examination of causality from *x* to *y*, causality from *y* to *x*, and instantaneous causality between *x* and *y*, based on panel VAR techniques. There are five main findings in Calderon and Liu's (2003) paper. First, financial development generally leads to economic growth in 109 developing and industrial countries. Second, the Granger causality from financial development to economic growth and the causality from economic growth to financial development coexist. Third, financial development contributes more to the causal relationships in the developing countries than in the industrial countries. Fourth, the longer the sampling interval, the larger the effect of financial development on economic growth. Finally, financial development propels economic growth through both a more rapid capital accumulation and productivity growth, with the latter channel being the strongest.

Christopoulos and Tsionas (2004) employ the panel unit root and panel cointegration to examine the relationship between financial development and economic growth in ten developing countries. In addition, they also employ threshold cointegration tests, and dynamic panel data estimations for a panel-based vector error correction model. The empirical results indicate that there is fairly strong evidence in favour of the hypothesis that long-run causality runs from financial development to economic growth. The relationship is significant for 10 developing economies and there is no evidence of bi-directional causality. The empirical evidence also points out that there is no short-run causality between financial deepening and output, so the effect is necessarily long run in nature.

Besides the finance-growth hypothesis, recent empirical studies also focus on the impact of finance on growth on various stages of economic development by Rioja and Valev

(2004b). They argue that if financial markets are important to fund production-related activities, then the effect of financial development on growth is also based on a country's relative position. They use a large panel data set of 74 countries that is divided into three different income levels namely high-income, middle-income and low-income, where the sample period is from 1961 – 1995. The generalised method of moments (GMM) dynamic panel data analysis is employed in their analysis, in order to deal with the possible simultaneity of financial development and economic growth, and to control for country-specific effects. The empirical results reveal that the effects of finance on economic growth vary in different types of economies. In low-income economies, finance affects economic growth predominantly through capital accumulation. In contrast, in middle and especially in high-income economies, financial development enhances productivity growth. It also contributes to physical capital growth, although the effect is somewhat smaller than in the low-income economies. Therefore, the strong contribution of financial development to productivity growth does not occur until a country has reached a certain income level.

2.2.4.4 Microeconomic-based Studies (Industrial and Firm Levels)

In a very influential study, Rajan and Zingales (1998) use industry-level data to examine the mechanisms through which financial development may affect economic growth and to deal rigorously with causality issues. They focus on one way in which financial development may affect economic growth: via external finance. They argue that financial development should be most relevant to industries that are dependent on external finance and that these industries should grow fastest in countries with well-developed financial systems. If industries that are naturally heavy, users of external finance grow faster in economies with better developed financial systems, and this supports the view that financial development spurs growth by facilitating the flow of external finance. They look at 36 individual industries in 41 different countries and examine the influence of the interaction between the external financial dependence of those industries and the financial development of the countries on the growth rates of those industries in the different countries over the period 1980 to 1990.

Rajan and Zingales (1998) use three measures of financial development of a country: the ratio of market capitalization to GDP, domestic credit to the private sector over GDP, and accounting standards. They measure financial dependence of an industry by the amount of external finance raised by firms in different industries in the United States. They study the US on the grounds that it has the best-developed capital markets in the world, and firms face the least friction in raising finance. The US therefore provides the purest measure of the true financing needs of industries, and a good proxy for the demand for external funds in other countries. The basic model that Rajan and Zingales (1998) employ is as follows[20]:

$$\begin{aligned} Growth_{j,k} = {} & Constant + \beta_{1....m} . Country\ Indicators + \beta_{m+1....n} . Industry\ Indicators + \\ & \beta_{n+1} . (Industry\ j\text{'s share of manufacturing in country } k \text{ in } 1980) + \\ & \beta_{n+2} . (External\ Dependence\ of\ Industry\ j . financial\ Development \\ & of\ country\ k) + \varepsilon_{j,k.} \end{aligned} \quad (2.8)$$

where the dependent variable is the average annual real growth rate of value added in industry j in country k over the period 1980 – 1990. If the coefficient estimate for the interaction between dependence and financial development is positive, then this indicates that industries that are more dependent on external financing will have relatively higher growth rates in countries that have more developed financial markets.

Controlling for other influences on economic growth by including dummy variables for industries and countries, they report a strong relationship between economic growth in different industries and countries and the interaction of financial development of countries and the financial dependence of industries. There is a particularly strong relationship when accounting standards are used as the measure of financial development of countries. They suggest that financial development has a substantial supportive influence on the rate of economic growth and this works, at least in part, by reducing the cost of external finance to financially dependent firms.

On the other hand, Demirguc-Kunt and Maksimovic (1998) use firm level data to evaluate the influence of financial systems on growth. They estimate the excess growth of a

[20] Numerous studies have also employed and extended the basic equation of Rajan and Zingales (1998) in their analysis especially in the financial dependence issue. For example, financial dependence and international trade (Beck, 2003); banking market structure, financial dependence and growth (Cetorelli and Gambera, 2001); financial dependence, stock market liberalisation and growth (Gupta and Yuan, 2002); financial development, property rights and growth (Claessens and Laeven, 2003).

firm over and above that which can be internally financed (with a zero dividend distribution) and from short-term finance (assuming that the firm maintains its current short-term borrowing to asset ratio). They examine the influence of market capitalization to GDP ratios, stock market turnover and bank deposits to GDP in 30 countries over the period 1980 to 1995 on the excess growth of firms in those countries over the period 1986 to 1991. They find that both stock market turnover and the size of the banking system are positively related to excess growth. They also include a measure of law and order (the extent to which the legal system of a country allows disputes to be mediated and contracts to be enforced) and find that this variable is also positively associated with excess growth. They conclude that an active stock market and a well-developed legal system are important in facilitating firm growth. Firms in countries that have active stock markets and high ratings for compliance with legal norms are able to obtain external funds and grow faster.

Demirguc-Kunt and Maksimovic (1999) provide support for Rajan and Zingales (1998) argument that financial development may influence economic growth through external financing. They examine the amount and maturity of debt of firms in 30 countries over the period 1980 to 1991 and relate these to turnover on stock markets, bank assets to GDP ratios, the same law and order variable described in the previous paragraph and measures of shareholder and creditor rights. They find that stock market turnover is associated with more long-term debt amongst large but not small firms and larger banking sectors are associated with more long-term debt of small but not large firms. Banks therefore appear to be particularly important in the financing of small firms and stock markets in the financing of large firms.

2.2.5 Stock Market, Banks and Growth

Besides focusing on the role of banking sector development and economic growth, recent research on the role of finance on economic growth has focused on stock market development. Theory generates conflicting predictions about whether stock markets and banks are substitutes or compliments and whether one is more conducive to growth than the other. For instances, Boyd and Prescott (1986) model the critical role that banks play in

easing information frictions and improving resource allocation, and Stiglitz (1985) and Bhide (1993) stress that stock markets will not produce the same benefits as banks. Atje and Jovanovic (1993) examine whether stock market can affect the growth rate and /or the level of economic activity using the Greenwood and Jovanovic (1990) 'AK' model structure, and the Mankiw *et al.* (1992) model, respectively. Their results based on cross-country analysis indicate that stock market has a positive effect on the level as well as on the growth. However, they could not establish a significant relationship between bank liabilities and growth.

In their recent World Bank study of the role of the stock market in the economic development process, Levine and Zervos (1996) use various measures of stock market development and emphasize the causality issue. They conclude that there is a significant relationship between stock market and economic growth. Nevertheless, when they include banking depth variables in their regressions the results turn out to be non-significant[21]. They highlight that, ".... analysts should extend this research by examining the time-series relationship between stock market development and economic growth. Cross-country regressions (estimated in their study) do not resolve issues of causality". They suggest that much work remains to better understand the relationship between stock market development and economic growth. Specifically, careful case studies might better identify the causal interactions between stock market development and economic growth. The present paper follows this line of thinking and examines the causal relationship between financial development and economic growth with respect to the role of stock market and banking development.

Another study carried out by Levine and Zervos (1998) reports the influence of stock markets as measured by their size (ratio of market capitalization to GDP) and value traded (as a proportion of GDP) as well as bank credit on economic growth across more than 40 countries over the period 1976 to 1993. They find that "stock market liquidity and banking development are both positively and robustly correlated with contemporaneous and future rates of economic growth. Since measures of stock market liquidity and banking

[21] They emphasise their results are indicative of partial correlation only, and more research would be needed in the area.

development both enter the growth regressions significantly, the findings suggest that banks provide different financial services from those provided by stock markets".

Murinde (1996) determines the role of financial markets in influencing economic growth in seven Asian Pasific Basin countries, namely Hong Kong, Indonesia, Korea, Malaysia, Singapore, Thailand and the Philippines. He extends a model of a Lucas (1988), Romer (1989) and Pagano (1993) type endogenous growth economy in order to incorporate the effects of financial markets – money market, bond market and stock market. Two estimation and testing procedure are employed namely the standard ordinary least squares (OLS) to estimate the model on each sample country in a country-specific spirit, and the Zellner estimation method[22] in order to capture simultaneously country-specific and cross-country experiences. The empirical results from both estimations indicate weak support for the model's theoretical predictions that financial markets have played a significant role in the growth process of these countries; of the three financial markets studied, only the stock market seems to play a significant role.

In order to examine the contribution of bank-based or market-based financial systems on industries growth, and to determine which systems the new firms prefer, Beck and Levine (2002) carry out panel data analysis on 42 countries and 36 industries of the US and Canada over the 1980s. Besides taking into consideration of bank-based and market-based financial systems in the process of economic development, they also highlight the role of financial services and legal systems in influencing the expansion of existing firms and the formation of new ones. Beck and Levine (2002) find that the results do not support either the market- or bank-based views[23]. Industries that depend heavily on external finance do not grow faster in either bank-based or market-based financial systems. However, their results are supportive of the financial services and the legal-based views[24]. Industries that depend heavily on external finance grow faster in economies with higher levels of overall financial

[22] The Zellner method takes the system of 'seemingly unrelated regression equations' (SURE) as a system equation to be estimated.

[23] The financial services view argues that both banks and markets arise to ameliorate information and transactions costs and thereby provide financial services. Banks and markets might act as complements in providing financial services and promoting economic development [Boyd and Smith (1998); Huybens and Smith (1999)].

[24] The legal-based view based on La Porta *et al.* (1999) rejects the analytical relevance of the bank-based versus market-based debate altogether. This view instead argues that countries with legal codes that protect outside investors and legal systems that enforce those codes will have financial systems that facilitate external finance. Therefore, this view predicts that the component of overall financial development defined by the legal system critically influences the expansion of existing firms and the formation of new ones.

development. Industries that depend heavily on external finance also grow comparatively faster in economies where legal codes protect the rights of outside investors and where the legal system effectively enforces those codes. Moreover, the findings show that the overall level of financial development along with strong creditor rights, shareholders rights, and contract enforcement mechanisms foster new firm formation.

Arestis *et. al* (2001) examine the relationship between stock market development and economic growth, controlling for the effects of the banking systems and stock market volatility for five developed economies, namely Germany, United States, Japan, United Kingdom and France. The empirical results based on Johansen cointegration test indicate that the banks and stock markets are able to promote economic growth in the cases of France, Germany and Japan, but the effects of the bank are more powerful in promoting economic growth. Tadesse (2002), however, find that market-based systems outperform bank-based systems among countries with developed financial sectors, while intermediary-based systems outperform market-based systems with underdeveloped financial sectors. This finding indicates that the difference between intermediary- and market-based systems is important in influencing economic growth.

Kassimatis and Spyrou (2001) find that stock markets have a role to cause economic growth only in relatively liberalised economies, such as Chile and Mexico. In financially repressed economies, such as India, the stock market does not affect real sector growth, whereas in countries in which the nature of the stock market has been speculative, such as Taiwan, a negative relationship is detected between stock market development and economic development. Their findings suggest that the causal link between the stock market and growth is crucially determined by the nature and operation of the financial institutions. Beck and Levine (2004) examine the impact of stock markets and banks on economic growth using a panel data approach for the sample period 1976 – 1998, and apply recent generalised-method-of moments (GMM) techniques. Their findings indicate that stock markets and banks positively influence economic growth, and these findings are not due to potential biases induced by simultaneity, omitted variables or unobserved country specific effects. In short, the empirical results strongly support that financial development is related to

economic growth, which rejects the notion that overall finance is unimportant or harmful for economic growth in the literature.

2.3 Institutions and Economic Growth

Recently, the role of institutions in promoting economic growth also received new interest in the literature from among others, Knack and Keefer (1995), Olson (1996), Keefer and Knack (1997), Hall and Jones (1999), Chong and Calderon (2000), Acemoglu *et al.* (2001) and Assane and Grammy (2003). Numerous institutional quality indicators, such as legal systems, corruption, property rights, bureaucracy and the political stability of a country have been used to investigate the link between institutional quality and economic growth. Indeed, by and large, empirical studies suggest that the capacity of national institutions to protect property rights, reduce transaction costs, and prevent coercion may be significant in determining whether economic development takes place.

The institutional environment of an economy determines what kinds of contracts are feasible, and hence what types of economic activities are realistic. North (1990), perhaps today's best-known economic 'institutionalist', defines institutions as the humanly devised constraints or rules of the game that structure political, economic and social interaction. An important element of these are formal rules (constitutions, laws, property rights, sustained through courts and the police) and informal constraints (sanctions, taboos, customs, traditions and codes of conduct). In general, the more complicated the transaction, the greater the scope for opportunism and the greater the need for efficient contracts. He further states that institutions provide the incentive structure of an economy; as that structure evolves, it shapes the direction of economic change towards growth. In short, institutions affect security of property rights, prevalence of corruption, distorted or extractive policies and thereby affects the incentive to invest in human and physical capital, and hence economic growth. In the absence of formal rules, a dense social network leads to the development of customs, laws, trust, and normative rules that constitute an informal institutional framework (Bates, 1989). Naturally, informal constraints on behaviour are pervasive and important in modern economies too (David, 1994).

On the other hand, Nelson and Sampat (2001) propose that institutions may be treated as 'social technologies' in the operation of productive economic activities, which involve patterned human interaction rather than physical engineering. If one reflects on the matter, the program built into a routine generally involves two different aspects: a recipe that is anonymous regarding any division of labour, and a division of labour plus a mode of coordination. They propose that the former is what scholars often have in mind when they think of 'physical technologies'. The latter Nelson and Sampat (2001) call a 'social technology' and propose that social technologies are what many scholars have in mind when they use the terms 'institutions'. North and Wallis (1994) have proposed a similar distinction between physical and social technologies.

2.3.1 Empirical Evidence

Principally because of data limitations, empirical research into cross-country sources of economic growth has been restricted to a narrow examination of the role of institutions. This has hindered the development of a cross-country test of North's (1990) proposition that 'the modern study of institutions offers the promise of dramatic new understanding of economic performance'. The process of integrating institutions into economic theory is of comparatively recent vintage. Over a decade ago, institutional measures were first introduced into cross-country growth equations, and there has been a recent renaissance in this literature. Early studies that investigated the economic growth-institutions nexus relied upon a measure of political stability, such as coups and assassinations, or on the Gastil (1983, 1986) measures of political freedom and civil liberties (Kormendi and Meguire, 1985; Scully 1988) as a proxy for security of property rights.

In the last five years, a number of studies have used the Economic Freedom Index from the Fraser Institute to investigate the link between economic growth and institutions. Ali (1997), and Ali and Crain (1999) find economic freedom to be a more robust determinant of growth than political freedom and civil liberties. Ayal and Karras (1998) find that economic freedom enhances growth both via increasing total factor productivity and via enhancing capital accumulation. In a study of Dawson (1998), economic freedom is found to be growth

enhancing. Barro (1996) finds that economic and political institutions are the most important factors in explaining differences in growth across economies.

Relatively new available data have allowed social economists to examine the link between institutions and economic growth empirically, for example, Mauro (1995), Knack and Keefer (1995), Olson (1996), Keefer and Knack (1997), Chong and Calderon (2000). Besides, there are some studies that associate institutional quality with poverty and income distribution (Chong and Calderon, 2000) and institutional quality with industrial growth (Grigorian and Martinez, 2001). In historical evidence presented by North and Thomas (1973), Rosenberg and Birdzell (1986) and North (1990), they show that the security of property rights provides incentives for economic growth.

Knack and Keefer (1995) pioneered the use of indicators of security of property rights in the growth literature, with the International Country Risk Guide (ICRG) and Business Environment Risk Guide (BERI) indices[25] as proxies for this aspect of institutions. These institutional indicators include quality of bureaucracy, property rights, and the political stability of a country. Their estimation results, based on cross-country, indicate that all these factors have a positive statistically significant relationship with economic performance. More recently, Mauro (1995) finds corruption in countries to be growth retarding. He demonstrates that indices of honesty, political stability, bureaucratic efficiency, and institutional efficiency exert positive effects on investment and output growth. Mauro estimates, for example, that a one standard deviation improvement in the index of bureaucratic efficiency, results in more than one percentage point increase in the annual growth rate of GDP per capita, *ceteris paribus*. Easterly (1999) also demonstrates that the countries which have a higher corruption index tend to have persistently lower growth.

Olson (1996) argues that the large differences in per capita income across nations are mainly due to differences in the quality of their institutions and their economic policies. Rodrik (1997) points out that an index of institutional quality does exceptionally well in rank-ordering East Asian countries according to their growth performance. Generally, empirical studies show that the higher the quality of a country's institutions, the higher its economic performance. Keefer and Knack (1997) examine the convergence hypothesis within the

[25] These indicators are provided by country risk evaluators to potential foreign investors.

context of institutional effectiveness. They find that low-income economies may not grow faster than high-income economies if they suffer from a weak institutional framework in terms of ineffectiveness of the rule of law, the pervasiveness of corruption, and a high risk of expropriation and contract repudiation.

However, the empirical evidence between institutions and growth, as provided by Knack and Keefer (1995) and Mauro (1995), does not identify the direction of causality and instead assumes that the direction of causality runs from quality of institutions to economic growth. Chong and Calderon (2000) correct this shortcoming and argue that the direction of causality could also go the other way. Not only does the improvement of institutional quality result in higher rates of economic growth, but also higher rates of growth which will make a country richer, and hence will enable it to improve the institutional quality. They collect similar institutional measures employed by Knack and Keefer (1995) for 55 countries and for the period 1972 – 1995, but focus on causality issues by employing a Granger causality technique. The empirical reveal that there is a causal effect running from institutional quality to economic growth even after controlling for the initial enrolment ratio for primary education, the gross domestic product and regional dummies (Latin America and Africa). Nevertheless, it also seems to be the case that economic growth causes institutional quality. The results appear to support the fact that time matters. In other words, institutional reform takes a long time to influence economic growth, and the potential gains of institutional reform on developing countries may be larger than in developed ones.

The most two influential papers in investigating the role of institutions on economic growth are (i) Hall and Jones (1999), who focus on what they call 'social infrastructure', and (ii) Acemoglu *et al.* (2001), who focus on the expropriation risk that current and potential investors face. Both studies use the instrumental variables for current institutions in the empirical work. Hall and Jones (1999) investigate cross-country differences in economic performance based on variations in inputs (capital and human capital). Their results show that there is a large amount of variation in the level of the Solow residual across countries, which indicates that differences in physical capital and educational attainment can only partially explain the variation in output per worker. They argue that the differences in capital

accumulation, productivity and therefore output per worker are driven by differences in institutions and government policies, which they call social infrastructure[26].

Hall and Jones (1999) build their analysis on the hypothesis that the single fundamental determinant of a country's economic performance is its social infrastructure. They estimate the equation

$$\log\frac{Y}{L} = \alpha + \beta S + \varepsilon \qquad (2.9)$$

where S is their index of social infrastructure, which is constructed based on two indices, namely an index of government anti-diversion policies (GADP) using the average of five of the categories reported in the International Country Risk Guide (ICRG)[27] (from the company Political Risk Services) and an openness to international trade constructed from the Sachs-Werner index. However, there is a major problem with estimating the above equation, namely that there is every reason to expect that social infrastructure is itself dependent upon production (Y/L) or S is endogenous. As such, an instrumental variable is needed to estimate this equation. Hall and Jones (1999) use up to four instruments, namely (i) distance from the equator; (ii) fraction of the population that speaks English; (iii) fraction of the population that speaks another European language; (iv) Frankel-Romer predicted trade share based on a gravity model of international trade. Using these instruments, Hall and Jones (1999) find evidence of a strong effect of social infrastructure on production and argue that differences in social infrastructure can explain between 25.2 - 35.1% differences in output.

Hall and Jones (1999) argue that latitude is correlated with 'Western influence', which leads to good institutions. Nevertheless, the theoretical reasoning that distance of equator as an instrumental variable is not entirely convincing. The notion that European influence is crude and theoretically the link is weak. For instance, it is not easy to argue that the Belgian influence in the Congo, or Western influence in the Gold Coast during the era of slavery promoted good institutions. Therefore, the distance of equator is a weak instrument since it is poorly correlated with the institutional quality. Ethno-linguistic fragmentation, on the other hand, seems endogenous, especially since such fragmentation almost completely

[26] According to their study, social infrastructure can be defined as the institutions and government policies that provide the incentives for individuals and firms in an economy. Incentives can encourage productive activities or instead encourage predatory behaviour such as rent-seeking, corruption and theft.

[27] These five indexes are law and order, bureaucratic quality, corruption, risk of expropriation and government repudiation of contracts.

disappeared in Europe during the era of growth when the centralised state and market emerged. Econometrically, both instruments namely distance from the equator and ethno-linguistic fragmentation can plausibly have a direct effect on economic performance[28], which is the dependent variable. Therefore, these instrumental variables are invalid instruments and do not establish that it is institutions that matter.

In the light of this critique, Acemoglu *et al.* (2001) provide a more elaborate perspective on the colonial impact argument by using the mortality facing settlers during colonisation as an instrumental variable. Their argument is as follows: High settler mortality led to 'extractive state' colonies (e.g. the Belgian Congo) while low mortality led to permanent settlements of Europeans (e.g. Australia) with the subsequent development of appropriate institutions for running these new 'European' societies. Their evidence is similar to that reported to Hall and Jones (1999), but the instrument does appear to have a better foundation.

Acemoglu *et al.* (2001) have formulated the following idea to get some 'exogenous' variation in the setting up of institutions. There are three steps to their argument. First, while culture does shape institutions, the colonisation strategy was driven partly by the feasibility of European settlement. In places where Europeans faced high mortality rates they adopted a 'take the money and run' approach to setting up institutions and creating extractive states (e.g. the Belgian colonisation of Congo, and West Africa in general, Spanish and Portuguese colonisation of Latin America) which did not provide much protection for private property rights and focused on transferring as much resources from the colonies to the coloniser. However, in other places where they faced a more favourable environment (e.g. Australia, US, Canada, New Zealand) they went and settled themselves and tried to create 'new Europes' and set up institutions that were favourable to economic growth. For instance, in Australia early settlers, who were mostly ex-convicts, demanded jury trials, freedom from arbitrary arrest and electoral representation. Second, the effect of these early institutions has persisted to the present day, i.e. has influenced current institutions. Third, current institutions affect the current level of economic performance.

[28] More recently, Bloom and Sachs (1998) and Gallup and Sachs (2001) argue for a direct effect of climate on performance.

Acemoglu *et al.* (2001) use the protection from risk of expropriation index[29] constructed by the International Country Risk Guide (ICRG) as a measure of efficiency of current institutions. They also have data on non-combat mortality rates (per thousand) of soldiers, bishops and sailors in colonies between 1817 – 1848 based on the work of Curtin (1989, 1998) for 64 countries that form the base sample. The regression of the following form is run

$$\log y_i = \mu + \alpha R_i + X_i'\gamma + \varepsilon_i \tag{2.10}$$

where y_i is income per capita in country i, R_i is the protection against expropriation measure, X_i is a vector of other covariances, and ε_i is a random error term. In order to overcome the reverse causality (rich countries can afford better institutions) between institutions and income, Acemoglu *et al.* (2001) estimate the above model by using the mortality rates as an instrumental variable for institutions.

$$R_i = \lambda_R + \beta_R \log M_i + X_i'\gamma_R + \upsilon_{Ri} \tag{2.11}$$

Their empirical results indicate that differences in institutions explain approximately three-quarters of the income per capita differences across former colonies.

Rodrik *et al.* (2002) investigates the impact of institutions, geography and trade in influencing income levels around the world, using recently developed instruments for institutions and trade. The empirical results indicate that quality of institutions trumps everything else. Once institutions are controlled, integration has no direct effect on incomes, while geography has at best only weak direct effects. Trade often enters the income regression with the 'wrong' (i.e. negative) sign, as do many of the geographical indicators. By contrast, their measure of property rights and the rule of law always enters with the correct sign, and is statistically significant, often with t-statistics that are very large. Of the links among determinants, Rodrik *et al.* (2002) find that institutional quality has a positive and significant effect on integration. Importantly, integration also has a positive impact on institutional quality, suggesting that trade can have an indirect effect on incomes by improving institutional quality. Their results also tend to confirm the findings of Easterly and Levine (2002), namely that geography exerts a significant effect on institutions. On the other

[29] This index reflects the risk of confiscation or measures of the security of property right.

hand, Dollar and Kraay (2003) find that a significant effect of trade on growth, with a smaller role for improvements in institutions. They conclude that there is an important joint role for both trade and institutions in the long-term, but a relatively larger role for trade over shorter horizons.

Assane and Grammy (2003) investigate the effect of institutional quality on economic development using the Solow model. The independent variables consist of physical capital accumulation, labour force growth, human capital formation, economic freedom and institutional quality. The empirical results support the hypothesis that good institutions improve efficiency and accelerate growth. The positive effect of institutional quality is more pronounced with mutually reinforcing support of economic freedom. Their results also reveal that good institutions help developing countries grow faster to achieve conditional convergence.

2.4 The Determinants of Financial Development

In the literature, there are three established theoretical views that explain the determinants of financial development, namely the law and finance view, the endowments theory of institutions view and interest group theory. Even though these views are clearly common characteristics, there are important differences, which are discussed below.

2.4.1 Law and Finance

The law and finance view is suggested by La Porta *et al.* (1997), which stresses that different legal traditions emphasize the comparative rights of individual investors vis-à-vis the state, with important ramifications for financial development [La Porta *et al.* (1997, 1998, 1999, 2002)]. La Porta *et al.* (1997) compares legal rules across 49 countries by dividing them into four legal systems, namely: English common law; French; German and Scandinavian civil laws. The legal environment variables used in the study are the legal and regulatory treatment of creditors, the efficiency of the legal system in enforcing contracts, and accounting standards. They find that the legal environment as described by both legal

rules and their enforcement has an influence on the size and extent of a country's capital markets, including equity and debt markets. The legal rules protecting investors and the quality of their enforcement differ greatly and systematically across countries. In other words, the quantity of external finance is, in part, determined by legal tradition. According to them, a good legal environment protects the potential financiers against expropriation by entrepreneurs; it raises their willingness to surrender funds in exchange for securities, and hence expands the scope of capital markets.

La Porta *et al.* (1997) point out that in the area of protection against expropriation by insiders, common law countries protect both shareholders and creditors the most, French civil law countries the least, and German civil law and Scandinavian civil law countries somewhere in the middle. They also show that richer countries enforce laws better than poorer countries, but, controlling for per capita income, French civil law countries have the lowest quality of law enforcement as well. Another study by La Porta *et al.* (1998) shows that the better investor protection in common law countries is reflected in higher dividend payouts than in civil law countries and lower dividend payouts by high rather than low growth companies in common, but not civil, law countries. Better investor protection therefore makes dividends more responsive to the investment needs of companies.

Beck *et al.* (2001) extend the analysis in La Porta *et al.* (1997,1998) by focusing the dynamics rather than the statics of legal systems. They argue that the French legal system was founded on the basis of the immutability of legal doctrine. On the other hand, in a common law system the judiciary has broad powers of interpretation. In terms of adaptability, the German system is closer to the common law than the French legal system. The authors go on to argue that if a legal system adapts slowly, then 'large gaps will appear between the commercial and financial needs of an economy and the ability of the legal system to support those needs efficiently'. They also find that common law systems have higher levels of financial development than French civil law, using several different measures of financial development. Controlling for differences in government and environmental endowment, they find that legal traditions remain an important factor of cross-country differences in financial development. The difference in financial development between common law and French civil law countries is more pronounced than that between common law and German civil law

countries. This is consistent with the view that it is the adaptability of, rather than the static differences in, legal systems that influences financial development.

The findings in La Porta *et al.* (1997) have been subject to criticism, in large part due to their emphasis on legal systems rather than institutions responsible for enforcement of laws and contracts and definition of the role of the state vis-à-vis private investors. An alternative view places greater emphasis on cross-country variation in the rule of law and protection of private investors against expropriation by the government. A comprehensive analysis of the relative significance of legal systems and institutions responsible for enforceability of contracts and defining the role of the state vis-à-vis private investors for financial development is yet to be undertaken. This is part due to the complexity of disentangling exogenous determinants of law from the exogenous determinants of aforementioned institutions. A recent study by Acemoglu *et al.* (2001) adopts such an alternative approach in a study of economic development. They use a measure of mortality of European colonisers in the post-colonial countries during their colonisation in the 17th, 18th and 19th centuries as an exogenous source of variation in their current institutions distinct from the countries' legal origins.

2.4.2 Endowments Theory of Institutions

The endowment theory focuses on the roles of geography and the disease environment in shaping institutional development; institutions tend to have an influence in determining the development of private property rights and financial systems. Acemoglu *et al.* (2001) base their theory on three premises. First, they point out that Europeans adopted different types of colonisation strategies. At one end of the spectrum, the Europeans settled and created institutions to support private property rights and check the power of the state. For example, these settler colonies include the United States, Australia and New Zealand. At the other end of the spectrum, Europeans did not aim to settle but rather to extract as much from the colony as possible. Therefore, in these extractive environments, Europeans did not create institutions to support private property rights; instead, they established institutions that

empowered the elite to extract gold, silver, etc (such as the Congo, Ivory Coast, and much of Latin America).

The second component of their theory holds that the type of colonisation strategy was heavily influenced by the feasibility of settlement. Mortality rates were high in some countries. In the inhospitable environment, Europeans tended to create extractive states, whereas in areas where endowments favoured settlement, Europeans tended to form settle colonies especially in low mortality rate area. Therefore, according to the endowment theory, the disease environment shaped colonisation strategy and the types of institutions established by European colonisers.

The final point focuses on the institutions created by European colonisers endured after independence. Settler colonies tended to produce post-colonial governments that were more democratic and more devoted to defending private property rights than extractive colonies. In contrast, since extractive colonies had institutions for effectively extracting resources, the post-colonial elite frequently assumed power and readily exploited the pre-existing extractive institutions.

Even though Acemoglu *et al.* (2001) emphasise institutional development in general, their theory is applicable to the financial sector. This is because in an extractive environment, colonisers will not construct institutions that favour the development of free, competitive financial markets because competitive markets may threaten the position of the extractors. Nevertheless, in settler colonies, colonisers will be much more likely to construct institutions that protect private property rights and hence foster financial development. Therefore, according to the endowment theory of institutions, differences in endowments shaped initial institutions and these initial institutions have had long-lasting repercussions on private property rights protection and financial development.

2.4.3 Interest Groups Theory

Rajan and Zingales (2003) show that some progress on the determinants of financial development can be explained from the political economy view. Politics, as driven by special-interest groups representing established business, can explain the uneven evolution

of capital markets. They propose an "interest group" theory of financial development where incumbents oppose financial development because it produces fewer benefits for them than for potential competitors. The incumbents will shape policies and institutions to their own advantage when they gain power. Incumbents can finance investment opportunities mainly with retained earnings, whereas potential competitors need external capital to start up. Nevertheless, when a country is open to trade and capital flows, it will deliver benefit to financial development due to openness to both trade and capital breeds competition and thus threatens the rents of incumbents. This has a number of consequences. First, there are fewer profits to protect in the system: given that the economy is open, incumbents cannot use domestic political action to restrain foreigners. Moreover, given that prospective profits from restraining domestic entry will be limited, both the incentive to keep restraints in place as well as the ability to pay politicians for their support diminishes. Finally, in the face of foreign competition, even established domestic incumbents find a need to rely on the domestic infrastructure – for instance, established firms finally find that the high cost of domestic finance hurts. Not only do they not want to oppose financial development, they become active supporters.

Rajan and Zingales (2003) point out that incumbents, in the financial sector and in industry, can be hostile to arm's length markets. This is because arm's length financial markets do not respect the value of incumbency and instead can give birth to competition. It is when both cross-border trade flows and capital flows are unimpeded that industrial and financial incumbents will have convergent incentives to push for financial development. Industrial incumbents, with depleted profits and the need for restructuring operations to meet competition, will require funds. But it is important to note that, with free cross-border capital flows, the government will not be able to respond by stepping up the flow of credit to incumbents: as product markets become more competitive, the risks in, and information requirements for, lending will increase. The potential for large errors form the government's directing the flow of credit will increase. Moreover, the ability of the government to provide large subsidized loans to favoured firms will decrease as mobile international capital forces governments to maintain a balanced budget. The government's role in the financial sector will diminish. With the diminished role of the government, competition in the industrial sector

and in the financial sector can reinforce each other when the economy is open to both trade and capital flows.

2.4.4 Empirical Evidence

The importance of institutional quality and legal system factors has recently caught the attention of economists in a variety of fields. Recently, these factors have been elevated to an important determinant of financial development. Economists' believe efficient working institutions are demanded to manage risks that comes from the financial intermediaries. In addition, the quality of institutions and legal framework are also likely to affect growth through the ability of the financial sector to channel resources to finance productive activities. In the absence of an adequate regulatory framework and supervision the ability of domestic banks to mobilize funds may be strongly undermined by lack of depositors' confidence. This will drift funds abroad and generally away from viable domestic investment opportunities. For example, Demetriades and Andrianova (2004) argue that the strength of institutions, such as financial regulation and the rule of law, may determine the success or failure of financial reforms. Well-defined institutions, such as financial regulation, property rights and legal systems can enhance investor confidence, play a crucial role in the functioning of financial intermediaries, and hence, boost financial development and economic growth.

According to Arestis and Demetriades (1996), cross-country differences in financial development may be due to at least three reasons. Firstly, the institutional structure of the financial system may matter; certain types of financial system may be in a better position than others to enhance the growth process. Secondly, financial sector policies may also have important implications concerning the issue of whether financial deepening is able to promote growth; therefore, differences in policies across countries may be responsible for differences in the causal nature between financial development and growth. Finally, the wider institutional structure may also matter; two countries with identical financial systems and financial sector policies may still differ in relation to the effectiveness of their governments. Thus, it is possible that the same financial policies work differently in different countries because of differences in the effectiveness of the institutions that implement them.

Levine (1998) investigates the relationship between the legal system and banking development and traces this connection through to long-term rates of per capita GDP growth, capital stock growth and productivity growth. The data implies a close relationship between the legal system and banking development. Countries where legal codes emphasize the rights of creditors have better developed banks, as measured by bank credit to the private sector divided by GDP, than countries where laws do not give a high priority to creditors in the case of corporate bankruptcy or reorganization. Furthermore, enforcement matters. Countries with legal systems that rigorously enforce laws and contracts have better developed banks than countries where enforcement is more lax. Moreover, these differences can be traced back to the legal origins of the country.

Pistor *et al.* (2000) investigate the legal changes in the protection of shareholder and creditor rights in transition economies and its impact on the propensity of firms to raise external finance. Following La Porta *et al.* (1998), they construct an expanded set of legal indices to capture a range of potential conflicts between different shareholders of the firm. It supplements the analysis of the law on the books with an analysis of the effectiveness of legal institutions. The regression analysis indicates that effectiveness of legal institutions has a much stronger impact on external finance than does the law on the books, despite legal changes that have substantially improved shareholder and creditor rights. The experience of transition economies suggests that good laws cannot substitute weak institutions.

Levine (1997) examines the connection between the legal environment and financial development, and then tracing this link through to long run economic growth. First, he finds that the legal and regulatory environment matters for financial development. Countries with legal and regulatory systems that give a high priority to creditors receiving the full present value of their claims on corporations have better functioning financial intermediaries than countries where the legal system provides much weaker support to creditors. Second, the empirical results indicate that contract enforcement is significant to determine financial development. Countries that impose compliance with laws efficiently and enforce contracts including government contract effectively tend to have much better developed financial intermediaries than countries where enforcement is more lax. Finally, he discovers that information disclosure also play an important role in determining financial development. For

instance, countries where corporations publish relatively comprehensive and accurate financial statements have better developed financial intermediaries than countries where published information on corporations is less reliable.

Other than the above findings, Levine (1997) employs the legal and regulatory indicators of creditor rights, contract enforcement, and information disclosure as instrumental variables for financial development in order to examine the causal effect between financial development and economic growth. The empirical results using the Generalized Method of Moments (GMM) procedure reveal that the exogenous component of financial intermediary development – the component of financial intermediary development defined by the legal and regulatory environment – is positively associated with economic growth. This implies that legal and regulatory changes that boost financial intermediary development will induce a rapid acceleration in long-run economic growth.

An interest group theory proposed by Rajan and Zingales (2003) suggest that a country's domestic financial development should be positively correlated with its degree of openness to product and capital flows. Rajan and Zingales (2003) provide a systematic analysis of the patterns of financial development in 15 industrialised countries. The data suggests that the positive relationship between trade openness and the size of a country's equity market is much weaker, or nonexistent, in the period between 1930 and 1980, when cross-border capital flows were much smaller. Therefore, both cross-border trade and capital flows may indeed be necessary for financial development.

The debate on the effects of capital inflows and trade openness on financial development has been characterised by a very limited number of empirical analyses. Most previous studies have focused on the link between capital account openness and economic growth. Previous studies examining the impact of capital account liberalisation on economic performance have viewed financial system strength as exercising an exogenous influence on this relationship. The predicted benefits of greater financial openness may not materialise in countries with weak financial systems. Such countries may struggle to efficiently intermediate large flows of capital, thus increasing financial fragility and potentially hindering macroeconomic performance.

Rodrik (1998) and Kraay (1998) find no evidence that the combination of open capital accounts and strong financial systems are correlated with long-term economic performance in large cross-sections of countries. In contrast to this approach, Klein and Olivei (1999) view financial depth as an endogenous variable in the process linking financial liberalisation and economic growth. They find that capital account liberalisation has a substantial impact on growth via the deepening of a country's financial system. This applies however only to a sub-sample of highly industrialised countries. The authors find little evidence of financial liberalisation promoting financial depth, and therefore economic growth, outside members of the OECD. Klein and Olivei (1999) conclude that the beneficial effects of capital account liberalisation, at least with respect to promoting financial depth, are achieved only in an environment in which there is a constellation of other institutions that can usefully support the changes brought about by the free flow of capital.

Levine (2001), on the other hand, shows that international financial market integration can positively influence economic growth. He finds that the presence of foreign banks tends to foster a more efficient domestic banking system, which positively effects productivity and growth. Besides, he also discovers that liberalising restrictions on international portfolio flows tends to boost domestic stock market liquidity, which positively effects productivity and growth. Thus, international financial integration can spur growth without inducing large capital flows into developing countries. Chinn and Ito (2002) show that there is a strong relationship between capital controls and financial development. Their finding is hold for less developed countries in terms of stock market value traded, and even more so for emerging market economies.

In terms of trade openness, only few studies have conducted to examine the link between two variables. Beck (2002) provides the first empirical examination of a small literature on the link between international trade and financial development. A theoretical model with two sectors developed by Beck (2002) shows one possible causal link from the level of financial development to the structure of the trade balance. The sector with high scale economies profits more from a higher level of financial development than the other sector. Countries with a better-developed financial sector therefore have a comparative advantage in sectors with high scale countries, and, all else equal, are net exports of them.

The empirical results based on cross-country and panel data estimations support to the predictions of the model. Countries with a higher level of financial development have higher shares of manufactured exports in GDP and in total merchandise exports and have a higher trade balance in manufactured goods.

Another study carried out by Beck (2003) shows that countries with better-developed financial systems have higher export shares and trade balances in industries that rely more on external finance. The approach that Beck (2003) employs is based on Rajan and Zingales (1998) by regressing export and trade shares on the interaction between external dependence across industries and financial development across countries. In addition, the instrumental variables for financial development are employed to control for the possibility that the results are driven by reverse causality or simultaneity bias by using the legal origin of countries. Nevertheless, the results indicate that there is no simultaneous determination of export specialisation and financial development or that development of the financial sector simply follows the real sector. Svaleryd and Vlachos (2002) demonstrate that there is a uni-directional causal effect running from openness to financial development, but they do not find evidence in the opposite direction.

2.5 Financial Liberalisation and Stock Market Volatility

In the latter half of the 1980s and the early part of the 1990s, many developing countries began to implement a wave of major economic reforms, which included financial liberalisation in terms of opening up their stock markets to foreign investors. This event fuelled an active academic and popular debate on the consequences of liberalisation, such as stock market volatility, in part because the aftermath of such events is important to domestic stock markets. Empirical studies on the consequences of this program will therefore be an important tool in assessing how best to implement similar liberalisation policies in opening up their stock market-minded economies.

2.5.1 Theoretical Views

The Keynesian view on the expansion of stock markets due to financial liberalization suggests that volatility will increase because of the quicker pace of financial transactions, which can have a destabilizing effect on the real economy. Moreover, volatility may be self-exacerbating: volatility forces investors to shorten their time horizons for both offensive (profit-seeking) and defensive (loss-minimising) reasons, with the paradoxical effect of inducing increased volatility. This indicates that increases in market volatility may lead to reductions in real-sector investment activities.

On the other hand, financial liberalization in terms of the opening market will attract new investors, such as institutional investors from the developed markets, whose decisions are based more on rational investment analyses and whose strategies focus on fundamental valuation factors. Therefore, it is expected that stock market volatility will be reduced after liberalization.

Tauchen and Pitts (1983) predict that a decrease in volatility following the opening up of stock markets to foreign investors. They introduce a model of stock price and volume traded in the speculative market. Their model shows that stock return volatility is inversely related to the number of traders in a market. In this framework, the market consists of J active traders who take long and short positions in a single futures contract. Within the day the market passes through a sequence of distinct Walrasian equilibria. The movement from the $(i-1)$st to the ith within day equilibrium is initiated by the arrival of new information to the market. The desired net position, Q_{ij}, of the jth trader is given by the linear relation:

$$Q_{ij} = \alpha\left[P_{ij}^{*} - P_i\right] \ (j = 1,2,\ldots,J) \tag{2.12}$$

where $\alpha > 0$ is constant; P_{ij}^{*} is the jth trader's reservation price, and P_i is the current market price.

A positive value for Q_{ij} represents a desired long position in the contract while a negative value represents a desired short position. These J active traders have reservation prices different from different expectations about the future and from different needs to transfer risk through the market. Non-active traders use the market quotation as their reservation price. Equilibrium requires that the following holds true:

$$\sum_{j=1}^{J} Q_{ij} = 0 \tag{2.13}$$

This implies that the average of the reservation prices clears the market:

$$P_i = \frac{1}{J} \sum_{j=1}^{J} P_{ij}^{*} \tag{2.14}$$

Consider now the movement from the $(i - 1)$st to the ith within-day equilibrium. A piece of news arrives to the market and changes the traders' reservation prices. The resulting change in the market price ΔP_i is the average of the increments to the traders' reservation prices. By making use of the equilibrium condition and Equation (2.12), the price change can be written as:

$$\Delta P_i = \frac{1}{J} \sum_{j=1}^{J} \Delta P_{ij}^{*} \tag{2.15}$$

where $\Delta P_{ij}^{*} \equiv P_{ij}^{*} - P_{i-1,j}^{*}$ is the increment to the jth trader's reservation price. Tauchen and Pitts (1983) assume a variance-component model

$$\Delta P_{ij}^{*} = \phi_i + \psi_{ij} \qquad E[\phi_i] = E[\psi_{ij}] = 0, \quad \text{var}[\phi_i] \equiv \sigma_{\phi}^2, \quad \text{var}[\psi_{ij}] = \sigma_{\psi}^2 \tag{2.16}$$

where the ϕ's and the Ψ's are mutually independent, both across traders and through time. The component ϕ_i is common to all traders while the component Ψ_{ij} is specific to the jth trader.

Using the variance-components model (2.15), Equation (2.16) is then rewritten as:

$$\Delta P_i = \phi_i + \frac{1}{J} \sum_{j=1}^{J} \psi_{ij} \tag{2.17}$$

The first two moments of the price change are then derived as the following:

$$\mu_1 \equiv E[\Delta P_i] = 0 \tag{2.18}$$

$$\sigma_1^2 \equiv Var[\Delta P_i] = \sigma_{\phi}^2 + \frac{\sigma_{\psi}^2}{J} \tag{2.19}$$

Equation (2.19) suggests that, other things equal, an increase in the number of traders J tends to decrease the stock price variance. On the other hand, an increase in the variance of

information sets available to traders – a common component ϕ_i and/or a unique component Ψ_{ij} – tends to increase the stock price variance.

2.5.2 Empirical Evidence

According to the Keynesian view, financial liberalisation could attract speculators and investors with short-term strategies who can introduce financial crises and economic instability. A market opening may trigger an increase in the variance of information sets available to traders such as speculation and uncertainties abroad that will transform into uncertainties in traders' information and be reflected in increase domestic stock price volatility. Therefore, financial liberalisation will create stock market more volatile due to increased liquidity[30]. Numerous studies have found stock market volatility has increased after financial liberalisation such as Grabel (1995), Levine and Zervos (1998) and Nilsson (2002). Nevertheless, not all the sample countries in their studies indicate this finding. For example, Grabel (1995) and Levine and Zervos (1998) demonstrate that stock market volatility tends to be higher in the period after liberalisation in four out of six, and sixteen out of twenty sample countries, respectively.

The evidence of stock market volatility has increased after liberalisation is not overwhelming, many studies have found that stock market volatility has decreased after financial liberalisation. For instance, Kim and Singal (2000) demonstrate that volatility in the first two years after opening is not significantly different from that before, and in the fourth and fifth years after opening is significantly less than before. Huang and Yang (2000) point out that stock market volatility has decreased in four out of ten emerging markets, whereas two markets have not changed after liberalisation. Kassimatis (2002) finds that stock market volatility fell after the emerging markets opened up their stock market to foreign investors.

Grabel's (1995) seminal work on assessing the impact of financial market liberalisation on stock market volatility has received great attention by the subsequent researchers. He finds that during the financial liberalization experiments market volatility increased, especially in Latin American, and in some cases this increase in volatility was

[30] Keynes (1964) regards liquidity as having destabilising effect on the market because of the assumption of market imperfection, particularly in relation to the availability of information to all participants.

found to be statistically significant. The findings of increased volatility are consistent across all measures of volatility in the cases of Chile, Colombia, Venezuela, and Korea, while the evidence for Argentina and the Philippines is mixed.

Bakaert and Harvey (1997) use liberalisation dates to examine the behaviour of volatility in emerging countries. They employ time series and cross-sectional models to analyse the reasons why stock market volatility is different across emerging markets, particularly with respect to the timing of capital market reforms. They estimate a world factor model of conditional variances using the generalised autoregressive conditional heteroskedasticity (GARCH) model. Besides the time series analysis, they also employ the cross sectional framework to investigate whether capital market liberalisation policies affect volatility after controlling for other factors that might affect volatility. Their results indicate that capital market liberalisation often increase the correlation between local market returns and the world market but do not drive up local market volatility.

DeSantis and Imrohoroglu (1997) use the liberalisation dates in emerging markets to study whether investors can successfully predict future changes in volatility and whether they are rewarded with higher expected returns for being exposed to a higher level of anticipated risk. The GARCH model is employed in the analysis based on three steps. First, a model assuming full market segmentation while allowing for time-varying volatility is estimated. In this scenario, they test whether investors can successfully predict future changes in volatility and, most important, if they are rewarded with higher expected returns for being exposed to a higher level of anticipated risk. Second, they relax the assumption of full segmentation and analyse a number of models that assume different degrees of market integration. Finally, they evaluate the claim that liberalisation is not necessarily beneficial for many developing countries, because it may increase the volatility of their financial markets. DeSantis and Imrohoroglu (1997) find clustering, predictability and persistence in conditional volatility. They also find that exposure to high country-specific risk does not appear to be rewarded with higher expected returns. Their study does not find evidence to support the claim that market liberalisation increases price volatility.

Spyrou and Kassimatis (1999) examine the impact of financial liberalisation on stock market volatility in a sample of emerging economies. They employ a methodology, namely

the GARCH (1,1), which allows them to (i) account for time variation in volatility and (ii) investigate changes in volatility persistence. In order to examine structural shifts in the unconditional stock return variance, they include dummy variables, which corresponds to the period September 1997 to February 1998 of the East Asian financial crisis in the variance equation of the standard GARCH model. The sample emerging markets in their analysis consists of Argentina, Chile, Mexico, India, Pakistan, Korea, Taiwan and the Philippines, whereas the sample period begins at 5 January 1988 for all markets and ends at 27 February 1998. The empirical results based on the two sub-sample periods namely pre- and post-liberalisation indicates that the nature of stock return volatility has not changed dramatically after liberalisation. Besides, volatility persistence also remains largely the same. The ARCH coefficient, which expresses the significance of past news on volatility, has been reduced for Argentina, Chile, Korea, Pakistan, Taiwan and the Philippines post-liberalisation. This implies that the markets are becoming less volatile after stock market liberalisation.

Huang and Yang (2000) find that South Korea, Mexico, and Turkey suffered from greater stock price volatility, whereas Argentina, Chile, Malaysia and the Philippines experienced diminished volatility after financial liberalization. Santis and Imrohogoglu (1997) do not find support for the claim that market liberalization increases price volatility. In general, the empirical evidence provides by all these previous is at best inconclusive. Therefore, further analysis is needed to examine the effect of financial liberalization on stock market volatility. Li (2002) finds that stock market volatility in Taiwan is significantly reduced three months after opening up to foreign investors. The involvement of foreign investors means a better dissemination of information, which leads to a more efficient market. In short, Li (2002) concludes that foreign investors have had a stabilising influence on the Taiwanese stock market and the liberalisation of the capital market enables risk sharing between domestic and foreign investors.

Nilsson (2002) investigates the impact of financial liberalisation on stock market returns in four largest Nordic stock markets, namely Sweden, Denmark, Finland and Norway. Almost all restrictions on both cross-border ownership and capital flows were officially removed in these economies by the end of 1992. The empirical results based on multivariate regime-switching model indicate that the time-period during liberalisation and afterward, i.e.

after 1982, is associated with significantly different return characteristics than during the regulated time-period, i.e. before 1970. Nilsson (2002) argues that stock market liberalisation is a strong candidate for causing these changes. He also shows that higher expected return, higher volatility and stronger links with international stock market characterise the deregulated period for all Nordic stock markets. Due to the much higher country-specific volatility in the deregulated period, the possibility to diversify both to other Nordic countries or internationally provides an attractive opportunity to lower portfolio risk without sacrificing return. Overall, Nilsson (2002) supports the argument that stock market liberalisation has created excess volatility but also that Nordic investors are more than compensated for this both in terms of expected return and the opportunity to cross-boarder diversification.

Another study carried out by Kassimatis (2002) reveals that stock price volatility fell after important liberalization policies were implemented. He investigates whether stock market volatility increased following financial liberalisation in six emerging economies, namely Argentina, India, Pakistan, Philippines, South Korea and Taiwan. In order to compare volatility before and after liberalisation, the news impact curves (Engle and Ng, 1993) suggested by the GARCH model are employed in the analysis, which related current volatility to past news. The news impact curves are derived from the parameters of GARCH models that measure the conditional volatility of stock returns in the sample markets. The empirical results suggest that volatility fell after the sample countries opened up their stock markets to foreign investors except for the Philippines.

Most of the researchers in analysing the impact of financial liberalisation on stock market volatility have employed the ARCH and GARCH type models without taking into consideration sudden changes of unconditional variance[31]. Nevertheless, recent financial literature that volatility display structural breaks and the verification of parameter stability in ARCH and GARCH models has become an area which has proved to be of interest to many researchers. Among others, Kokoska and Leipus (1999), Granger and Huang (1999), Lundbergh and Terasvirta (2002), Andreou and Ghyshels (2002) and Sanso *et al.* (2003). Diebold (1986) suggests that conditional heteroskedastic models tend to over-estimate persistence of volatility when there are instabilities at the unconditional second moment.

[31] For examples, see Huang and Yang (2000), Syprou and Kassimatis (1999) and Kassimatis (2002).

Lamoureux and Lastrapes (1990) examine the consequences of jumps in the unconditional variance when the time series is conditionally heteroskedastic. They suggest that persistence in volatility may be overstated with the presence of structural breaks, where this persistence may originate from structural changes in the variance process.

Mikosch and Starica (2004) point out that some classical stylised facts in financial time series can be explained by a variance shift in the data. As such, the time varying variance must be previously estimated and extracted from the data before using traditional stationary methods (families of ARCH model, long memory process etc). Thus, it is important to detect the sudden shift of variance in order to explain the non-normality and heavy tails observed in the distribution of the financial time series.

Aggarwal *et al.* (1999) examines what kinds of events cause large shifts in the volatility of emerging stock markets in Asia and Latin America. Their empirical approach is different from most of the previous literature. They first detect shifts in volatility from the stock returns and then determine what events took place around that time period. A procedure based on an iterated cumulative sums of squares (ICSS) developed by Inclan and Tiao (1994) is employed to detect the number of (significant) sudden changes in variance in the time series, as well as to estimate the time point and magnitude of each detected sudden change in the variance. The structural break points identified by using the iterated cumulative sum of squares (ICSS) procedure are included in the GARCH (1,1) model as dummy variables. Their results indicate that the periods with high volatility are found to be associated with important events in each country rather than global events. The October 1987 crash is the only global event in the last decade that significantly increased volatility in several emerging markets. With respect to the market liberalisation, none of the sudden change points clearly corresponds to the initiation of market liberalisation policies. Nevertheless, Aggarwal *et al.* (1999) point out that they cannot conclude directly that liberalisation does not affect volatility. The liberalisation process seems to be gradual and probably results in a smooth adjustment rather than a shock. This argument may explain why previous work attempts to measure the impact of financial liberalisation have been mixed.

2.6 Conclusions

This chapter reviews the theoretical and empirical work on the relationship between finance and growth, the determinants of financial development, as well as the impact of financial liberalisation on stock market volatility.

With respect to finance and growth, this chapter discuss the classical view, the role of finance in influencing growth, possible causal patterns between both variables and empirical evidence using various econometric techniques, namely cross-country, time-series, panel data and macroeconomic-based studies to examine the link between finance and economic growth. The empirical results produce remarkably consistent findings even though the various econometrics techniques are employed in the empirical analysis. First, countries with better-developed financial markets tend to grow faster – specifically, those with (i) large, privately owned banks that channel credit to the private sector, and (ii) liquid stock exchanges. The level of banking development and stock market liquidity each exert a positive impact on growth. Second, simultaneity bias does not seem to be the cause of the finance-growth results. Third, better functioning financial markets ease the external financing constraints that impede firm and industrial expansion. Besides the role of finance, the impact of institutional quality on economic growth is also discussed in this chapter.

The second part of this chapter has discussed the determinants of financial development with respect to three theoretical views, namely law and finance, endowment theory of institutions and interest group theory. The law and finance view predicts that countries that inherited the British Common law tradition obtained a legal origin that tends to both emphasise private property rights and support financial development to a much greater degree than countries that obtained the French Civil law tradition. The endowment theory of institutions, on the other hand, predicts that the long-lasting institutions created by colonisers continue to influence financial development today. The interest group theory argues that incumbent elites block potential entrants' access to finance and financial underdevelopment is a political choice.

Lastly, the impact of financial liberalisation on stock market volatility is also reviewed in this chapter. As far as the financial development literature is concerned, financial

liberalisation in terms of opening up the stock market to foreign investors has an effect on stock market volatility. High stock market volatility may affect the role of finance in allocating the financial resources from surplus to deficits units. Even though much research has been conducted examining this issue, the empirical results are still mixed and require further investigation. Recent econometric analysis of financial volatility is concerned about the structural break in volatility, and the topic of changes in the variance of the series is frequently found in economic or financial time series. Thus, detecting variation or sudden changes in these time series is central to understanding and properly interpreting financial volatility behaviour.

CHAPTER THREE

FINANCIAL DEVELOPMENT, INSTITUTIONS AND ECONOMIC GROWTH

3.1 Introduction

The determinants of economic growth have long been investigated due to different economic growth rate amongst nations. It is now widely accepted that factor accumulation (including human capital) and technological change alone cannot adequately explain differences in growth performance across countries[32]. Institutions and financial development are separately emerging as the key fundamental determinants of economic growth in recent literature. For example, in the case of Africa economies, Easterly and Levine (1997) find that the conventional factors of growth such as capital, labour, human capital and so on do not fully explain these economies experience and have turned to institutional explanations. Pistor *et al.* (1998) point out that the law and legal systems were important in promoting Asian economic growth, even though they have been largely ignored by the literature. In terms of financial development, King and Levine (1993b and 1993c), Levine (1997) and Levine *et al.* (2000) find that financial development has a positive statistically significant to determine economic growth.

North (1990) defines institutions as the humanly devised constraints that structure political, economic and social interaction. They consist of both formal rules (constitutions, laws, property rights) and informal constraints (sanctions, taboos, customs, traditions and codes of conduct). He further states that institutions provide the incentive structure of an economy; as that structure evolves, it shapes the direction of economic change towards growth. According to Nelson and Sampat (2001), institutions may be treated as "social technologies" in the operation of productive economic activities, which involve patterned human interaction rather than physical engineering. When the rules change frequently or are not respected, when corruption is widespread or when property rights are not well defined or

[32] For example, Blomstrom *et al.* (1996) show that increases in capital stock are generally not the igniting source of economic growth. Bils and Klenow (2000) point out that human capital does not have a causal impact on output growth, but they conclude that the evidence favours a dominant role for the reverse channel from growth to schooling.

enforced, markets will not function well, uncertainty would be high, and the allocation of resources would be adversely affected. In this view, what matters are the rules of the game in a society and their conduciveness to desirable economic behaviour. Recently, the role of institutions in influencing economic growth has received careful econometric treatment in Hall and Jones (1999), who focus on what they call 'social infrastructure', and in Acemoglu *et al.* (2001), who focus on the expropriation risk that current and potential investors face.

A number of recent papers provide empirical evidence that confirms the importance of institutional quality for economic performance[33] using various institutional quality indicators. For example, Assane and Grammy (2003) find that good institutions improve efficiency and accelerate economic growth. Rodrik *et al.* (2002) demonstrate that quality of institutions overrides geography and integration (international trade) in explaining cross-country income levels. Hall and Jones (1999) show that differences in physical capital and educational attainment can only partially explain the variation in output per worker. They find that the differences in capital accumulation, productivity and output per worker across countries are driven by differences in institutions and government policies. Knack and Keefer (1995) find a positive and significant relationship between institutional indicators such as quality of bureaucracy, property rights, and political stability and economic growth utilising cross-country data. Mauro (1995) demonstrates that the countries that have a higher corruption index tend to have persistently lower growth. Rodrik (1997) finds that an index of institutional quality does exceptionally well in rank-ordering East Asian countries according to their growth performance.

With respect to financial markets and systems, it performs an important function in the development process, particularly through their role in allocating resources to their most productive uses. The increased availability of financial instruments reduces transaction and information costs while larger and more efficient financial markets help economic agents hedge, trade, pool risk, raising investment and economic growth (Goodhart, 2004). Various financial development indicators have been widely employed to examine the link between financial development and economic growth, indeed, the empirical evidence shown that financial development is statistically significant to determine growth. Notable recent research

[33] Aron (2000) provides an excellent review of a large body of empirical literature that tries to link quantitative measures of institutions with economic growth across countries and over time.

in this area includes King and Levine (1993b and 1993c), Demetriades and Hussein (1996), Levine (1997), Demirgüç-Kunt and Maksimovic (1998), Rajan and Zingales (1998), Luintel and Khan (1999), Khan and Senhadji (2000), Al-Yousif (2002), Calderon and Liu (2003) and Christopoulos and Tsionas (2004). Levine (2003) provides an excellent overview of a large body of empirical literature that suggests that financial development can robustly explain differences in economic growth across countries. However, as Levine admits establishing that the relationship is causal in cross-country studies is not straightforward. Zingales (2003) questions the extent to which cross-country relationships of this type can be utilised for policy purposes, especially since there is a bunch of variables, all positively correlated with growth, which are also highly correlated among themselves. These difficulties have prompted a number of authors to examine the relationship using time-series data for individual countries in the hope of a better understanding of causality between finance and growth[34]. Within individual countries the evidence on the relationship between financial development and growth over time is broadly consistent with that obtained from cross-section studies in the sense that it is usually a positive and significant one. However, causality typically varies across countries. For example, Demetriades and Hussein (1996) examine the relationship in 16 less developed countries and find, more often than not, causality running from growth to finance and not vice-versa. Habibullah (1999) also concludes that the direction of causation between finance and economic growth is country specific[35]. As such, it is very difficult to draw any policy implications for the positive association obtained between finance and growth in cross-country studies. More finance may mean more growth in some cases but not in others. Knowing where it does and where it doesn't is critical for policy makers. Understanding why there is such variation across countries is an important next step for both policy makers and academics, as it holds the key to successful financial development.

The variation in causality between finance and growth detected in time-series studies suggests that there are important differences in the way in which finance influences

[34] This is to some extent because the nature of Granger causality test requires time-series data but also because other conditioning variables which may vary considerably across countries, such as human capital will only vary slowly, if at all, within countries. Therefore, time-series methods could, in principle, be better able to unveil the causal pattern between finance and growth.

[35] In seven Asian countries, he finds that the finance-led growth hypothesis is supported in the case of the Philippines; growth causes financial development in Malaysia, Myanmar and Nepal; whereas bi-directional causal effect is detected for Indonesia, Sri Lanka and Thailand.

economic growth across countries. Arestis and Demetriades (1997), for example, suggest that it may reflect institutional differences across countries. This idea is developed further in Demetriades and Andrianova (2004), who argue that varying causal patterns may reflect differences in the quality of finance, which are, in turn, determined by the quality of financial regulation and the rule of law. For example, an increase in financial deepening, as captured by standard indicators of financial development, may not result in increased growth because of corruption in the banking system or political interference, which diverts credit to unproductive or even wasteful activities. While this is a plausible conjecture, there is as yet no hard empirical evidence to suggest that institutions do make a difference to the way in which finance affects economic growth. Such evidence is clearly the logical next step in the evolution of the literature on financial development.

The objectives of this study are two-fold. First, it examines the impact of financial development and institutions on economic growth. So far there is limited evidence that documents the impact of both factors on growth, and these factors are examined separately in literature. By examining financial development and institutions simultaneously, this study tends to assess the relative importance of both factors on economic success. If there is clear evidence that weak financial markets and institutions significantly hamper economic growth, then policy makers should place financial markets and institutional quality reform high on their agenda. They should propose measures that strengthen both factors to improve the functioning of financial markets and institutional quality to boost economic development. Second, this study further investigates whether the interaction between financial development and institutions – i.e. financial systems that is embedded with good institutions, have any impact on economic growth. Although a number of studies have been conducted to examine the link between financial development and institutions in the past, there is no study[36] to date focusing on the interaction between financial development and institutions in influencing growth, and it is exactly here that this study wants to contribute. If the coefficient of the interaction term turns out to be significant, this would imply that financial development embedded within good institutional quality will enhance economic growth. This effect would

[36] Few studies have examined the role of institutions, trade and economic growth (Dollar and Kraay, 2003); trade, geography, institutions and growth (Rodrik *et al.*, 2002); technology differences, institutions and growth (Boulhol, 2004); institutions, infrastructure and economic growth (Esfahani and Ramirez, 2003) and foreign direct investment, institutions and growth (Hsiao and Shen, 2003).

be over and above the individual effects of financial development and institutional quality. Thus, policy makers can increase the effectiveness of financial development by ensuring good institutional quality in the economy, which may enhance the performance of financial markets.

The analysis in this study departs from that found in much of the extant literature from four aspects. First, this study uses data set that is sufficiently large to enable robust conclusions to be drawn from the econometric results; specifically, the sample utilised in this study consists of annual data from 72 countries, covering the period 1978 – 2001. Second, this study employs a variety of financial development indicators, which consists of banking sector development and capital market development to capture various aspects of financial deepening. Third, given the diverse country sample, the growth effect may differ across the countries with varying level of economic development. Hence, in order to examine whether the stage of economic development matters for the relationship between finance and institutions, the sample of this study is further divided into four groups[37], namely (i) high-income OECD economies; (ii) upper middle-income economies; (iii) lower middle-income economies and (iv) low-income economies based on the World Bank classification, where each group contains 18 countries. Due to the small sample size, the dynamic heterogeneous panel data techniques are employed in the analysis for these different groups, which have more advantages compared to the traditional panel data analysis.

This chapter is organised into five sections, including introduction and concluding remarks. Section 3.2 explains the empirical model and econometric methodology; Section 3.3 describes the data set employed in the analysis, section 3.4 reports the estimated results. Finally, the last section summarises the main results along with the concluding remarks.

[37] Rioja and Valev (2004a) demonstrate that financial development is most effective in promoting growth in middle-income economies and has positive, albeit smaller effect in high-income economies, and is ineffective in low-income countries. The approach is to some extent consistent with Rioja and Valev (2004a), given that financial development and institutional quality varies with the stage of development. In addition, it provides a plausible explanation why the stage of economic development matters for this relationship.

3.2 The Empirical Model and Methodology

3.2.1 The Empirical Model

In order to test the effects of financial development and institutions on economic growth, this study adopts the frameworks introduced by Mankiw *et al.* (1992), Knight *et al.* (1993) and Ghura and Hadjimichael (1996). Consider the following Cobb-Douglas production function:

$$Y_t = K_t^{\alpha} H_t^{\beta} (A_t L_t)^{1-\alpha-\beta} \tag{3.1}$$

where Y is real output, K is the stock of physical capital, H is the stock of human capital, L is the raw labour, A is a labour-augmenting factor reflecting the level of technology and efficiency in the economy and the subscript t indicates time.

Assuming that $\alpha + \beta < 1$, which implies that there are decreasing returns to all capital. Raw labour (L) and labour-augmenting technology (A) are assumed to grow at rates n and g according to the following functions:

$$L_t = L_0 e^{nt} \tag{3.2}$$

$$A_t = A_0 e^{gt+P\theta} \tag{3.3}$$

where n is the exogenous rate of growth of the labour force, g is the exogenous rate of technological progress, P is a vector of financial development and institutions policies and the other factors that can affect the level of technology and efficiency in the economy, and θ is a vector of coefficients related to these policies and other variables.

In this model, variable A depends on exogenous technological improvements, the degree of openness of the economy and the level of other variables. The technological improvements are encouraged by developments in financial markets, which tend to increase the productive sector's efficiency or increase the productivity of investment (Bencivenga and Smith, 1991; Pagano, 1993) and also efficient institutions (North, 1990, Nelson and Sampat, 2001).

Furthermore, in the steady state, output per worker grows at the constant rate g (the exogenous component of the growth rate of the efficiency variable A). This outcome can be obtained directly from the definition of output per effective worker as follows:

$$\frac{Y_t}{A_t L_t} = (k_t)^{\alpha}(h_t)^{\beta}$$

$$\frac{Y_t}{L_t} = A_t(k_t)^{\alpha}(h_t)^{\beta} \tag{3.4}$$

Let $y_t^* = \left(\frac{Y_t}{L_t}\right)^*$

Taking logs both sides of Equation (3.4) and log income per worker at a given time – time 0 for simplicity is

$$\ln\left(\frac{Y}{L}\right)^* = \ln A + \alpha \ln k^* + \beta \ln h^* \quad (t \text{ is omitted})$$

where $A_t = A_0 e^{(gt+P\theta)}$

$$\ln\left(\frac{Y}{L}\right)^* = \ln A_0 + gt + P\theta + \frac{\alpha}{1-\alpha-\beta}\ln s_K + \frac{\beta}{1-\alpha-\beta}\ln s_H - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) \tag{3.5}$$

Equation (3.5) indicates steady state output per worker or labour productivity where a vector of financial development and institutions policy proxies exist, where P consists of financial development (FD) and institutions (INS). The terms $\frac{\alpha}{1-\alpha-\beta}$, $\frac{\beta}{1-\alpha-\beta}$ and $\frac{\alpha+\beta}{1-\alpha-\beta}$ in the above equation are the elasticities of per capita income with respect to the fraction of income invested in physical capital, the fraction of income invested in human capital and labour growth, respectively.

Largely because of data limitations, this study assumes that s_H and gt does not vary over time but s_K and n can be assumed to vary over time. This means that $\ln A_0$, s_H and gt can be considered as a constant term A_0 in Equation (3.6). Then, the steady-state output per worker or labour productivity (y^*) grows according to the following equation:

$$\ln\left(\frac{Y}{L}\right)^{*} = A_0 + P\theta + \frac{\alpha}{1-\alpha-\beta}\ln s_K - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) \quad (3.6)$$

Rearranging Equation (3.6), it yields an estimation equation for a relationship between financial development, institutions and output per worker as follows:

$$\ln RGDPC = \beta_0 + \theta_1 \ln FD + \theta_2 \ln INS + \beta_1 \ln KC - \beta_2 \ln(n+g+\delta) \quad (3.7)$$

where *RGDPC* is real GDP per capita, *FD* is financial development proxy which contains five different proxies (liquid liabilities, private sector credit, domestic credit, stock market capitalisation and number of companies listed), *INS* is institutions, *KC* is capital stock per capita, $(n + g + \delta)$: n is the rate of labour growth, g is the rate of technology growth or technological progress and δ is the rate of depreciation. g and δ are assumed to be constant across countries and over time and their sum equals 0.05, following Mankiw *et al.* (1992). β_0 is constant term and θ_1, θ_2, β_1 and β_2 are the estimated parameters in the model.

In order to examine the interaction effects between financial development and institutions on growth, Equation (3.7) is extended to include the interaction term as follows:

$$\ln RGDPC = \beta_0 + \theta_1 \ln FD + \theta_2 \ln INS + \theta_3 \ln(FD \times INS) + \beta_1 \ln KC - \beta_2 \ln(n+g+\delta) \quad (3.8)$$

Equation (3.8) provides the basis for the empirical models that are estimated in this study.

3.2.2 The Econometric Approach

In this study, Equation (3.8) is estimated on the base of annual data and considering cross-country and pooled cross-country time series. The empirical analysis of the growth model generally involves a system of N x T equation (N countries and T time observations) that can be investigated in different ways. The choice of the econometric approach partially depends upon the size of N and T and the quality of data across these two dimensions. The main econometric approaches employed in the empirical literature include cross-country regressions and different forms of pooled cross-section time-series regressions and these are discussed as below.

Cross-Country Estimations

Numerous studies have conducted to examine the determinants of economic growth using cross-country data such as Barro and Sala-i-Martin (1992, 1995), Mankiw *et al.* (1992) Ghura and Hadjimichael (1996) and Temple (1998), where the dependent and independent variables are the average over a fairly long period (usually 20 or move years). The limited data requirement allows cross-section analyses to emphasise on large sets of countries. However, the straightforward econometric procedure allows testing for different specification and check the robustness in the specification. In this study, Equation (3.8) is estimated by using the ordinary least squares (OLS) and three diagnostic tests are carried out in order to check the robustness of cross-sectional analysis, namely Jarque-Bera normality test, and Breusch-Pagan heteroscedasticity test[38] and Ramsey's RESET test of functional form. Besides, the OLS regression with robust standard error is also carried out to check the robustness of the OLS results.

The cross-country regressions are estimated based on two samples: (i) 72 countries, where the financial development proxies are banking sector development and the sample period is spanning from 1978 – 2001 (country averages over the full 24-year period for all variables). The regional dummies for Latin America, East Asia and sub-Saharan Africa are also included in the models to control for regional effect. (ii) 44 countries, where the financial development proxies are capital market development and the sample period is covering from 1988 – 2001.

Cross-Country Regressions with Two Stage Least Squares (2SLS) Instrumental Variables

Recent literature has highlighted the possibility of bi-directional causal effect between financial development and economic growth (Demetriades and Hussein, 1996;

[38] The Breusch-Pagan (*BP*) test is a large sample test, which assumes normality of the error terms. The test statistic is:

$BP = \frac{(SSE_1)/2}{(SSR/n)^2} \sim \chi_1^2$ where SSE_1 is the explained sum of squares from a regression of the squared OLS residuals on the x_j, and SSR is the residual sum of squares from a regression of y on the x_j. This is equivalent to assuming that the log of the variance of the error term is a liner function of the x_j, or that:

$$Var(u_i) = \sigma^2 \exp(\beta_0 + \beta_1 x_1 + \ldots \beta_k x_k)$$

Luintel and Khan, 1999) and between institutions and economic growth (Hall and Jones, 1999; Chong and Calderon, 2000 and Acemoglu *et al.*, 2001). It is, therefore, likely that OLS procedures biased and inconsistent estimates. Two-stage least squares (2SLS) method is therefore employed to re-estimate the effect of financial development and institutions on economic growth. For this method to work well, we need good instruments that are correlated with financial development and institutions, but uncorrelated with error terms. The approach in this study consists of using the La Porta *et al.* (1997, 1998) and Acemoglu *et al.* (2001) instruments to control for the potential endogeneity in the models.

La Porta *et al.* (1997, 1998) suggest that the legal origins in general can explain cross-country differences in financial development. They show that the legal origin of a country materially influences its legal treatment of shareholders, the laws governing creditor rights, the efficiency of contract enforcement, and accounting standard. Shareholders and creditors enjoy greater protection in English common law countries than in civil law countries. French Civil Law countries are comparatively weak both in terms of shareholder and creditor rights. Thus, in this study, the legal origins are employed as an instrument variable for financial development.

On the other hand, Acemoglu *et al.* (2001) use mortality rates of colonial settlers as an instrument for institutional quality[39]. The raw data on settler mortality was derived from the mortality records on soldiers, bishops, and sailors, stationed in the colonial countries in the 17th and 19th centuries[40]. They argue that high settler mortality led to 'extractive state' colonies while low mortality led to permanent settlements of Europeans (e.g. Australia) with subsequent development of the appropriate institutions for running these new 'European' societies. The argument in favour of mortality of settlers as instrument for current institutions rests on the following premises. First, the feasibility of early settlements in areas colonised by Europeans was determined by the colonies' disease environment. Acemoglu *et al.* (2001) show that a measure of European settlements in colonies in 1900 has a strong and positive

[39] Hall and Jones (1999) use three instruments namely: distance from the equator, the fractions of the population speaking English and the fractions of the population speaking another European language as instrument variables. Nevertheless, their choice of instruments have been criticised due to the geographical instruments might be correlated with error terms, their notion of European influence is crude and theoretically the link is weak and ethnolinguistic fragmentation is probably endogenous (depends on income).

[40] This data was published by Curtin (1989, 1998) for most of the colonies, and by Gutierrez (1986) for Spanish and Portuguese colonies in South American.

correlation with the colonies' disease environment. Second, the colonisation strategies were influenced by the feasibility of settlements by the colonisers. Third, different types of colonisation policies led to the creation of different sets of institutions. In places where the disease environment was particularly harmful to European settlement, it was more likely that 'extractive states' would be created.

Panel Data Estimations at Four Different Income Groups

Recent empirical studies find that the differences in causality across countries may reflect different stages of development. For instance, Rioja and Valev (2004a) demonstrate that financial development is most effective in enhancing economic growth in middle-income economies and has positive, albeit smaller effect in high-income economies, and is ineffective in low-income economies. Studies focused on OECD countries have typically failed to find significant links between financial development and growth (Andres *et al.* 1999). Nevertheless, Deidda and Fattouh (2002) predict that financial development will have larger effect on developed rather than developing countries. Therefore, besides estimating the whole sample countries using the cross-country technique, this study also dividing the sample size into four different groups to examine whether the growth enhancing effect of financial development would increase directly with the level of economic development. In addition, it also can determine whether the effect of institutions on growth may vary with the stage of development. In short, it provides a plausible explanation why the stage of economic development matters for this relationship. Thus, the panel data analyses are carried out based on 18 countries at four different income levels, namely high-income, upper middle-income, lower middle-income and low-income.

The static panel data technique based on either pooling or fixed effects, which could be applied to Equation (3.8), makes no attempt to accommodate heterogeneous dynamic adjustment around the long-run equilibrium relationship (Pesaran and Smith, 1995; Pesaran *et al.* 1999). The literature warns against the use of standard pooled estimators such as fixed effects to estimate the dynamic panel data model, arguing that they are subject to large potential bias when the parameters are heterogeneous across countries and the regressors

are serially correlated (Pesaran and Smith, 1995; Lee *et al.*, 1997; and Pesaran *et al.*, 1999). Therefore, the panel data techniques, which can accommodate heterogeneous dynamic across groups are employed in the analysis.

Dynamic Heterogeneous Panel Data Analysis

The empirical analysis of the growth model in Equation (3.8) above generally involves a system of N x T equations (N countries and T time observations) that can be examined in different ways. In this study, the parameters estimates of Equation (3.8) are obtained by using recently developed method for the statistical analysis of dynamic panel data, namely the pooled mean-group (PMG) estimations proposed by Pesaran *et al.* (1999). They observe that while it is implausible that the dynamic specification is the same in all countries, it is at least conceivable that the long-run parameters of the model may be common. They propose the pooled mean group estimation by either averaging the individual country estimates, or by pooling the long-run parameters, if the data allows, and estimating the model as a system. So far the PMG test has been adopted within different literatures, such as money demand (Slok, 2002), energy demand (Pesaran *et al.* 1999), economic growth and convergence issues (Bassanini and Scarpetta, 2001). This more recent method is well suited to the analysis of dynamic panels that have both large time and cross-section data fields.

The pooled mean group (PMG) estimations based on autoregressive distributed lagged (ARDL) model have advantages to determine the long-run and short-run dynamic relationships[41]. Imposing equality restrictions, if they are valid, will increase the efficiency and reduce the standard errors of the estimates. Careful modelling of short-run dynamics requires a slightly different econometric modelling approach. We, therefore, assume that Equation (3.8) holds in the long-run but that the dependent variable may deviate from its equilibrium path in the short-run. Following Pesaran *et al.* (1999), we base our panel analysis on the unrestricted error correction ARDL (p, q) representation:

[41] As Pesaran *et al.* (1999) have shown, this approach yields consistent and asymptotically normal estimates of the long-run coefficients irrespective of whether the underlying regressors are I(1) or I(0).

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i' x_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \gamma_{ij}' \Delta x_{i,t-j} + \mu_i + u_{it} \qquad (3.9)$$

$$i = 1,2, \ldots N; t = 1,2, \ldots T.$$

where y_{it} is a scalar dependent variable, x_{it} is the k x 1 vector of (weakly exogenous) regressors for group i, μ_i represent the fixed effects, ϕ_i is a scalar coefficient on the lagged dependent variable, β_i''s is the k x 1 vector of coefficients on explanatory variables, λ_{ij}'s are scalar coefficients on lagged first-differences of dependent variables, and γ_{ij}'s are k x 1 coefficient vectors on first-difference of explanatory variables and their lagged values. We assume that the disturbances u_{it}'s in the ARDL model are independently distributed across i and t, with zero means and variances $\sigma_i^2 > 0$. Further assuming that $\phi_i < 0$ for all i and therefore there exists a long-run relationship between y_{it} and x_{it} defined by:

$$y_{it} = \theta_i' x_{it} + \eta_{it} \qquad i = 1,2, \ldots N; t = 1,2, \ldots T. \qquad (3.10)$$

where $\theta_i' = -\beta_i' / \phi_i$ is the k x 1 vector of the long-run coefficients, and η_{it}'s are stationary with possibly non-zero means (including fixed effects). Since Equation (3.9) can be rewritten as

$$\Delta y_{it} = \phi_i \eta_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \gamma_{ij}' \Delta x_{i,t-j} + \mu_i + u_{it} \qquad (3.11)$$

where $\eta_{i,t-1}$ is the error correction term given by (3.10), hence ϕ_i is the error correction coefficient measuring the speed of adjustment towards the long-run equilibrium.

Under this general framework, Pesaran *et al.* (1999) propose the Pooled Mean Group (PMG) estimator (see Appendix A for more details). This estimator allows the intercepts, short-run coefficients and error variances to differ freely across groups, but the long-run coefficients are constrained to be the same; that is, $\theta_i = \theta$ for all i. The group-specific short-run coefficients and the common long-run coefficients are computed by the pooled maximum likelihood estimation, and these estimators are denoted by $\hat{\phi}_i, \tilde{\beta}_i, \tilde{\lambda}_{ij}, \tilde{\delta}_{ij}$ and $\tilde{\theta}$. We then obtain the PMG estimators by

$$\hat{\phi}_{PMG} = \frac{\sum_{i=1}^{N} \tilde{\phi}_i}{N}, \quad \hat{\beta}_{PMG} = \frac{\sum_{i=1}^{N} \tilde{\beta}_i}{N},$$

$$\hat{\lambda}_{j\,PMG} = \frac{\sum_{i=1}^{N} \tilde{\lambda}_{ij}}{N}, j = 1, \ldots, p-1, \qquad (3.12)$$

$$\hat{\delta}_{j\,PMG} = \frac{\sum_{i=1}^{N} \tilde{\delta}_{ij}}{N}, j = 0, \ldots, q-1,$$

$$\hat{\theta}_{PMG} = \tilde{\theta}$$

Besides the pooled mean group estimations, two alternative panel data estimation techniques are utilised, namely the mean group (MG) estimator proposed by Pesaran and Smith (1995) and the static fixed effect estimators. The MG estimator is the least restrictive, in that it allows for heterogeneity of all the parameters. It is defined as follows:

$$\hat{\phi}_{MG} = \frac{\sum_{i=1}^{N} \hat{\phi}_i}{N}, \quad \hat{\beta}_{MG} = \frac{\sum_{i=1}^{N} \hat{\beta}_i}{N},$$

$$\hat{\lambda}_{j\,MG} = \frac{\sum_{i=1}^{N} \hat{\lambda}_{ij}}{N}, j = 1, \ldots, p-1, \qquad (3.13)$$

$$\hat{\delta}_{j\,MG} = \frac{\sum_{i=1}^{N} \hat{\delta}_{ij}}{N}, j = 0, \ldots, q-1,$$

$$\hat{\theta}_{MG} = \frac{1}{N} \sum_{i=1}^{N} (\hat{\beta}_i / \hat{\phi}_i)$$

where $\hat{\phi}_i, \hat{\beta}_i, \hat{\lambda}_{ij}$ and $\hat{\gamma}_{ij}$ are the OLS estimates obtained individually from Equation (3.9). In other words, the mean group (MG) approach consists of estimating separate regressions for each country and computing averages of the country-specific coefficients (e.g. Evans, 1997; Lee *et al.*, 1997). This estimator is likely to be inefficient in small country samples, where any country outlier could severely influence the averages of the country coefficients.

Both MG and PMG estimations require selecting the appropriate lag length for the individual country equations. In this study, the selection was made using the Schwarz Baysian Criterion (SBC). The MG estimator provides consistent estimates of the mean of the long-run coefficients, though these will be inefficient if slope homogeneity holds. Under long-run slope homogeneity, the pooled estimators are consistent and efficient. The hypothesis of

homogeneity of the long-run policy parameters cannot be assumed a priori and is tested empirically in all specifications. Thus, the effect of heterogeneity on the means of the coefficients can be determined by a Hausman-type test (Hausman, 1978) applied to the difference between the MG and the PMG, where under the null hypothesis, the difference in the estimated coefficients between the MG and PMG are not significantly different and PMG is more efficient.

3.3 The Data

In this study, the data set consists of a panel of observations for 72 countries[42] for the period 1978 – 2001, where the financial development proxy is banking sector development. The sample countries are further divided into four groups based on World Bank classification[43], namely: (i) high-income OECD countries; (ii) upper middle-income countries; (iii) lower middle-income countries and (iv) low-income countries. Another data set is based on 44 countries for the period 1988 – 2001, where the financial development proxy is capital market development.

The annual data of real GDP per capita, gross fixed capital formation and total labour force are collected from the World Development Indicators 2003 CD-ROM database. In this study, the capital stock is constructed from the gross investment figures following the perpetual inventory method[44] and it is defined as follows:

$$K_t = (1-\delta)K_{t-1} + I_t \tag{3.14}$$

where K represents the capital stock, δ is the rate of physical depreciation and I is investment (gross fixed capital formation). Initial capital stocks are calculated using the

[42] The list of countries is presented in Appendix A.3.I.

[43] The World Bank classifies economies as low-income if the GDP per capita is less than US$755; middle-income if the GDP per capita is between US$755 until US$9265 and high-income economies if the GDP per capita is more than US$9265.

[44] The perpetual inventory method (PIM) is a method of constructing estimates of the capital stock from time series of gross fixed capital formation (gross investment); it allows an estimate to be made of the stock of fixed assets in existence and in the hands of producers which is generally based on estimating how many of the fixed assets installed as a result of gross fixed capital formation undertaken in previous years have survived to the current period.

assumption that over long periods of time capital and output grow at the same rate. A depreciation rate of 6% and the average growth rate of the initial 3 years are used to generate the initial level of capital stock[45]. Specifically, for countries with investment data beginning in 1978 we set the initial capital stock $K_{1977} = I_{1978}/(g + \delta)$ where g is the 3 years growth rate of output (e.g. from 1978 to 1980) and δ (0.06) is the assumed rate of depreciation. Capital stock per capita (KC) is derived as a ratio of the total capital stock to total population.

3.3.1 Measures of Financial Development

The finance and growth literature suggests that there is no single, fully satisfactory measure of financial development that can capture all aspects of financial development. The indicators suggested by King and Levine (1993b and 1993c) are the most commonly used in the context of financial development and economic growth literature, where financial development is appropriately measured by using the size of financial sector relative to economic activity, or called "financial depth". According to King and Levine (1993b and 1993c), there exists a positive correlation between market size of the financial system and economic growth.

In this study, two different categories of financial development indicators are employed, namely banking sector development and capital market development that have previously used in the literature on financial development. The aim is to proxy for the degree to which national financial systems facilitate the acquisition of firm information, monitor and control managers, ease risk management and facilitate resource mobilisation.

Banking Sector Development

The banking sector development indicators consist of liquid liabilities, private sector credit and domestic credit provided by banking sector, which are available for 72 countries, except for liquid liabilities, which is only available for 66 countries[46]. These three aggregate

[45] see Hall and Jones (1999) and Bernanke and Gurkaynak (2001).
[46] These countries are Belgium, France, Greece, Netherlands, Portugal and Spain.

measures of financial development have been previously employed in the literature. All these variables are expressed as ratios to GDP.

Liquid Liabilities/GDP

To measure the financial market size, the ratio of liquid liabilities (LIA) over GDP or the ratio of M3 to GDP is employed in the analysis, which comprised of currency held outside the banking system plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries. This indicator is intended as a measure of the overall size of the financial intermediary system, which has been used by King and Levine (1993b). Some previous studies argued that these proxies of monetary aggregates are poor measures for the financial development because these ratios do not reflect the efficiency of banking sector in channelling financial resources from surplus units to deficit units (Khan and Senhadji, 2000). However, the constructed ratios are used in the analysis to reflect the ability of financial banks in providing their transaction services. We are interested whether the size of financial system tends to promote a higher economic growth, or vice versa.

Private Sector Credit/GDP

The second financial development indicator is private sector credit, which equals the value of credits by financial intermediaries to the private sector divided by GDP. Private sector credit excludes credit to the public sector and cross-claims between financial intermediaries, and thus measures the amount of savings that is channelled through debt-issuing financial intermediaries to private borrowers. This measure reflects more precisely the efficiency of banking institutions in providing the sources to private sector, as opposed to credit issued to government, government agencies and public enterprises. Levine *et al.* (2000) show that there is a strong connection between private sector credit and economic growth.

In general, it is viewed that the private sector is more efficient than public sector in making investment decisions because private sector is profit-oriented sector. Moreover, an increase in the size of the public sector might not lead to a higher economic growth if the government spending is emphasise on its consumption expenditure and reduce the marginal productivity of public services (Karras, 1994). Indeed, higher portions of resources allocated to public

sector will create "crowd-out" effect, which increase the equilibrium interest rate and reduce private investment. This, of course, will reduce the economic performance (Barram and Ward, 1993; Giannaros *et al.*, 1999).

Domestic Credit/GDP

In order to measure the efficiency of banking institutions in allocating their resources into public sectors, the domestic credit provided by banking sector indicator is also employed in the analysis. Numerous studies have been employed this indicator as another proxy for financial development such as Wai (1980) and Odedokun (1998). It includes all credit to various sectors and represents domestic assets of the financial sector.

Capital Market Development

According to Levine (2003), the impact of stock market development on economic growth still needs to be addressed due to the mixed empirical evidence in the literature. According to him, differences in data frequency, country coverage, sample period and econometric technique may account for the differences. Therefore, besides using the banking sector development indicators, this study also employs capital market development indicators, namely stock market capitalisation (MC) and number of companies listed (NC). Nevertheless, these two indicators are only available for 44 countries. Besides estimating the whole sample, the analyses using capital market development indicators are further divided into two groups, namely developed and developing markets in order to quantify the role of capital market development on economic growth at two different stages of economic development.

Stock Market Capitalisation

Stock market capitalisation, consisting of the value of listed shares, attempts to measure the ease with which funds can be raised in the stock market. The data are primarily obtained from the Beck *et al.* (1999). This measure represents the overall size of the stock market relative to the size of the economy. A large (small) country with larger (smaller) stock market tends to have a larger (smaller) value of market capitalisation. Thus, a well-developed stock

market tends to have a larger stock market relative to the size of the economy, as reflected in the large value of market capitalisation. One limitation is that it measures the market value of existing listed companies rather than the amount of funds raised in the stock market in any particular year – though, on the other hand, changes in stock market valuations may play an important signalling role as concerns expected returns on investment.

Number of Companies Listed

Number of companies listed is the domestically incorporated companies listed on the country's stock exchanges at the end of the year as a fraction of total population. This is a measure that is not tainted by fluctuations in stock market valuations and possible mis-measurement of the level of GDP. The data are primarily gathered from the World Development Indicators 2003. One limitation is that it could be too slow-moving a measure to fully capture high frequency changes in the environment.

3.3.2 Indicator of Institutional Quality

The data set on institutional quality indicator employed in this study was assembled by the Centre for Institutional Reform and the Informal Sector (IRIS) of the University of Marryland from the International Country Risk Guide (ICRG)[47] – a monthly publication of Political Risk Services (PRS)[48]. Following Knack and Keefer (1995), five PRS indicators are used to measure the overall institutional environment, namely: (i) *Corruption*, which reflect the likelihood that officials will demand illegal payment or using their position or power to their own advantage; (ii) *Rule of Law*, which reveals the degree to which citizens are willing to accept the establish institutions, to make and implement laws, and to adjudicate dispute. It can also be interpreted as a measure of 'rule obedience' (Clague, 1993) or government credibility; (iii) *Bureaucratic Quality*, which represents autonomy from political pressure,

[47] The website of the ICRG is: http://www.icrgonline.com. The *ICRG*'s risk ratings have been cited by experts at the IMF, World Bank, United Nations and many other international bodies as a standard against which other ratings can be measured. The *ICRG* has been independently acclaimed by publications such as *Barron's* and *The Wall Street Journal* for the strength of its analysis and ratings system. In studies at academic institutions including Harvard, Duke, and New York University.

[48] The PRS group provides these ratings for a fee, and their methodology is proprietary information. See **Appendix B** for more details.

strength, and expertise to govern without drastic changes in policy or interruptions in government services, as well as the existence of an established mechanism for recruitment and training of bureaucrats; (iv) *Government Repudiation of Contracts*, which describes the risk of a modification in a contract taking due to change in government, priorities, contracts, or other matters; and (v) *Risk of Expropriation*, which reflects the risk that the rules of the game may be abruptly changed. The above first three variables are scaled from 0 to 6, whereas the last two variables are scaled from 0 to 10. Higher values imply better institutional quality and vice versa. The institutions indicator is obtained by summing the above five indicators[49]. Table 3.1 shows the correlations between the institutional quality indicators are high, range from 0.67 – 0.87.

Table 3.1: Correlations Results between the Institutional Quality Indicators

	Corruption	Rule of Law	Bureaucratic Quality	Repudiation of Government Contracts	Risk of Expropriation
Corruption	1.00				
Rule of Law	0.70	1.00			
Bureaucratic Quality	0.75	0.74	1.00		
Repudiation of Government Contracts	0.71	0.76	0.71	1.00	
Risk Expropriation	0.70	0.78	0.67	0.87	1.00

According to Knack and Keefer (1995), these measures reflect security of property and contractual rights, as well as convey additional information about the institutional environment that is not captured by other institutional measurement, such as the Gastil political and civil liberties indexes. Numerous studies have employed this data set in the empirical analysis, among others, Knack and Keefer (1995), Easterly and Levine (1997), Hall and Jones (1999), Chong and Calderon (2000), Clarke (2001) and Acemoglu *et al.* (2001).

Figures 3.1 – 3.4 illustrate that the level of institutional quality, as measured by sum of the five PRS indicators in four different groups, varies considerably across country's level

[49] The scale of corruption, bureaucratic quality and rule of law has converted to 0 to 10 in order to make a comparison of all these indicators and construct the aggregate institutional quality index. Therefore, the highest institutional quality indicator for a country is 50. For robustness checks, we also used different weight for each indicator to construct the aggregate index and the estimates are similar.

income. These figures clearly show that institutional quality is substantially higher in high-income OECD countries than in low-income countries.

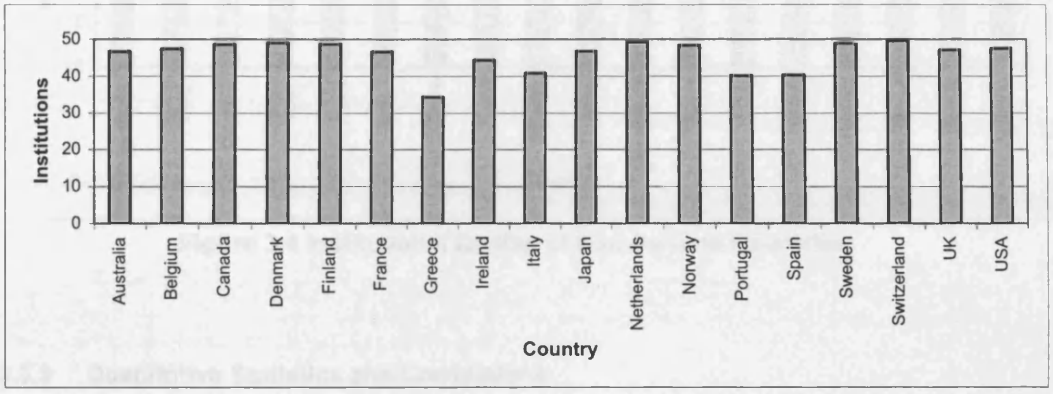


Figure 3.1 Institutional Quality of High-Income OECD Countries

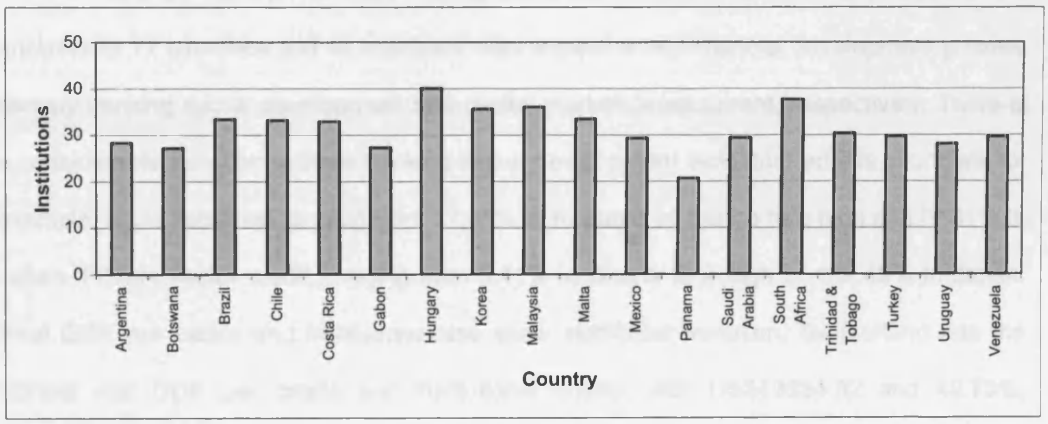


Figure 3.2 Institutional Quality of Upper Middle-Income Countries

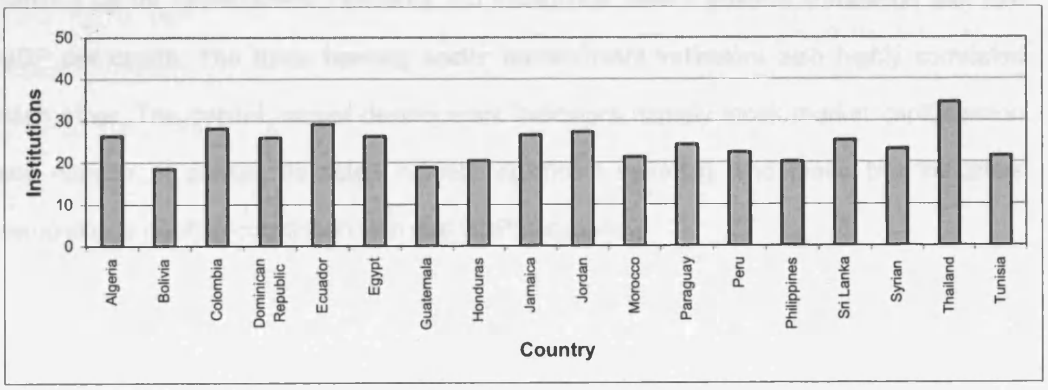


Figure 3.3 Institutional Quality of Lower Middle-Income Countries

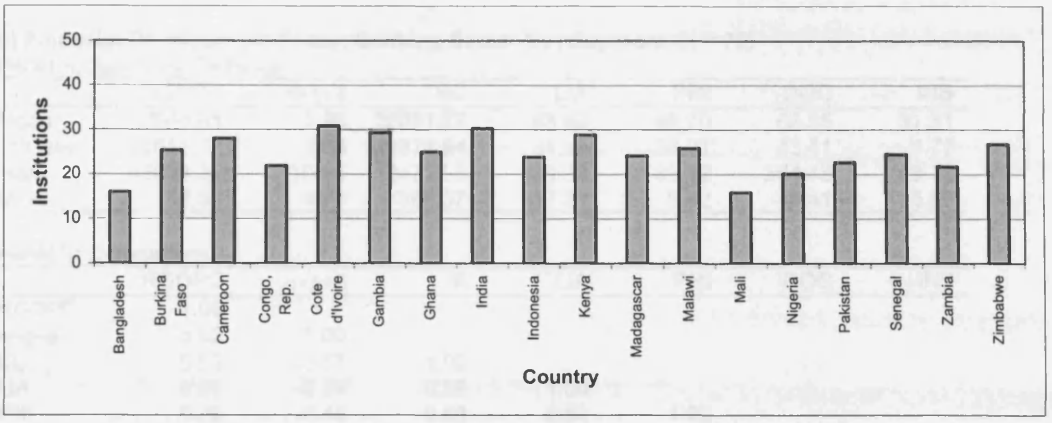


Figure 3.4 Institutional Quality of Low-Income Countries

3.3.3 Descriptive Statistics and Correlations

Table 3.2 reports summary statistics and correlations of the variables used in the analysis for 72 countries and 44 countries, with respect to two financial development proxies, namely banking sector development and capital market development, respectively. There is a considerable variation in three banking sector development indicators across countries, for example, liquid liabilities, ranging from 17.31% in Republic of Congo to a high of 179.31% in Japan. Private sector credit, ranging from 5.41% in Ghana to a high of 182.42% in Japan. Real GDP per capita and institutions also show significant variation. Switzerland has the highest real GDP per capita and institutional quality, with US$43634.32 and 49.73%, respectively. Malawi has the lowest real GDP per capita with US$152.57, whereas Mali has the lowest institutional quality. On the other hand, the correlation results indicate that banking sector development indicators and institutions have a positive correlation with real GDP per capita. The three banking sector development indicators also highly correlated each other. The capital market development indicators namely stock market capitalisation and number of companies listed indicate significant variation, and these two indicators demonstrate positive correlation with real GDP per capita.

Table 3.2: Summary Statistics and Correlations

(i) Financial Development Proxy: Banking Sector Development (N = 72)

Panel A: Summary Statistics

	RGDPC	n+g+δ	KC	LIA	PRI	DOC	INS
Mean	7646.81	7.26	20261.77	48.62	46.70	62.55	31.51
Std Dev	10611.67	1.08	29377.94	31.39	35.21	43.41	9.72
Max	43634.32	10.25	124722.3	179.32	182.42	264.48	49.73
Min	152.57	4.83	368.37	17.31	5.42	-46.41	15.90

Panel B: Correlations

	RGDPC	n+g+δ	K	LIA	PRI	DOC	INS
RGDPC	1.00						
n+g+δ	-0.62	1.00					
KC	0.93	-0.57	1.00				
LIA	0.59	-0.34	0.56	1.00			
PRI	0.76	-0.45	0.68	0.82	1.00		
DOC	0.66	-0.43	0.59	0.88	0.86	1.00	
INS	0.82	-0.64	0.74	0.54	0.66	0.62	1.00

Note: RGDPC = real GDP per capita; (n+g+δ) = labour growth; KC = capital stock per capita; LIA = liquid liabilities/GDP; PRI = private sector credit/GDP; DOC = domestic credit/GDP and INS = institutional quality. The correlation results for LIA are based on 66 countries.

(ii) Financial Development Proxy: Capital Market Development (N = 44)

Panel A: Summary Statistics

	RGDPC	n+g+δ	KC	MC	NC	INS
Mean	11454.93	6.92	31535.98	47.80	0.0016	36.67
Std Dev	12934.37	1.11	38030.52	41.59	0.0015	9.08
Max	44796.25	10.35	133241	170.60	0.0066	49.84
Min	254.38	5.20	520.96	2.74	0.0001	19.12

Panel B: Correlations

	RGDPC	n+g+δ	KC	MC	NC	INS
RGDPC	1.00					
n+g+δ	0.17	1.00				
KC	0.93	-0.75	1.00			
MC	0.65	0.33	0.56	1.00		
NC	0.70	0.26	0.71	0.71	1.00	
INS	0.92	0.13	0.83	0.70	0.73	1.00

Note: RGDPC = real GDP per capita; (n+g+δ) = labour growth; KC = capital stock per capita; LIA = liquid liabilities/GDP; PRI = private sector credit/GDP; DOC = domestic credit/GDP and INS = institutional quality.

Table 3.3 presents summary statistics and correlations for four different income levels (high-income OECD, upper middle-income, lower middle-income and low-income countries) where the banking sector development indicators are employed as a proxy for financial development. As shown in this table, the high-income countries have the highest real GDP per capita, financial development and institutional quality compared to the middle-income and low-income countries. This implies that higher income is associated with more developed financial markets and institutional quality. These differences prompt us to examine whether finance and institutions have different channels for influencing economic

performance at various levels of development. Table 3.3 also reports the correlation results and this table shows that all three banking sector development indicators have positive relationship with real GDP per capita for all four income groups, except for domestic credit indicator in lower middle-income countries, which is negative. Table 3.4 presents summary statistics and correlations for the capital market development indicators based on two different sub-samples, namely developed and developing countries. As shown in this table, the market capitalisation, number of companies listed and institutions have a positive correlation with real GDP per capita in both sample countries.

Table 3.3 Summary Statistics and Correlations of Different Income Groups
(Financial Development Indicator: Banking Sector Development)

(i) High-income OECD (N = 18)

Panel A: Summary Statistics

	RGDPC	n+g+δ	KC	LIA	PRI	DOC	INS
Mean	23951.82	5.90	63627.10	76.49	84.29	107.01	45.81
Std Dev	8985.32	0.44	29761.16	40.91	36.17	46.88	4.21
Max	43634.32	6.81	124722.3	179.32	182.42	264.48	49.73
Min	10003.90	5.34	24316.55	51.29	40.25	66.83	34.36

Panel B: Correlations

RGDPC	1.00						
n+g+δ	-0.10	1.00					
KC	0.89	-0.26	1.00				
LIA	0.70	0.03	0.41	1.00			
PRI	0.67	0.11	0.56	0.92	1.00		
DOC	0.56	0.01	0.55	0.93	0.91	1.00	
INS	0.72	0.03	0.54	0.11	0.38	0.14	1.00

(ii) Upper Middle-Income (N = 18)

Panel A: Summary Statistics

	RGDPC	n+g+δ	KC	LIA	PRI	DOC	INS
Mean	4703.47	7.38	12131.90	49.99	48.00	57.72	31.24
Std Dev	1869.28	1.02	6544.33	32.02	30.12	39.79	4.55
Max	8772.49	9.45	26708.98	150.77	105.24	121.62	40.01
Min	2618.87	4.83	5387.322	17.95	11.40	-46.41	20.71

Panel B: Correlations

RGDPC	1.00						
n+g+δ	-0.25	1.00					
KC	0.47	-0.18	1.00				
LIA	0.40	-0.22	0.08	1.00			
PRI	0.30	-0.01	0.32	0.74	1.00		
DOC	0.23	-0.28	0.24	0.64	0.85	1.00	
INS	0.21	-0.36	0.21	0.31	0.39	0.56	1.00

(iii) Lower Middle-income (N = 18)

Panel A: Summary Statistics

	RGDPC	n+g+δ	KC	LIA	PRI	DOC	INS
Mean	1475.35	8.00	4132.97	48.84	35.42	52.54	24.47
Std Dev	535.35	0.81	1729.88	24.16	21.24	27.01	4.09
Max	2244.71	10.25	7708.89	107.22	96.11	106.59	34.42
Min	675.57	6.69	1574.48	23.44	8.63	21.00	18.53

Panel B: Correlations

RGDPC	1.00						
n+g+δ	-0.08	1.00					
KC	0.80	0.05	1.00				
LIA	-0.02	0.28	0.33	1.00			
PRI	0.34	-0.01	0.28	0.64	1.00		
DOC	-0.01	0.10	0.28	0.95	0.76	1.00	
INS	0.46	-0.04	0.69	0.37	0.46	0.43	1.00

(iv) Low-Income (N = 18)

Panel A: Summary Statistics

	RGDPC	n+g+δ	KC	LIA	PRI	DOC	INS
Mean	456.60	7.76	1155.08	28.44	19.09	32.93	24.52
Std Dev	231.33	0.45	801.81	9.70	8.50	14.39	4.33
Max	874.70	8.62	3258.62	45.66	34.60	61.16	30.79
Min	152.57	6.93	368.36	17.31	5.42	11.66	15.90

Panel B: Correlations

RGDPC	1.00						
n+g+δ	0.32	1.00					
KC	0.75	0.30	1.00				
LIA	0.05	0.12	-0.12	1.00			
PRI	0.44	0.14	0.15	0.79	1.00		
DOC	0.20	0.19	0.28	0.72	0.57	1.00	
INS	0.23	0.27	0.08	0.32	0.33	0.18	1.00

Note: RGDPC = real GDP per capita; (n+g+δ) = labour growth; KC = capital stock per capita; LIA = liquid liabilities/GDP; PRI = private sector credit/GDP; DOC = domestic credit/GDP and INS = institutional quality.

Table 3.4 Summary Statistics and Correlations of Different Income Groups
(Financial Development Indicator: Capital Market Development)

(i) Developed Countries (N = 17)

Panel A: Summary Statistics

	RGDPC	n+g+δ	KC	MC	NC	INS
Mean	25687.44	5.79	70491.86	67.26	0.0027	46.72
Std Dev	9487.50	0.43	32799.23	38.44	0.0017	3.30
Max	44796.25	6.61	133241	156.70	0.0066	49.84
Min	11022.08	5.20	27740.49	16.81	0.0004	39.05

Panel B: Correlations

RGDPC	1.00					
n+g+δ	-0.09	1.00				
KC	0.92	-0.12	1.00			
MC	0.44	0.18	0.34	1.00		
NC	0.09	0.44	0.19	0.22	1.00	
INS	0.72	-0.03	0.71	0.48	0.42	1.00

(ii) Developing Countries (N = 27)

Panel A: Summary Statistics

	RGDPC	n+g+δ	KC	MC	NC	INS
Mean	2493.72	7.62	6064.82	35.54	0.0009	30.35
Std Dev	2335.55	0.76	5885.61	39.35	0.0008	4.71
Max	10267.49	10.35	25756.13	170.60	0.0030	39.70
Min	254.38	6.40	520.96	2.74	0.0001	19.12

Panel B: Correlations

RGDPC	1.00					
n+g+δ	-0.33	1.00				
KC	0.96	-0.25	1.00			
MC	0.31	0.05	0.49	1.00		
NC	0.35	0.12	0.48	0.64	1.00	
INS	0.68	-0.22	0.68	0.53	0.43	1.00

Note: RGDPC = real GDP per capita; (n+g+δ) = labour growth; KC = capital stock per capita; LIA = liquid liabilities/GDP; PRI = private sector credit/GDP; DOC = domestic credit/GDP and INS = institutional quality.

3.4 Empirical Results

3.4.1 Ordinary Least Square (OLS) Estimations

This section presents OLS regressions on the role of financial development and institutions on economic growth while controlling for other possible determinants of economic growth for the sample of 72 and 44 countries. The dependent variable is real GDP per capita; whereas independent variables are capital stock per capita, labour growth, institutions and one of the five measures of financial development – liquid liabilities, private sector credit, domestic credit, stock market capitalisation and number of companies listed.

Table 3.5 presents the estimation results of Equation (3.8) on the full sample of 72 countries using OLS and OLS with robust standard error estimations, utilising three banking

sector development alternative proxies for financial development. The regional dummies namely East Asia, Latin America and sub-Saharan Africa are also included in models 4 – 6 to control for the regional effect.

To start with, it is important to note that the signs of the estimated coefficients in models 1 – 6 on physical capital and labour growth are consistent with theory; both have positive and negative signs, respectively. An adequate of the OLS estimated models come from the diagnostic tests. The Jarque-Bera normality statistics suggest that the residuals of the regressions are normal distributed. The Breusch-Pagan test indicates that the residuals are homoskedastic and independent of the regressors, except for models 2 and 3. The Ramsey RESET test reveals that there is no functional form error in all models. Thus, the results of the diagnostic tests suggest that the model is relatively well specified, except for models 2 and 3, which contain heteroskedasticity problem. In addition, the adjusted R-square of these models explain about 90 – 93 percent of the variation in the real GDP per capita can be attributed to the independent variables.

The OLS estimations without regional dummies (models 1 – 3) demonstrate that all three financial development indicators, as well as the institutions variable are positive and statistically significant at 10% level. Nevertheless, the interaction term between financial development and institutions is highly significant. When the regional dummies are included in the model as shown in models 4 - 6, three financial development indicators are statistically significant at 5% level, but the institutions variable is not statistically significant. On the other hand, the interaction term is still statistically significant at 5% level. These findings seem to indicate that both the quantity and the quality of finance matter for economic growth, while institutions matter only in so far as they can improve the quality of finance.

Table 3.5 also repeats the estimations of Equations (3.8) using OLS with heteroskedasticity-robust standard error estimations since there are two regression residuals in OLS estimation are heteroskedastic. Nevertheless, the estimated results as shown in models 7 – 12 indicate similar findings in terms of coefficient signs on institutions and financial development. Both variables are statistically significant to determine economic growth, whereas the interaction term is highly significant.

Table 3.5: OLS Regression Estimations
Dependent Variable: Real GDP Per Capita
Financial Development Indicator: Banking Sector Development (1978 - 2001)

	OLS						OLS with Robust Standard Error					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Constant	7.73 (1.63)	2.76 (0.90)	6.51 (1.65)	10.02 (2.14)	4.79 (1.61)	7.80 (2.04)	7.73 (2.25)	2.76 (1.16)	6.51 (1.96)	10.02 (2.76)	4.79 (1.93)	7.80 (2.49)
KC	0.67 (12.11)***	0.65 (12.11)***	0.66 (12.85)***	0.61 (10.75)***	0.61 (11.08)***	0.61 (11.51)***	0.67 (4.82)***	0.65 (4.62)***	0.66 (4.78)***	0.61 (4.09)***	0.61 (4.11)***	0.61 (4.39)***
$n+g+\delta$	-0.26 (-1.11)	-0.23 (-0.49)	-0.21 (-0.03)	-0.24 (-0.45)	-0.52 (-1.10)	-0.34 (-0.72)	-0.26 (-0.17)	-0.23 (-0.73)	-0.21 (-0.04)	-0.23 (-0.57)	-0.52 (-1.38)	-0.34 (-0.89)
INS	0.36 (1.75)*	0.35 (1.68)*	0.34 (1.77)*	0.32 (1.62)	0.30 (0.73)	0.29 (1.45)	0.36 (2.02)**	0.35 (1.86)*	0.34 (1.67)*	0.32 (2.44)**	0.30 (1.13)	0.29 (1.87)*
LIA	0.45 (1.90)*	-	-	0.31 (2.26)**	-	-	0.45 (2.38)**	-	-	0.31 (2.65)**	-	-
PRI	-	0.47 (1.86)*	-	-	0.30 (2.16)**	-	-	0.47 (2.21)**	-	-	0.30 (1.85)*	-
DOC	-	-	0.33 (1.73)*	-	-	0.27 (2.08)**	-	-	0.33 (2.15)**	-	-	0.27 (2.48)**
LIA x INS	0.79 (2.03)**	-	-	0.93 (2.40)**	-	-	0.79 (2.42)**	-	-	0.93 (2.74)***	-	-
PRI x INS	-	0.63 (2.26)**	-	-	0.45 (2.37)**	-	-	0.63 (2.48)**	-	-	0.45 (2.02)**	-
DOC x INS	-	-	0.60 (2.10)**	-	-	0.69 (2.33)**	-	-	0.60 (2.20)**	-	-	0.69 (2.46)**
East Asia	-	-	-	-0.04 (-0.20)	-0.01 (-0.01)	-0.02 (-0.11)	-	-	-	-0.04 (-0.29)	-0.01 (-0.02)	-0.02 (-0.14)
Latin America	-	-	-	0.37 (2.40)**	0.36 (2.69)***	0.37 (2.65)***	-	-	-	0.37 (2.68)**	0.36 (2.88)***	0.37 (2.44)**
Sub-Saharan Africa	-	-	-	-0.22 (-1.14)	-0.15 (-0.89)	-0.15 (-0.82)	-	-	-	-0.22 (-1.07)	-0.15 (-0.83)	-0.15 (-0.81)
Adj R^2	0.90	0.92	0.91	0.92	0.93	0.93	0.91	0.92	0.92	0.93	0.94	0.94
Jarque-Bera (χ^2)	4.50 (0.10)	3.87 (0.14)	3.06 (0.22)	3.91 (0.14)	3.85 (0.15)	4.20 (0.13)	-	-	-	-	-	-
Breusch-Pagan (χ^2)	2.30 (0.13)	3.50 (0.07)*	4.94 (0.03)***	0.36 (0.58)	1.55 (0.23)	0.95 (0.35)	-	-	-	-	-	-
Ramsey's RESET (F-stat)	1.04 (0.35)	0.53 (0.78)	0.90 (0.45)	2.20 (0.09)	1.40 (0.23)	1.74 (0.16)	-	-	-	-	-	-
N	66	72	72	66	72	72	66	72	72	66	72	72

Notes: Figures in parentheses are t-statistics except for normality, Breusch-Pagan and Ramsey's RESET tests, which are p-values. Significance at 1%, 5% and 10% denoted by ***, ** and * respectively.

Table 3.6 reports the estimations for another two capital market development indicators namely market capitalisation and number of company listed, using the OLS and robust standard error estimators. Models 1 – 2 are estimates of Equation (3.8) without the regional dummies, whereas models 3 – 4 are with regional dummies. Similar with the results of Table 3.5, the estimated coefficients on physical capital and labour growth indicate positive and negative signs, which is consistent with the theory. The diagnostic checking results demonstrate that the residuals of the regressions are normally distributed, there is no heteroskedasticity problem and functional form error in all models.

In models 1 – 4, the institutions variable is positive and statistically significant at conventional levels except for model 1, whereas the market capitalisation indicator is not significant and the number of companies listed is statistically significant at 10% level. In models 5 – 8, the interaction term is highly significant, and the institutions variable is significant as well except for model 6, which is significant at 10% level.

Due to the residuals have a heteroskedasticity problem, the models in Table 3.7 are also estimated using the heteroskedasticity-robust standard errors estimations and the results are reported in Table 3.8. In models 1 – 4, the two capital market development indicators are not statistically significant, but the institutions variable is positive and statistically significant. In models 5 – 8, the interaction term is highly significant as well as the institutions variable. The capital market development indicators are statistically significant at 10% in models 7 and 8. These findings suggest that capital market development embedded in good institutions also tend to stimulate higher economic growth.

Table 3.6 OLS Regression Estimations
Dependent Variable: Real GDP Per Capita
Financial Development Indicator: Capital Market Development (1988 - 2001)

	OLS				OLS with Robust Standard Error			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Constant	-1.99 (-0.54)	-17.46 (-2.27)	-0.81 (-0.25)	-22.30 (-3.33)	-1.99 (-0.74)	-17.46 (-2.16)	-0.81 (-0.33)	-22.30 (-2.98)
KC	0.48 (7.03)***	0.51 (7.05)***	0.40 (6.46)	0.42 (6.57)***	0.48 (2.58)**	0.51 (2.80)***	0.40 (2.51)**	0.42 (2.69)**
$n+g+\delta$	-0.17 (-0.24)	-0.11 (-0.16)	-0.61 (-0.92)	-0.54 (-0.83)	-0.17 (-0.36)	-0.11 (-0.23)	-0.61 (-1.17)	-0.54 (-0.97)
INS	0.35 (1.79)*	0.40 (3.00)***	0.42 (2.18)**	0.31 (4.54)***	0.35 (1.53)*	0.40 (2.50)**	0.42 (1.85)*	0.31 (3.58)***
MC	0.30 (1.78)*	-	0.35 (2.63)***	-	0.30 (2.47)**	-	0.35 (2.99)***	-
NC	-	0.22 (1.54)	-	0.19 (2.75)***	-	0.22 (1.77)*	-	0.19 (2.76)***
MC x INS	0.45 (1.77)*	-	0.56 (2.60)**	-	0.45 (2.51)**	-	0.56 (2.98)***	-
NC x INS	-	0.37 (1.45)	-	0.60 (2.69)***	-	0.37 (1.73)*	-	0.60 (2.73)***
East Asia	-	-	0.18 (1.07)	0.09 (0.55)	-	-	0.18 (1.01)	0.09 (0.58)
Latin America	-	-	0.57 (3.41)***	0.56 (3.17)***	-	-	0.57 (3.31)***	0.56 (2.76)***
Sub-Sahara	-	-	-0.37 (-1.51)	-0.48 (-1.92)*	-	-	-0.37 (-1.71)*	-0.48 (-2.13)**
Adj R^2	0.93	0.93	0.95	0.95	0.94	0.94	0.96	0.96
Jarque-Bera (χ^2)	2.55 (0.27)	5.90 (0.05)	0.34 (0.82)	0.88 (0.65)	-	-	-	-
Breusch-Pagan (χ^2)	0.15 (0.70)	0.44 (0.51)	0.71 (0.40)	0.23 (0.63)	-	-	-	-
Ramsey's RESET (F-stat)	1.24 (0.31)	1.19 (0.33)	0.20 (0.90)	0.09 (0.96)	-	-	-	-
N	44	44	44	44	44	44	44	44

Notes: Figures in parentheses are t-statistics except for normality, Breusch-Pagan and Ramsey's RESET tests, which are p-values. Significance at 1%, 5% and 10% denoted by ***, ** and * respectively.

3.4.2 Two-Stage Least Square (2SLS) Estimations

The two-stage least square estimations are carried out not only to correct the endogenity, but also to check the robustness of the findings. First, the 2SLS estimations are carried out using the legal origin as an instrumental for financial development based on the whole sample country (72 and 44 countries for banking sector development and capital market development, respectively). Second, the mortality rate is used as an instrumental variable for institutions based on the 45-country sample. This is because the mortality rate indicator from Acemoglu *et al.* (2001) is only available for 45 out of 72 countries. Third, both instrumental variables are employed simultaneously in the models based on 45 sample countries. Nevertheless, before conducting the 2SLS estimations, the Hausman test is carried out to test for endogeneity or to examine if the estimates from OLS and 2SLS are different. If there is no endogeneity problem, then both OLS and 2SLS are consistent.

The estimated 2SLS and endogeneity test results when the legal origins are employed as an instrumental variable for financial development are reported in Table 3.7. As shown in this table, the first stage regression results indicate that English legal origin is statistically significant to determine financial development especially the banking sector development indicators. Most first-stage regressions tend to exhibit the relationship between the countries' legal origins and financial development as predicted by the law and finance theory. This finding is consistent with La Porta *et al.* (1997), who find that English common law countries have the highest quality of law enforcement tend to have better-developed financial markets. The Sargan test results indicate that the legal origin instrumental variables are valid since the chi-square test statistics are failed to reject at 5% significant level.

The 2SLS regression results indicate that financial development indicators are statistically significant to determine economic growth at conventional levels, except for domestic credit and number of companies listed, which are statistically significant at 10% level; whereas the institutions variable only has weak significant effect on economic growth. On the other hand, the interaction term is statistically significant to determine economic growth especially liquid liabilities, private sector credit and market capitalization variables.

As shown in this table, the Hausman test results reveal that the null hypothesis is failed to reject, this indicates that financial development is exogenous. Therefore, we should prefer OLS results because it is the most efficient. This finding is consistent with Levine *et al.* (2000) and Beck *et al.* (2000), where they also find no evidence of simultaneously bias in the finance-growth relationship using legal origins as instrumental variables for financial development indicators. Levine (2003) also concludes that simultaneity bias doe not seem to be the cause of the relationship between finance and growth.

Table 3.7: Instrumental 2SLS Estimations
Dependent Variable: Real GDP Per Capita
(Instrumented: Financial Development; Instrumental Variable: Legal Origins)

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.21 (0.03)	-3.47 (-0.47)	4.89 (0.47)	-14.72 (-1.49)	27.35 (1.00)
KC	0.67 (12.38)***	0.65 (11.99)***	0.66 (13.39)***	0.45 (4.56)	0.43(3.90)***
n+g+δ	-0.22 (-0.38)	-0.54 (-0.92)	-0.08 (-0.13)	-0.51 (-1.11)	-0.46 (-1.07)
INS	0.42 (1.74)*	0.38 (1.70)*	0.31 (1.84)*	0.20 (1.91)*	0.28 (1.83)*
LIA	0.28 (2.12)**	-	-	-	-
PRI	-	0.24 (2.18)**	-	-	-
DOC	-	-	0.21 (1.89)*	-	-
MC	-	-	-	0.47 (2.08)**	-
NC	-	-	-	-	0.39 (1.75)*
LIA x INS	0.14 (2.20)**	-	-	-	-
PRI x INS	-	0.27 (2.40)**	-	-	-
DOC x INS	-	-	0.50 (1.88)*	-	-
MC x INS	-	-	-	0.31 (2.26)**	-
NC x INS	-	-	-	-	0.24 (1.87)*
Adj R^2	0.91	0.90	0.88	0.89	0.87
Sargan Test	4.55 (0.21)	5.42 (0.07)	4.12 (0.23)	5.47 (0.06)	5.24 (0.07)
Hausman Test	1.14 (0.97)	0.77 (0.99)	0.19 (0.98)	1.88 (0.93)	2.49 (0.78)

First-Stage Regression

	Dependent Variable: Financial Development Indicator				
	LIA	PRI	DOC	MC	NC
Constant	3.30 (23.89)	3.04 (13.72)	3.47 (19.39)	2.13 (3.63)	-7.54 (-14.20)
KC	0.01 (0.07)	0.01 (0.38)	0.01 (0.02)	0.01 (0.30)	0.01 (0.73)
n+g+δ	0.11 (2.60)**	0.14 (2.14)**	0.15 (2.74)***	0.16 (1.27)	0.11 (0.87)
INS	0.26 (5.03)***	0.28 (4.55)***	0.21 (5.23)***	0.51 (5.48)***	0.47 (4.98)***
LIA x INS	0.29(8.58)***	-	-	-	-
PRI x INS	-	0.29 (6.02)***	-	-	-
DOC x INS	-	-	0.29 (7.86)***	-	-
MC x INS	-	-	-	0.28 (7.21)***	-
NC x INS	-	-	-	-	0.28 (6.75)***
English Legal Origin	0.28 (2.06)**	0.30 (2.39)**	0.12 (2.09)**	0.06 (1.97)*	0.06 (1.88)*
French Legal Origin	0.04 (1.06)	0.03 (0.97)	0.01 (0.07)	0.04 (0.92)	0.09 (1.05)
German Legal Origin	0.12 (0.95)	0.08 (1.38)	0.08 (1.26)	0.03 (0.61)	0.04 (0.70)
Adj R^2	0.94	0.94	0.93	0.92	0.91
N	66	72	72	44	44

Notes: Figures in parentheses are t-statistics, except for Hausman test, which are p-values. Significance at 1%, 5% and 10% denoted by ***, ** and * respectively.
Instrumented: LIA, PRI or DOC
Instruments: K, n+g+δ, INS, English Legal Origin, French Legal Origin and German Legal Origin

Table 3.8 reports the 2SLS when the mortality rate (MOR) is employed as an instrumental variable for institutions. The data set of mortality rate is obtained from Acemoglu *et al.* (2001), but this data is only available for 45 out of 72 countries. Therefore, the 2SLS estimation is based on 45 cross-country and only the banking sector development indicators are employed in the analysis[50]. The first-stage regression results indicate that mortality rate is statistically significant to determine institutions, and this indicates that mortality rate is a valid instrument for institutional quality. The 2SLS estimations reveal that financial development and institutions are statistically significant to determine economic growth, but the impact of financial development is more powerful. The Hausman test results indicate that the null hypothesis is failed to reject, this implies that institutions is exogenous. The empirical results are different with Acemoglu *et el.* (2001) because the institutions indicator employed in their analysis is proxied by risk of expropriation indicator, whereas the institutions indicator of this study consists of five indicators, namely corruption, rule of law, bureaucratic quality, government repudiation of contracts and risk of expropriation.

[50] The capital market development indicators are not employed due to the small sample size. The mortality rate data set from Acemoglu *et al.* (2001) is available for the less developed countries, whereas the capital market development indicators are available for the developed and developing countries.

Table 3.8: Instrumental 2SLS Estimations
Dependent Variable: Real GDP Per Capita
(Instrumented: Institutional Quality; Instrumental Variable: Mortality Rate)

	Model 1	Model 2	Model 3
Constant	1.22 (1.14)	2.52 (1.05)	1.74 (1.53)
KC	0.42 (2.32)**	0.41 (2.06)**	0.46 (2.34)**
n+g+δ	-0.68 (-1.23)	-0.77 (-1.08)	-0.58 (1.03)
INS	0.52 (1.85)*	0.50 (1.77)*	0.48 (1.69)*
LIA	0.50 (2.10)**	-	-
PRI	-	0.29 (2.04)**	-
DOC	-	-	0.51 (1.84)*
LIA x INS	0.56 (2.33)**	-	-
PRI x INS	-	0.36 (2.24)**	-
DOC x INS	-	-	0.30 (2.05)**
Hausman Test	0.22 (0.97)	0.20 (0.97)	0.27 (0.98)
	First-Stage Regression		
	Dependent Variable: Institutions		
Constant	3.25 (35.82)	3.20 (25.16)	3.18 (28.11)
KC	0.03 (0.67)	0.05 (0.75)	0.03 (0.43)
n+g+δ	0.06 (1.12)	0.01 (1.02)	0.05 (1.23)
LIA	0.88 (3.45)***	-	-
PRI	-	0.87 (2.86)***	-
DOC	-	-	0.82 (2.56)**
LIA x INS	0.27 (6.85)***	-	-
PRI x INS	-	0.26 (3.50)**	-
DOC x INS	-	-	0.25 (4.72)***
MOR	0.01 (2.14)**	0.03 (2.05)**	0.04 (1.94)*
Adj R^2	0.98	0.96	0.93
N	45	45	45

Notes: Figures in parentheses are t-statistics, except for Hausman test, which are p-values. Significance at 1%, 5% and 10% denoted by ***, ** and * respectively.
Instrumented: Institutions (INS)
Instruments: K, $n+g+\delta$, FD (LIA, PRI or DOC), MOR

Table 3.9 reports the 2SLS regression when legal origins and mortality rates are instrument simultaneously based on 45 cross-country. However, the legal origins for these sample countries are either from English (ENG) or French (FRA). Therefore, the English common law legal origin is used as an instrument for financial development. The first stage results of the instrumental variables regression indicate that the English legal origin and mortality rate are statistically significant to determine financial development and institutions. This implies that both variables are relevant instruments in the analysis. The Sargan test results verify that the legal origin and mortality rate instrumental variables are valid since the chi-square test statistics are failed to reject at 5% significant level.

The 2SLS regression results show the strong financial development-growth relationship similar to the OLS results, and institutions variable has weak statistically significant to determine growth. The interaction term also shows statistically significant to promote economic growth. Thus, this finding strengthens the argument that higher financial

development and better institutions are matter for economic growth. In addition, financial development embedded within good institutional framework tends to stimulate growth. The Hausman test statistics indicate that the null hypothesis is failed to reject, this implies that financial development and institutions are exogenous. Overall, the 2SLS results demonstrate that the OLS results are robust since both estimations indicate similar findings.

Table 3.9: Instrumental 2SLS Estimations (N = 45)
Dependent Variable: Real GDP Per Capita
(Instrumented: Financial Development and Institutional Quality;
Instrumental Variables: Legal Origin and Mortality Rate)

	Model 1	Model 2	Model 3
Constant	1.48 (0.39)	3.17 (0.38)	1.92 (0.66)
KC	0.67 (2.05)**	0.66 (2.33)**	0.56 (2.54)**
n+g+δ	-0.41 (-1.79)*	-0.38 (-1.36)	-0.40 (-1.31)
INS	0.19 (1.73)*	0.29 (1.69)*	0.24 (1.71)*
LIA	0.28 (2.03)**	-	-
PRI	-	0.25 (2.35)**	-
DOC	-	-	0.20 (1.77)*
LIA x INS	0.72 (2.16)**	-	-
PRI x INS	-	0.53 (2.22)**	-
DOC x INS	-	-	0.45 (1.66)*
Sargan Test	0.25 (0.61)	0.02 (0.88)	0.05 (0.82)
Hausman Test	0.60 (0.99)	0.32 (0.99)	0.91 (0.98)

Notes: Figures in parentheses are t-statistics, except for Sargan and Hausman tests, which are p-values. Significance at 1%, 5% and 10% denoted by ***, ** and * respectively.
Instrumented: INS and FD (LIA, PRI or DOC)
Instruments: K, n+g+δ, English Legal Origin, French Legal Origin, Mortality Rate

3.4.3 Panel Data Estimation Results at Different Income Groups

The panel data estimation results reported in this section consist of three alternative panel data estimators: mean group (MG), which imposes no restrictions; pooled mean group (PMG), which imposes common long-run effects and static fixed effect models. The tables present estimate of the long-run coefficients, the error correction coefficients, Hausman test statistics and the long-run coefficients. The lag order is first chosen in each country on the unrestricted mode by Schwarz Baysian Criterion (SBC), subject to a maximum lag of 1, and is allowed to vary between countries. Then, using these SBC-determined lag orders, homogeneity is imposed.

Overall, the joint Hausman tests do not reject poolability of the long-run parameters in all panel data estimations. This implies that the efficient estimates of the common long-run

parameters are given by the PMG method. Therefore, only the PMG estimator appears to be an informative method of analysis although the mean group and static fixed effect estimators results are also reported. In addition, the time span of the panel data is only 24 years (1978 – 2001) for the banking sector development indicators, and 14 years (1988 – 2001) for the capital market development indicators, the MG estimators suffers from the shortage of degrees of freedom. The individual Hausman test for the independent variables also demonstrate that the pooling restrictions cannot be rejected for five independent variables, which implies that the data of the sample countries can be pooled.

Table 3.10 presents the dynamic panel data estimation results of high-income countries. The PMG results reveal that the signs of the coefficients on the capital stock and labour growth are consistent with theory; both demonstrate positive and negative signs, respectively. The banking sector development indicators have positive sign, and only liquid liabilities indicator is statistically significant at conventional levels to determine economic growth in the long-run. Various interpretations have been offered for the failure to find a strong finance-growth link in the OECD sample, such as close international linkages across OECD financial markets make it difficult to identify the influence of domestic financial development on a country's growth rate. In addition, OECD countries are at a more advanced stage of development, where financial systems may have a different (and more difficult to measure) impact on growth than in earlier stages of development. On the other hand, the institutions variable is not statistically significant to determine economic growth in the long-run. This is not surprisingly since the institutional quality in OECD countries is well developed. Interesting, the coefficients of the interaction term between financial development and institutions are statistically significant at 5% level in the three models. The coefficients on the interaction term are larger than financial development and institutions individually, which is similar to that obtained with the cross-section OLS regression.

On the other hand, the short-run coefficients demonstrate different story. As discussed in the methodology section, short-run coefficients are not restricted to be the same across countries, so that we do not have a single pooled estimate for each coefficient. However, we can still analyse the average short-run effect by considering the mean of the corresponding coefficients across countries. The short-run average relationship results

between economic growth and the measures of financial development appear to be negative in the case of domestic credit. Thus, comparing the long-run and short-run estimates, we can conclude that the sign of the relationship between economic growth and financial development depends on whether their movements are cyclical or permanent. This finding is consistent with Demetriades and Hussein (1996) and Luintel and Khan (1999), where they find that financial development is positively and significantly linked to the measures of economic growth in the long-run. All short-run coefficients are not statistically significant to determine economic growth except for capital stock.

The diagnostic statistics for each individual high-income country are reported in Table A.3.3 (Appendix 3.II). In model 1, at the 5% level, the equations fail the test for residual serial correlation in Ireland, Japan and United Kingdom, the test for functional form for Japan, Switzerland and United Kingdom and the test for heteroskedasticity in the case of Canada. In model 2, at the 5% level, the equation fails the test for residual serial correlation in Ireland, and the test for functional form in Canada, France, Netherlands and Sweden. Finally, in model 3, at the 5% level, the equation fails the test for residual serial correlation in Belgium, Finland and Ireland, the test for functional form in Finland, France, Spain and Switzerland.

Table 3.10: Alternative Panel Data Estimation for ARDL of High-Income OECD Countries
Dependent Variable: Real GDP Per Capita (1978 – 2001)
(Financial Development Proxy: Banking Sector Development)

	MG Estimators	PMG Estimators	*Hausman Test*	Static Fixed Effects Estimators
Model 1: Liquid Liabilities (LIA)				
Long-Run Coefficients				
KC	0.29 (2.99)***	0.21 (3.47)***	1.42 (0.23)	0.15 (2.15)**
(n+g+δ)	-0.27 (-0.55)	-0.25 (-1.04)	0.20 (0.65)	-0.48 (-1.54)
LIA	0.25 (0.64)	0.28 (2.35)**	0.28 (0.60)	0.24 (1.84)*
INS	0.28 (0.65)	0.08 (1.42)	0.27 (0.60)	0.29 (0.77)
LIA x INS	0.40 (0.69)	0.35 (2.33)**	0.29 (0.59)	0.28 (2.14)**
	Joint Hausman Test		7.69 (0.17)	
Error Correction Coefficients	-0.67 (-3.93)***	-0.33 (-3.25)***		
Short-Run Coefficients				
ΔKC	0.10 (2.89)***	0.11 (2.40)**		
Δ(n+g+δ)	0.03 (0.36)	0.02 (1.21)		
ΔLIA	0.16 (1.17)	0.06 (1.19)		
ΔINS	0.20 (0.99)	0.19 (1.81)*		
ΔLIA x INS	0.12 (1.13)	0.02 (1.59)		
N x T	288	288		288
Model 2: Private Sector Credit (PRI)				
Long-Run Coefficients				
KC	0.25 (2.44)**	0.20 (2.54)**	1.99 (0.16)	0.13 (1.99)**
(n+g+δ)	-0.20 (-1.59)	-0.08 (-1.22)	0.15 (0.70)	-0.12 (-1.67)*
PRI	0.36 (0.69)	0.22 (1.89)*	2.94 (0.09)	0.28 (2.11)**
INS	0.24 (0.53)	0.03 (1.49)	0.27 (0.61)	0.26 (1.57)
PRI x INS	0.25 (0.94)	0.26 (2.18)**	0.37 (0.55)	0.33 (3.14)***
	Joint Hausman Test		4.26 (0.51)	
Error Correction Coefficients	-0.64 (3.80)***	-0.35 (-3.31)***		
Short-Run Coefficients				
ΔKC	0.14 (1.09)	0.04 (2.25)**		
Δ(n+g+δ)	-0.07 (0.13)	0.05 (1.58)		
ΔPRI	0.19 (1.24)	0.16 (0.90)		
ΔINS	0.13 (0.29)	0.01 (0.29)		
ΔPRI x INS	0.18 (0.87)	0.19 (1.11)		
N x T	432	432		432
Model 3: Domestic Credit (DOC)				
Long-Run Coefficients				
KC	0.21 (0.26)	0.21 (2.28)**	0.95 (0.33)	0.36 (2.27)**
(n+g+δ)	-0.22 (-0.83)	-0.09 (-1.46)	0.37 (0.54)	-0.16 (-1.50)
DOC	0.36 (0.97)	0.15 (1.36)	0.98 (0.32)	0.25 (0.44)
INS	0.42 (0.75)	0.05 (1.62)	0.98 (0.32)	0.26 (1.41)
DOC x INS	0.25 (0.94)	0.22 (2.05)**	0.98 (0.32)	0.30 (0.46)
	Joint Hausman Test		8.42 (0.13)	
Error Correction Coefficients	-0.47 (-4.77)***	-0.43 (-4.50)***		
Short-Run Coefficients				
ΔKC	0.15 (1.97)**	0.10 (2.17)**		
Δ(n+g+δ)	0.06 (1.60)	0.04 (1.04)		
ΔDOC	-0.19 (-0.91)	-0.08 (-1.09)		
ΔINS	0.08 (0.99)	0.02 (1.07)		
ΔDOC x INS	0.14 (0.97)	0.17 (1.11)		
N x T	432	432		432

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

The estimated pool mean group results for upper middle-income country are reported in Table 3.11.The direct effects of financial development on economic growth are larger and more significant than in the high-income group in all three models. This finding is consistent with Rioja and Valev (2004a), who also find a much stronger growth enhancing effect of financial development in middle-income countries compared to high-income countries. The result also indicates that the private sector credit variable has the strongest impact on economic growth, as reflected in its larger coefficient compared to those of the other two financial development variables. This finding is consistent with Beck *et al.* (2000), who also find a very strong connection between private sector credit and long-run economic growth. Institutional quality also has a positive and highly significant effect on economic growth in all three models. This is in line with the argument that good institutions are important to promote growth in the less developed countries (Rodrik, 1997). This finding also demonstrates that both of the financial development and institutions are equally important in enhancing economic growth.

The interaction term between financial development and institutions has the statistically significant positive sign, confirming that higher financial development would enhance economic growth in the countries with better quality of institutions. These findings seem to suggest that both finance and institutional quality have large direct and indirect effects on growth. Improving both finance and institutional quality in upper middle-income countries is, therefore, likely to boost economic growth, much more than in high-income countries.

The short-run results demonstrate that the coefficients on all independent variables are consistent with the theory in the PMG estimations. However, these coefficients are not significant except for capital stock, which is statistically significant at 1% level. Again, this finding suggests that economic growth is positively and significantly linked to the financial development in the long-run.

The diagnostic checking results of OLS regression of these three models are presented in Table A.3.4 (Appendix 3.II). In model 1, at the 5% level, there is evidence of serial correlation of residual in Korea, Brazil and Saudi Arabia; functional form misspecification in Korea, Brazil, Gabon, Argentina and Hungary; and evidence of non-

normal of residuals in Chile. In model 2, at the 5% level, the equation fails the test for residual serial correlation in Brazil and Saudi Arabia, and the test for functional form in Korea, Gabon, Malaysia, Trinidad & Tobago and Hungary. Lastly, in model 3, at the 5% level, the equation fails the test for residual serial correlation in Chile, Malta, Mexico and Argentina, the test for functional form in Gabon, Malta, Botswana and South Africa, the test for normality in Brazil.

Table 3.11: Alternative Panel Data Estimation for ARDL of Upper Middle-income Countries
Dependent Variable: Real GDP Per Capita (1978 – 2001)
(Financial Development Proxy: Banking Sector Development)

	MG Estimators	PMG Estimators	*Hausman Test*	Static Fixed Effects Estimators
Model 1: Liquid Liabilities (LIA)				
Long-Run Coefficients				
KC	0.65 (6.29)***	0.45 (6.19)***	1.06 (0.30)	0.65 (32.54)***
(n+g+δ)	-0.21 (-1.79)*	-0.19 (-3.14)***	4.05 (0.04)**	-0.10 (-2.51)**
LIA	0.14 (0.90)	0.32 (4.55)***	0.60 (0.44)	0.11 (0.92)
INS	0.30 (0.89)	0.16 (5.92)***	0.67 (0.41)	0.15 (1.11)
LIA x INS	0.42 (0.91)	0.58 (6.34)**	0.63 (0.43)	0.21 (1.16)
	Joint Hausman Test		7.36 (0.20)	
Error Correction Coefficients	-0.75 (-8.90)***	-0.84 (-10.53)***		-
Short-Run Coefficients				
ΔKC	0.42 (5.43)***	0.43 (6.19)***		
Δ(n+g+δ)	-0.15 (-1.94)*	-0.08 (-1.05)		
ΔLIA	0.65 (1.02)	0.24 (0.98)		
ΔINS	0.76 (1.03)	0.12 (1.01)		
ΔLIA x INS	0.20 (1.08)	0.25 (1.01)		
N x T	432	432		432
Model 2: Private Sector Credit (PRI)				
Long-Run Coefficients				
KC	0.76 (0.75)	0.50 (6.32)***	1.56 (0.21)	0.66 (8.58)***
(n+g+δ)	-0.17 (-0.76)	-0.11 (-3.50)***	3.41 (0.06)	-0.10 (-2.67)***
PRI	0.27 (1.14)	0.41 (3.03)***	1.20 (0.27)	0.38 (3.02)***
INS	0.31 (1.12)	0.11 (5.29)***	1.22 (0.27)	0.15 (4.11)***
PRI x INS	0.40 (1.13)	0.44 (5.99)***	1.20 (0.27)	0.61 (4.96)***
	Joint Hausman Test		4.78 (0.44)	
Error Correction Coefficients	-0.69 (-7.67)***	-0.82 (-8.99)***		-
Short-Run Coefficients				
ΔKC	0.60 (5.95)***	0.42 (5.32)***		
Δ(n+g+δ)	-0.05 (-1.15)	-0.06 (-0.47)		
ΔPRI	-0.02 (-1.00)	0.25 (1.00)		
ΔINS	0.04 (0.09)	0.04 (0.24)		
ΔPRI x INS	0.07 (1.40)	0.08 (0.70)		
N x T	432	432		432
Model 3: Domestic Credit (DOC)				
Long-Run Coefficients				
KC	0.81 (4.47)***	0.85 (9.37)***	0.05 (0.82)	0.61 (6.32)***
(n+g+δ)	-0.20 (-0.86)	-0.56 (-3.90)***	2.54 (0.11)	-0.12 (-3.05)***
DOC	0.35 (1.54)	0.26 (2.24)**	0.42 (0.51)	0.11 (1.33)
INS	0.49 (1.62)	0.16 (2.82)***	0.52 (0.47)	0.11 (1.15)
DOC x INS	0.56 (1.52)	0.48 (3.83)***	0.44 (0.51)	0.22 (0.61)
	Joint Hausman Test		4.36 (0.50)	
Error Correction Coefficients	-0.94 (-10.21)***	-0.54 (-4.96)***		
Short-Run Coefficients				
ΔKC	0.23 (4.74)***	0.69 (3.08)***		
Δ(n+g+δ)	-0.03 (-0.30)	0.04 (0.57)		
ΔDOC	-0.25(-0.93)	0.20 (1.72)		
ΔINS	0.22 (1.16)	0.08 (1.47)		
ΔDOC x INS	-0.13 (0.93)	0.14 (1.63)		
N x T	432	432		432

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 3.12 presents the empirical results of lower middle-income countries, where the analysis focuses on those obtained with the PMG estimator. As shown in this table, the economic growth is positively related to capital stock, financial development and institutions, and negatively related to labour growth in the long-run. Both financial development and institutions variables are statistically significant to determine economic growth through out all three models. The direct effects of financial development on economic growth are larger and more significant than in the high-income countries but smaller than in the upper middle-income countries in all three models. The interaction term between financial development and institutions in these three models is larger and highly significant.

On the other hand, the short-run coefficients are not statistically significant to determine economic growth except for capital stock. The short-run average relationship results between economic growth and the measures of financial development appear to be negative in the cases of private sector credit and domestic credit. Thus, comparing the long-run and short-run estimates, we can conclude that the sign of the relationship between economic growth and financial development depends on whether their movements are cyclical or permanent.

The diagnostic checking results of OLS regression of these three models are presented in Table A.3.5 (Appendix 3.II). In model 1, at the 5% level, there is evidence of serial correlation of residual in Algeria, Colombia, Guatemala, Peru, Sri Lanka, Syrian and Thailand; functional form misspecification in Colombia, Ecuador, Sri Lanka and Thailand; evidence of non-normal of residuals in Ecuador; evidence of heteroskedasticity in Algeria and Colombia. In model 2, at the 5% level, the equation fails the test for residual serial correlation in Morocco, Peru and Tunisia, and the test for functional form in Egypt, Jordan and Tunisia, evidence of non-normal of residuals in Guatemala, Jordan and Tunisia; and evidence of heteroskedasticity in Jamaica. Lastly, in model 3, at the 5% level, the equation fails the test for residual serial correlation in Egypt and Syrian, the test for functional form in Bolivia, Colombia, the Philippines, Sri Lanka and Thailand, the test for normality in Ecuador and Tunisia; and evidence of heteroskedasticity in Guatemala and Jordan.

Table 3.12: Alternative Panel Data Estimation for ARDL of Lower Middle-Income Countries
Dependent Variable: Real GDP Per Capita (1978 – 2001)
(Financial Development Proxy: Banking Sector Development)

	MG Estimators	PMG Estimators	*Hausman Test*	Static Fixed Effects Estimators
Model 1: Liquid Liabilities (LIA)				
Long-Run Coefficients				
KC	0.41 (0.51)	0.76 (5.10)***	0.15 (0.70)	0.53 (13.48)***
(n+g+δ)	-0.05 (-0.06)	-0.25 (-1.66)*	0.81 (0.37)	-0.09 (-1.24)
LIA	0.30 (0.93)	0.29 (2.94)***	0.01 (0.91)	0.27 (2.99)***
INS	0.28 (1.02)	0.15 (3.42)***	0.06 (0.81)	0.25 (2.05)**
LIA x INS	0.32 (0.99)	0.43 (3.36)***	0.01 (0.93)	0.38 (2.84)***
	Joint Hausman Test		4.80 (0.43)	
Error Correction Coefficients	-0.40 (-2.97)***	-0.23 (-2.53)**		
Short-Run Coefficients				
ΔKC	0.33 (0.71)	0.58 (4.19)***		
Δ(n+g+δ)	0.05 (0.21)	-0.03 (-0.38)		
ΔLIA	0.22 (0.91)	0.11 (0.52)		
ΔINS	0.25 (0.65)	0.28 (1.03)		
ΔLIA x INS	0.08 (0.73)	0.05 (0.71)		
N x T	432	432		432
Model 2: Private Sector Credit (PRI)				
Long-Run Coefficients				
KC	0.46 (0.70)	0.29 (6.69)***	0.07 (0.80)	0.54 (14.01)***
(n+g+δ)	-0.23 (-1.21)	-0.06 (-0.52)	1.29 (0.26)	-0.10 (-1.34)
PRI	0.32 (1.13)	0.24 (2.31)**	1.36 (0.24)	0.19 (2.76)***
INS	0.29 (1.34)	0.19 (2.95)***	1.40 (0.24)	0.16 (2.35)**
PRI x INS	0.38 (1.38)	0.37 (2.59)***	1.80 (0.18)	0.24 (2.07)**
	Joint Hausman Test		9.01 (0.11)	
Error Correction Coefficients	-0.50 (-4.84)***	-0.46 (-4.40)***		
Short-Run Coefficients				
ΔKC	0.30 (1.45)	0.24 (3.05)***		
Δ(n+g+δ)	0.20 (1.12)	0.04 (1.16)		
ΔPRI	0.05 (1.19)	-0.13 (-0.26)		
ΔINS	0.01 (0.12)	0.04 (2.13)**		
ΔPRI x INS	0.08 (0.60)	0.16 (1.09)		
N x T	432	432		432
Model 3: Domestic Credit (DOC)				
Long-Run Coefficients				
KC	0.37 (1.42)	0.32 (7.76)***	0.03 (0.86)	0.57 (5.97)***
(n+g+δ)	-0.32 (-0.82)	-0.16 (-1.67)*	0.38 (0.54)	-0.12 (-1.66)*
DOC	0.39 (1.29)	0.21 (4.27)***	1.92 (0.17)	0.14 (1.98)**
INS	0.26 (1.37)	0.15 (1.98)*	1.83 (0.18)	0.05 (0.59)
DOC x INS	0.35 (1.34)	0.34 (2.39)**	1.89 (0.17)	0.05 (1.95)*
	Joint Hausman Test		2.21 (0.82)	
Error Correction Coefficients	-0.55 (-5.76)***	-0.47 (-4.74)***		
Short-Run Coefficients				
ΔKC	0.28 (1.64)	0.19 (2.29)**		
Δ(n+g+δ)	0.05 (0.66)	0.10 (1.50)		
ΔDOC	0.17 (1.06)	-0.09 (-0.26)		
ΔINS	0.22 (0.88)	0.05 (0.50)		
ΔDOC x INS	0.03 (0.54)	0.04 (0.29)		
N x T	432	432		432

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 3.13 reports the results for low-income countries. Financial development is found to have very small direct effects on growth. The estimated coefficients are not only small but they are also statistically significant at conventional level for two of the three banking sector development indicators, namely liquid liabilities and private sector credit. The private sector coefficient, for example, is only 0.20 compared to 0.41 for upper middle-income, 0.24 for lower middle-income and 0.22 for high-income OECD countries. This may be attributed to the low-income countries have not implemented the appropriate regulatory and supervisory financial systems that are comparable to those of the developed and developing countries. However, the institutional quality has a large positive and significant direct effect on growth in these countries.

The estimated coefficients of the interaction term are positive and highly significant and they are higher than high-income OECD countries. These results suggest that institutions not only important to promote growth in the low-income countries, but it also play a pivotal role in ensuring that financial development does indeed promote economic growth. In terms of policy implication, this finding suggests that policy makers in low-income countries should primarily be focusing on improving institutional quality, which is likely to have both direct and indirect effects on growth. Financial development, especially if it boosts credit to the private sector, is also likely to have significant payoffs in terms of growth, but even these to a large extent depend on institutional quality improvement.

The diagnostic checking results of OLS regression of these three models are presented in Table A.3.6. In model 1, at the 5% level, there is evidence of serial correlation of residual in Burkina Faso, Cameroon, Senegal and Zambia; functional form misspecification in Bangladesh, Indonesia and Madagascar; evidence of non-normal of residuals in Bangladesh, Ghana and Mali; and evidence of heteroskedasticity in Madagascar. In model 2, at the 5% level, the equation fails the test for residual serial correlation in Bangladesh, Cameroon, India and Kenya, and the test for functional form in Ghana, India, Indonesia and Zambia; evidence of heteroskedasticity in Cote d'Ivoire, India and Madagascar. Lastly, in model 3, at the 5% level, the equation fails the test for residual serial correlation in Burkina Faso, Kenya, Madagascar and Nigeria, the test for functional form in Gambia, Indonesia and Madagascar,

the test for normality in Cote d'Ivoire and evidence of heteroskedasticity in Cote d'Ivoire, Gambia, Madagascar and Mali.

Table 3.13: Alternative Panel Data Estimation for ARDL of Low-income Countries Dependent Variable: Real GDP Per Capita (1978 – 2001)
(Financial Development Proxy: Banking Sector Development)

	MG Estimators	PMG Estimators	*Hausman Test*	Static Fixed Effects Estimators
Model 1: Liquid Liabilities (LIA)				
Long-Run Coefficients				
KC	0.06 (0.21)	0.27 (6.61)***	0.52 (0.47)	0.39 (14.05)***
(n+g+δ)	-0.12 (-0.13)	-0.26 (-2.34)**	0.08 (0.78)	-0.14 (-1.69)*
LIA	0.35 (0.45)	0.15 (2.14)**	1.29 (0.26)	0.21 (4.34)***
INS	0.52 (0.28)	0.32 (6.12)***	0.76 (0.38)	0.31 (3.47)***
LIA x INS	0.15 (0.42)	0.38 (5.65)***	1.05 (0.31)	0.34 (4.49)***
	Joint Hausman Test		10.95 (0.05)	
Error Correction Coefficients	-0.75 (-10.93)***	-0.68 (-6.99)***		
Short-Run Coefficients				
ΔKC	0.04 (0.48)	0.19 (2.97)***		
Δ(n+g+δ)	0.08 (1.74)*	-0.04 (1.60)		
ΔLIA	0.16 (0.39)	0.13 (0.95)		
ΔINS	0.11 (0.25)	0.43 (0.94)		
ΔLIA x INS	0.18 (0.20)	0.32 (0.99)		
N x T	432	432		432
Model 2: Private Sector Credit (PRI)				
Long-Run Coefficients				
KC	0.28 (1.09)	0.36 (7.19)***	1.95 (0.33)	0.37 (14.59)***
(n+g+δ)	-0.16 (-1.02)	-0.31 (-5.15)***	0.73 (0.39)	-0.13 (-1.58)
PRI	0.32 (1.05)	0.20 (2.22)**	1.06 (0.30)	0.14 (1.82)*
INS	0.30 (1.02)	0.27 (2.05)**	1.06 (0.30)	0.24 (2.17)**
PRI x INS	0.26 (1.08)	0.30 (1.80)*	1.06 (0.30)	0.16 (2.38)**
	Joint Hausman Test		6.02 (0.30)	
Error Correction Coefficients	-0.79 (-8.99)***	-0.62 (-6.20)***		
Short-Run Coefficients				
ΔKC	0.13 (1.53)	0.16 (1.89)*		
Δ(n+g+δ)	0.07 (0.80)	0.05 (0.88)		
ΔPRI	-0.16 (-1.13)	-0.15 (-1.15)		
ΔINS	0.24 (1.17)	0.09 (0.84)		
ΔPRI x INS	0.17 (1.11)	0.12 (1.07)		
N x T	432	432		432
Model 3: Domestic Credit (DOC)				
Long-Run Coefficients				
KC	0.17 (0.73)	0.36 (7.04)***	0.73 (0.39)	0.42 (18.13)***
(n+g+δ)	-0.10 (-0.73)	-0.34 (-5.09)***	2.17 (0.14)	-0.22 (-1.64)*
DOC	0.26 (1.52)	0.25 (1.93)*	1.35 (0.25)	0.06 (0.55)
INS	0.27 (1.94)*	0.31 (2.39)**	1.13 (0.29)	0.08 (0.73)
DOC x INS	0.32 (1.85)*	0.35 (3.86)***	1.35 (0.24)	0.14 (0.58)
	Joint Hausman Test		4.33 (0.50)	
Error Correction Coefficients	-0.79 (-10.01)***	-0.57 (-6.16)***		
Short-Run Coefficients				
ΔKC	0.12 (1.18)	0.19 (1.65)*		
Δ(n+g+δ)	0.07 (1.16)	0.26 (0.62)		
ΔDOC	0.13 (1.43)	0.18 (1.16)		
ΔINS	0.12 (1.67)*	0.06 (1.12)		
ΔDOC x INS	0.15 (1.35)	0.26 (1.16)		
N x T	432	432		432

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 3.14 reports the results for the developed countries when capital market development indicators are employed in the analysis. The pooled mean group results reveal that stock market capitalisation is statistically significant at 5% level to determine economic growth in these countries, and number of companies listed is statistically significant at 10% level. On the other hand, the effect of institutions on economic growth is weaker for developed countries, where it is only statistically significant at 10 percent level in both models. This result is consistent with Table 3.10, when the financial development is proxied by three banking sector development indicators. However, the interaction term between capital market development indicators and institutions demonstrate statistically significant at 5% level, and the coefficients are slightly higher than capital market development indicator and institutions individually. Given that institutional quality is higher in developed countries, financial development may overall still have positive effects on economic growth especially capital market development. The same cannot be said for institutional quality, the effects of which are now largely through the financial system. Thus, while institutional improvements appear display diminishing returns, financial development remains an important engine of growth for developed countries. Table A.3.7 (Appendix 3.II) reports the diagnostic checking results of these two models.

Table 3.14: Alternative Panel Data Estimation for ARDL of Developed Countries/ High-Income OECD Countries
Dependent Variable: Real GDP Per Capita (1978 – 2001)
(Financial Development Proxy: Capital Market Development)

	MG Estimators	PMG Estimators	*Hausman Test*	Static Fixed Effects Estimators
Model 1: Market Capitalisation (MC)				
Long-Run Coefficients				
KC	0.65 (1.13)	0.51 (12.31)***	0.06 (0.80)	0.44 (4.84)***
(n+g+δ)	-0.33 (-0.66)	-0.07 (-2.21)**	0.65 (0.42)	-0.06 (-1.27)
MC	0.47 (0.68)	0.28 (3.63)***	0.34 (0.56)	0.32 (3.98)***
INS	0.32 (0.62)	0.21 (1.82)*	0.28 (0.60)	0.21 (2.33)**
MC x INS	0.55 (0.97)	0.32 (3.91)***	0.33 (0.57)	0.35 (4.17)***
	Joint Hausman Test		8.24 (0.14)	
Error Correction Coefficients	-0.45 (-2.33)***	-0.55 (-6.51)***		
Short-Run Coefficients				
ΔKC	0.34 (1.32)	0.40 (1.95)*		
Δ(n+g+δ)	0.08 (0.73)	-0.02 (-0.21)		
ΔMC	0.34 (1.16)	0.25 (0.54)		
ΔINS	0.21 (1.11)	0.20 (0.35)		
ΔMC x INS	0.19 (1.15)	0.12 (0.57)		
N x T	238	238		238
Model 2: Number of Companies Listed (NC)				
Long-Run Coefficients				
KC	0.52 (0.99)	0.53 (10.02)***	1.95 (0.16)	0.38 (4.55)***
(n+g+δ)	-0.27 (-1.08)	-0.16 (-1.82)*	1.60 (0.21)	-0.08 (-1.59)
NC	0.16 (2.23)**	0.32 (1.74)*	0.45 (0.50)	0.26 (1.42)
INS	0.25 (1.34)	0.20 (1.66)*	0.26 (0.61)	0.17 (1.57)
NC x INS	0.29 (2.24)**	0.34 (2.47)**	0.45 (0.50)	0.38 (1.44)
	Joint Hausman Test		9.51 (0.09)	
Error Correction Coefficients	-038 (-3.19)***	-0.34 (-3.57)***		
Short-Run Coefficients				
ΔKC	0.17 (2.22)**	0.40 (2.21)**		
Δ(n+g+δ)	-0.13 (-0.66)	0.05 (1.17)		
ΔNC	0.14 (-1.56)	-0.18 (-0.92)		
ΔINS	0.18 (1.41)	0.10 (0.79)		
ΔNC x INS	0.16 (1.58)	0.17 (0.87)		
N x T	238	238		238

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 3.15 presents the results where the financial development is proxied by capital market development indicators in developing countries. The pooled mean group estimations indicate that capital market development is found to have very small direct effects on growth. Only the stock market capitalisation indicator is statistically significant but its coefficient is only 0.11 compared to 0.28 for high-income countries. Institutions, however, have a large positive and significant direct effect on growth in these countries. The estimated coefficients of the interaction terms are positive and highly significant. This finding suggests that capital market development is likely to have significant impact on growth, but even these to a large extent

depend on institutional quality improvements. On the other hand, the short-run relationship results demonstrate that all independent variables are not statistically significant to determine economic growth, except for capital stock, which is significant at 10% level. The diagnostic checking results of these two models are presented in Table A.3.8 (Appendix 3.II).

Table 3.15: Alternative Panel Data Estimation for ARDL of Developing Countries Dependent Variable: Real GDP Per Capita (1978 – 2001)
(Financial Development Proxy: Capital Market Development)

	MG Estimators	PMG Estimators	*Hausman Test*	Static Fixed Effects Estimators
Model 1: Market Capitalisation (MC)				
Long-Run Coefficients				
KC	0.49 (0.94)	0.49 (2.40)**	0.07 (0.78)	0.45 (9.55)***
(n+g+δ)	-0.34 (-0.70)	-0.06 (-1.73)*	0.42 (0.52)	-0.09 (-1.61)
MC	0.29 (1.44)	0.11 (4.49)***	1.86 (0.17)	0.05 (0.86)
INS	0.39 (1.24)	0.12 (2.34)**	1.69 (0.19)	0.04 (1.82)*
MC x INS	0.18 (1.46)	0.25 (4.74)***	1.87 (0.17)	0.10 (1.02)
	Joint Hausman Test		2.50 (0.78)	
Error Correction Coefficients	-0.72 (-4.12)***	-0.61 (-5.86)***		
Short-Run Coefficients				
ΔKC	0.16 (0.83)	0.23 (1.73)*		
Δ(n+g+δ)	-0.14 (-0.63)	0.08 (1.38)		
ΔMC	0.18 (0.73)	0.08 (1.50)		
ΔINS	0.19 (0.51)	0.10 (1.35)		
ΔMC x INS	0.07 (0.66)	0.04 (1.50)		
N x T	364	364		364
Model 2: Number of Companies Listed (NC)				
Long-Run Coefficients				
KC	0.45 (1.60)*	0.57 (2.05)**	0.38 (0.54)	0.45 (7.08)***
(n+g+δ)	-0.39 (-0.77)	-0.05 (-1.77)*	0.61 (0.43)	-0.03 (-0.18)
NC	0.12 (0.94)	0.03 (1.02)	0.86 (0.35)	0.17 (2.68)***
INS	0.32 (0.98)	0.15 (2.22)**	0.87 (0.35)	0.10 (1.69)*
NC x INS	0.16 (0.91)	0.20 (2.47)**	0.84 (0.36)	0.07 (1.94)*
	Joint Hausman Test		2.47 (0.78)	
Error Correction Coefficients	-0.47 (-3.99)***	-0.57 (-4.67)***		
Short-Run Coefficients				
ΔKC	0.29 (1.03)	0.16 (1.89)*		
Δ(n+g+δ)	0.13 (0.41)	0.05 (0.88)		
ΔNC	0.08 (0.89)	0.15 (1.15)		
ΔINS	0.15 (0.91)	0.09 (0.84)		
ΔNC x INS	0.11 (1.18)	0.12 (1.07)		
N x T	364	364		364

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

3.5 Conclusions

This chapter examines the role of financial development and institutions in influencing economic growth using the cross-country framework. It also investigates the effect of the interaction term between financial development and institutions on growth. Given the diverse country sample in the analysis, the growth effect may differ across the countries with varying level of economic development. Hence, the relationship between finance, institutions and growth is further analysed at four different stages of economic development using panel data analysis, namely high-income, upper middle-income, lower middle-income and low-income economies, respectively.

The cross-country results based on the augmented Solow Growth model indicate that financial development and institutions are statistically significant to determine economic growth. Nevertheless, the financial development indicators demonstrate more powerful impact on growth compared to institutions variable. The interaction term between financial development and institutions also turned out to be positive, economically large and statistically significant effect on real GDP per capita. This finding suggests that well developed financial development has larger effects on growth when the financial system is embedded within a sound institutional framework. The estimation results are valid using banking sector development and capital market development indicators.

With respect to the panel data analysis, the empirical results suggest that financial development and institutional quality have different impact on economic growth at different stages of economic development. Banking sector development and institutions have a positive sign, but not all banking sector development indicators are statistically significant, whereas institutions variable demonstrate weak statistically significant effect on growth in high-income OECD countries. On the other hand, the capital market development indicators reveal highly statistically significant results to promote growth in high-income countries. The interaction term between finance and institutions, however, demonstrate statistically significant results. These findings seem to suggest that even within high-income countries financial development has positive, albeit smaller direct effects on growth, but its indirect effects are depend on the quality of institutions. Given that institutional quality is higher in

high-income countries, financial development may overall still have large positive effects on economic growth.

The results also suggest that financial development is most potent in delivering extra growth in middle-income countries especially upper middle-income group. Its effects are particularly large when institutional quality is high. Institutional improvement can also deliver more growth, especially when the financial system is developed. With respect to low-income countries, the findings suggest that financial development has weak significant impact on growth but institutions have positive statistically significant direct effects on growth. For poor economies, improvements in institutions are likely to deliver much larger direct effects on growth than financial development itself. Financial development, on the other hand, has larger effect on growth when the financial system is embedded within a sound institutional framework in these economies, where more finance may well fail to deliver more growth, if institutional quality is low.

To conclude, it does appear to be the case that the interaction between financial development and institutional quality, a variable that has been neglected in previous studies, is very important in terms of economic growth at all stages of development. One possible interpretation of this variable is 'quality-adjusted finance' – since more of it is tantamount to a better functioning financial system. Thus, while more finance may not always and everywhere deliver more growth, there does appear to be evidence to suggest that quality-adjusted finance does so.

Appendix 3.I: List of Countries

Table A.3.1: List of 72 Countries for Banking Sector Development Indicators

No.	High-Income OECD	Upper-Middle Income	Lower-Middle Income	Low-Income
1	Australia	Argentina	Algeria	Bangladesh
2	Belgium	Botswana	Bolivia	Burkina Faso
3	Canada	Brazil	Colombia	Cameroon
4	Denmark	Chile	Dominican Republic	Congo, Rep.
5	Finland	Costa Rica	Ecuador	Cote d'Ivoire
6	France	Gabon	Egypt, Arab Rep.	Gambia
7	Greece	Hungary	Guatemala	Ghana
8	Ireland	Korea	Honduras	India
9	Italy	Malaysia	Jamaica	Indonesia
10	Japan	Malta	Jordan	Kenya
11	Netherlands	Mexico	Morocco	Madagascar
12	Norway	Panama	Paraguay	Malawi
13	Portugal	Saudi Arabia	Peru	Mali
14	Spain	South Africa	Philippines	Nigeria
15	Sweden	Trinidad & Tobago	Sri Lanka	Pakistan
16	Switzerland	Turkey	Syrian Arab Republic	Senegal
17	United Kingdom	Uruguay	Thailand	Zambia
18	United States	Venezuela, RB	Tunisia	Zimbabwe

Table A.3.2: List of 44 Countries for Capital Market Development Indicators

No.	Developed OECD	No.	Developing Countries	No.	*Developing Countries*
1	Australia	18	Korea	35	Sri Lanka
2	Belgium	19	Brazil	36	Thailand
3	Canada	20	Chile	37	Bangladesh
4	Denmark	21	Malaysia	38	Cote d'Ivoire
5	Finland	22	Mexico	39	India
6	France	23	Trinidad & Tobago	40	Indonesia
7	Greece	24	Venezuela	41	Kenya
8	Italy	25	Argentina	42	Nigeria
9	Japan	26	South Africa	43	Pakistan
10	Netherlands	27	Turkey	44	Zimbabwe
11	Norway	28	Colombia		
12	Portugal	29	Egypt		
13	Spain	30	Jamaica		
14	Sweden	31	Jordan		
15	Switzerland	32	Morocco		
16	United Kingdom	33	Peru		
17	United States	34	Philippines		

Appendix 3.II: Diagnostic Checking Results for the OLS Regressions

Table A.3.3 Diagnostic Statistics for the High-Income OECD Countries (Financial Development Indicator: Banking Sector Development)

COUNTRY	$\chi^2_{SC}(1)$	$\chi^2_{FF}(1)$	$\chi^2_N(2)$	$\chi^2_H(1)$	$\bar{R}^2$
Model 1					
Australia	2.15	1.50	0.80	0.00	0.92
Canada	0.51	0.00	0.04	4.31*	0.34
Denmark	0.26	3.18	1.85	0.50	0.86
Finland	1.85	3.12	1.67	0.03	0.94
Ireland	7.89*	0.57	0.62	2.32	0.75
Italy	3.14	1.54	0.72	0.35	0.84
Japan	3.64*	4.21*	0.20	0.14	0.99
Norway	0.18	3.42	1.29	0.90	0.78
Sweden	0.73	0.45	0.32	0.29	0.42
Switzerland	0.39	5.35*	0.41	0.03	0.45
UK	9.08*	4.85*	0.12	0.18	0.98
US	0.07	1.16	2.47	1.45	0.85
Model 2					
Australia	2.37	0.11	1.18	0.68	0.85
Belgium	1.94	0.90	0.10	0.55	0.95
Canada	0.02	4.86*	3.49	0.00	0.76
Denmark	2.39	0.49	4.80	1.43	0.97
Finland	0.05	1.62	3.90	0.07	0.85
France	0.65	17.75*	0.88	0.20	0.94
Greece	2.80	1.88	1.29	0.13	0.80
Ireland	5.00*	0.01	0.61	0.43	0.96
Italy	0.25	1.33	1.11	0.11	0.84
Japan	0.88	2.53	1.47	0.16	0.78
Netherlands	1.15	15.30*	1.83	3.15	0.88
Norway	0.05	3.28	0.25	0.00	0.98
Portugal	0.01	0.87	0.35	0.16	0.88
Spain	0.89	2.83	0.15	0.00	0.81
Sweden	0.80	3.88*	0.88	1.43	0.87
Switzerland	0.30	0.97	1.42	0.20	0.90
UK	2.18	0.88	1.03	1.64	0.78
US	0.26	1.20	0.33	1.03	0.94
Model 3					
Australia	0.23	2.63	1.12	0.37	0.89
Belgium	7.44*	0.55	2.31	0.41	0.95
Canada	2.48	1.46	0.40	0.67	0.94
Denmark	0.76	0.45	0.50	1.14	0.31
Finland	4.05*	11.30*	3.73	0.34	0.92
France	2.51	4.91*	0.87	0.94	0.90
Greece	0.07	2.58	2.95	0.44	0.82
Ireland	6.10*	0.02	1.82	0.96	0.96
Italy	0.00	0.57	1.32	0.70	0.88
Japan	1.79	2.14	0.15	0.54	0.96
Netherlands	0.68	0.10	0.67	0.85	0.89
Norway	0.11	3.42	1.48	0.60	0.97
Portugal	0.13	3.66	1.57	0.34	0.96
Spain	0.01	12.60*	0.85	0.74	0.99
Sweden	0.33	1.58	0.87	0.85	0.83
Switzerland	1.19	13.18*	3.61	0.18	0.53
UK	0.02	2.71	0.87	0.70	0.85
US	2.80	0.22	0.39	0.55	0.93

Notes: $\chi^2_{SC}(1)$, $\chi^2_{FF}(1)$, $\chi^2_N(2)$ and $\chi^2_H(1)$, are Lagrange multiplier test statistics for residual serial correlation, functional formmis-specification, non normal errors and heteroskedasticity. Significance at 5% denoted by *.
Critical Values for the Chi-distribution with 1 and 2 degree of freedoms are 3.84 and 5.99, respectively.

Table A.3.4 Diagnostic Statistics for the Upper Middle-Income Countries (Financial Development Indicator: Banking Sector Development)

COUNTRY	$\chi^2_{SC}(1)$	$\chi^2_{FF}(1)$	$\chi^2_N(2)$	$\chi^2_H(1)$	$\bar{R}^2$
Model 1					
Korea	4.14*	6.09*	0.89	2.26	0.35
Brazil	6.07*	5.94*	0.91	0.31	0.42
Chile	0.00	1.08	6.37*	0.06	0.92
Costa Rica	1.34	3.20	2.60	4.95	0.87
Gabon	1.91	5.06*	0.88	4.17	0.53
Malaysia	2.39	3.25	0.80	4.29	0.69
Malta	0.21	2.43	1.05	0.04	0.62
Mexico	3.65	0.02	0.28	0.62	0.88
Trinidad & Tobago	3.24	0.57	0.32	0.43	0.50
Uruguay	0.14	2.60	1.93	0.05	0.75
Venezuela	0.07	1.63	0.90	1.24	0.78
Argentina	1.87	4.81*	0.31	0.03	0.96
Botswana	0.19	0.27	3.09	1.78	0.40
Panama	0.39	3.28	1.12	0.50	0.90
Saudi Arabia	4.38*	3.34	1.29	1.63	0.82
Hungary	3.16	4.96*	5.32	0.85	0.75
South Africa	1.27	0.65	0.62	1.13	0.42
Turkey	3.04	2.28	0.49	4.76	0.63
Model 2					
Korea	3.67	5.03*	0.53	0.31	0.55
Brazil	4.07*	1.55	0.60	0.01	0.39
Chile	0.22	0.90	0.00	0.10	0.97
Costa Rica	0.64	1.94	0.69	2.30	0.88
Gabon	1.90	4.47*	1.26	2.36	0.64
Malaysia	0.05	4.34*	1.25	0.00	0.80
Malta	0.12	3.63	1.24	0.00	0.45
Mexico	0.00	0.93	4.85	0.88	0.91
Trinidad & Tobago	2.66	4.33*	1.48	0.05	0.47
Uruguay	0.80	1.30	2.68	0.18	0.77
Venezuela	0.81	3.78	0.89	0.37	0.82
Argentina	0.60	3.13	3.80	0.38	0.94
Botswana	0.12	0.15	0.58	5.96	0.62
Panama	0.95	3.17	0.76	0.20	0.77
Saudi Arabia	4.63*	3.49	0.68	0.60	0.84
Hungary	1.63	4.73*	0.76	0.41	0.75
South Africa	0.09	0.07	0.22	0.07	0.50
Turkey	1.09	2.37	0.88	1.70	0.72
Model 3					
Korea	3.49	1.61	0.86	0.34	0.99
Brazil	1.74	3.69	6.95*	2.38	0.83
Chile	5.54*	2.31	1.22	0.43	0.98
Costa Rica	3.62	3.74	0.78	2.11	0.89
Gabon	3.46	5.09*	1.54	0.89	0.71
Malaysia	0.05	0.19	0.98	0.51	0.90
Malta	5.59*	5.66*	3.51	5.54	0.85
Mexico	5.60*	3.09	0.36	0.07	0.94
Trinidad & Tobago	3.69	2.57	0.56	0.23	0.79
Uruguay	3.05	3.89	1.86	1.79	0.93
Venezuela	3.59	0.08	0.74	1.24	0.89
Argentina	5.84*	3.77	1.59	1.73	0.97
Botswana	3.65	4.02*	1.64	0.04	0.67
Panama	2.71	0.57	0.46	0.90	0.94
Saudi Arabia	1.61	1.82	0.11	1.27	0.95
Hungary	0.73	0.88	3.25	0.33	0.81
South Africa	2.96	4.67*	1.10	1.76	0.82
Turkey	0.89	3.69	0.13	1.58	0.86

Notes: $\chi^2_{SC}(1)$, $\chi^2_{FF}(1)$, $\chi^2_N(2)$ and $\chi^2_H(1)$, are Lagrange multiplier test statistics for residual serial correlation, functional formmis-specification, non normal errors and heteroskedasticity. Significance at 5% denoted by *.
Critical Values for the Chi-distribution with 1 and 2 degree of freedoms are 3.84 and 5.99, respectively.

Table A.3.5 Diagnostic Statistics for the Lower Middle-Income Countries (Financial Development Indicator: Banking Sector Development)

COUNTRY	$\chi^2_{SC}(1)$	$\chi^2_{FF}(1)$	$\chi^2_{N}(2)$	$\chi^2_{H}(1)$	$\overline{R}^2$
Model 1					
Algeria	6.68*	2.13	0.80	5.30*	0.94
Bolivia	1.13	0.91	2.52	1.97	0.77
Colombia	5.15*	6.08*	3.48	8.10*	0.86
Dominica Rep	3.73	1.78	0.26	0.14	0.89
Ecuador	3.82	4.35*	17.73*	0.01	0.69
Egypt	3.16	1.29	0.99	0.00	0.83
Guatemala	5.04*	3.73	0.73	0.02	0.64
Honduras	3.16	0.00	0.96	0.26	0.68
Jamaica	0.13	0.11	0.45	2.29	0.84
Jordan	3.66	1.87	0.27	2.28	0.95
Morocco	0.00	3.06	1.08	1.10	0.74
Paraguay	1.75	2.17	1.47	0.00	0.65
Peru	4.34*	3.31	1.54	0.69	0.91
Philippines	3.76	3.39	1.09	0.43	0.97
Sri Lanka	5.68*	4.64*	0.41	0.60	0.74
Syrian Arab Rep	5.79*	1.43	0.62	0.64	0.95
Thailand	7.37*	5.15*	0.04	1.10	0.45
Tunisia	0.17	1.40	1.66	2.30	0.20
Model 2					
Algeria	0.21	0.52	0.87	2.78	0.75
Bolivia	3.70	2.52	1.28	0.12	0.70
Colombia	0.04	3.63	1.20	1.63	0.32
Dominica Rep	0.04	3.22	0.77	0.57	0.47
Ecuador	0.62	2.03	2.45	2.96	0.38
Egypt	0.12	5.06*	1.16	0.04	0.41
Guatemala	0.05	2.27	10.40*	2.57	0.55
Honduras	3.68	0.59	0.55	0.42	0.35
Jamaica	3.69	2.22	2.47	4.16*	0.60
Jordan	0.78	5.11*	7.06*	1.57	0.48
Morocco	6.23*	0.22	1.23	0.00	0.53
Paraguay	0.14	0.01	0.38	0.81	0.69
Peru	4.91*	1.83	0.37	1.73	0.46
Philippines	0.54	3.04	2.72	0.02	0.81
Sri Lanka	0.02	4.23*	0.21	0.03	0.43
Syrian Arab Rep	0.21	3.82	0.66	0.11	0.70
Thailand	0.45	1.65	0.66	0.01	0.84
Tunisia	4.33*	3.76	6.23*	0.27	0.42
Model 3					
Algeria	0.14	3.85	0.34	0.05	0.66
Bolivia	0.75	4.50*	5.66	0.06	0.69
Colombia	1.36	5.13*	1.18	0.01	0.55
Dominica	0.04	2.15	1.82	0.02	0.72
Ecuador	0.43	2.37	10.17*	0.13	0.42
Egypt	5.30*	3.75	1.18	2.91	0.33
Guatemala	0.27	3.32	0.12	7.05*	0.78
Honduras	0.03	3.68	0.82	2.01	0.48
Jamaica	2.29	2.96	1.28	1.30	0.55
Jordan	3.43	3.73	1.30	4.62*	0.75
Morocco	3.71	0.16	1.09	0.54	0.69
Paraguay	0.70	0.07	1.01	2.13	0.90
Peru	3.44	0.06	0.70	0.25	0.31
Philippines	1.40	5.89*	1.24	0.45	0.88
Sri Lanka	2.04	6.15*	2.95	2.90	0.42
Syrian Arab Rep	3.93*	2.51	1.05	0.01	0.74
Thailand	2.17	4.94*	0.56	0.02	0.93
Tunisia	0.18	0.35	9.56*	0.27	0.45

Notes: $\chi^2_{SC}(1)$, $\chi^2_{FF}(1)$, $\chi^2_{N}(2)$ and $\chi^2_{H}(1)$, are Lagrange multiplier test statistics for residual serial correlation, functional formmis-specification, non normal errors and heteroskedasticity. Significance at 5% denoted by *.
Critical Values for the Chi-distribution with 1 and 2 degree of freedoms are 3.84 and 5.99, respectively.

Table A.3.6 Diagnostic Statistics for the Low-Income Countries (Financial Development Indicator: Banking Sector Development)

COUNTRY	$\chi^2_{SC}(1)$	$\chi^2_{FF}(1)$	$\chi^2_N(2)$	$\chi^2_H(1)$	$\overline{R}^2$
Model 1					
Bangladesh	3.50	6.69*	9.86*	0.67	0.24
Burkina Faso	4.17*	0.07	1.23	0.23	0.61
Cameroon	6.41*	1.20	1.12	0.32	0.81
Congo, Rep	0.03	2.65	1.48	0.84	0.64
Cote d'Ivoire	0.02	0.83	0.26	1.48	0.78
Gambia	3.50	2.09	1.03	1.45	0.59
Ghana	1.51	0.59	45.18*	0.00	0.54
India	3.44	1.67	4.15	0.27	0.87
Indonesia	3.51	6.99*	0.24	0.07	0.83
Kenya	0.02	1.11	0.49	0.36	0.72
Madagascar	1.47	5.91*	1.47	7.64*	0.79
Malawi	0.14	2.24	1.08	0.47	0.49
Mali	3.73	0.22	6.87*	0.62	0.58
Nigeria	0.54	0.69	0.32	0.27	0.81
Pakistan	1.88	0.51	0.24	1.31	0.33
Senegal	4.78*	2.40	0.22	1.17	0.61
Zambia	6.30*	2.23	1.85	1.35	0.58
Zimbabwe	3.48	3.55	2.19	0.34	0.79
Model 2					
Bangladesh	7.66*	3.71	2.64	0.01	0.26
Burkina Faso	3.64	0.02	0.11	0.43	0.73
Cameroon	6.63*	2.06	1.15	0.30	0.82
Congo, Rep	1.19	2.82	4.04	0.89	0.65
Cote d'Ivoire	1.14	2.74	5.89	10.27*	0.71
Gambia	2.47	1.22	0.18	0.32	0.73
Ghana	0.36	8.49*	0.96	2.93	0.74
India	8.13*	9.59*	1.01	11.76*	0.76
Indonesia	0.41	11.32*	1.50	1.50	0.81
Kenya	6.04*	1.08	0.66	0.33	0.30
Madagascar	0.48	3.71	0.95	10.08*	0.88
Malawi	0.12	0.48	3.43	0.17	0.82
Mali	0.04	3.49	1.44	0.77	0.64
Nigeria	0.27	1.06	3.29	1.87	0.70
Pakistan	1.10	3.60	0.94	0.02	0.54
Senegal	2.94	1.38	0.69	2.61	0.30
Zambia	3.04	8.59*	0.45	0.02	0.54
Zimbabwe	1.52	0.21	2.97	0.01	0.70
Model 3					
Bangladesh	3.73	3.31	1.88	0.00	0.71
Burkina Faso	9.25*	0.48	2.48	0.48	0.75
Cameroon	3.10	1.55	0.93	0.16	0.82
Congo, Rep	0.54	1.90	3.50	0.89	0.66
Cote d'Ivoire	2.43	3.58	9.77*	11.19*	0.71
Gambia	0.25	5.19*	0.54	7.04*	0.53
Ghana	0.29	1.08	4.13	1.55	0.46
India	3.51	3.54	0.65	0.31	0.83
Indonesia	2.26	5.07*	0.42	0.51	0.90
Kenya	5.18*	0.09	1.04	2.53	0.29
Madagascar	5.97*	6.13*	0.24	5.98*	0.88
Malawi	3.59	0.44	0.29	0.31	0.72
Mali	3.66	1.86	0.51	3.98*	0.60
Nigeria	6.38*	3.10	0.12	1.08	0.77
Pakistan	0.82	0.00	0.38	0.55	0.54
Senegal	0.18	0.03	0.68	0.46	0.50
Zambia	0.80	0.24	2.12	0.00	0.74
Zimbabwe	3.56	0.11	1.85	0.17	0.71

Notes: $\chi^2_{SC}(1)$, $\chi^2_{FF}(1)$, $\chi^2_N(2)$ and $\chi^2_H(1)$, are Lagrange multiplier test statistics for residual serial correlation, functional formmis-specification, non normal errors and heteroskedasticity. Significance at 5% denoted by *.
Critical Values for the Chi-distribution with 1 and 2 degree of freedoms are 3.84 and 5.99, respectively.

Table A.3.7 Diagnostic Statistics for the Developed Countries (Financial Development Indicator: Capital Market Development)

COUNTRY	$\chi^2_{SC}(1)$	$\chi^2_{FF}(1)$	$\chi^2_N(2)$	$\chi^2_H(1)$	$\overline{R}^2$
Model 1					
Australia	2.99	2.14	0.87	4.84	0.99
Belgium	1.50	2.74	0.56	1.04	0.90
Canada	4.12	2.11	0.38	0.59	0.89
Denmark	3.25	9.35*	0.00	0.05	1.00
Finland	9.44*	3.81	0.38	1.19	1.00
France	9.56*	3.01	1.29	2.95	0.93
Greece	2.61	1.90	0.11	0.04	1.00
Italy	3.11	3.00	0.31	0.41	0.97
Japan	3.28	3.00	0.09	3.91	0.99
Netherlands	5.36*	1.49	1.15	1.23	0.96
Norway	2.04	1.42	0.12	0.83	0.61
Portugal	2.19	3.09	0.59	2.18	0.95
Spain	3.47	3.01	2.07	0.24	0.95
Sweden	2.99	4.42*	5.12*	2.44	1.00
Switzerland	3.23	3.00	0.15	1.64	0.99
UK	3.81	2.19	1.34	0.31	0.94
USA	3.15	3.00	0.06	3.42	0.99
Model 2					
Australia	4.49*	3.00	0.33	0.02	0.99
Belgium	3.65	3.08	1.02	0.03	0.97
Canada	1.36	2.29	0.91	0.90	0.95
Denmark	2.28	4.58*	10.78*	0.42	0.99
Finland	4.47*	3.24	1.48	0.01	1.00
France	3.52	3.05	0.15	1.29	0.99
Greece	3.36	2.58	0.74	1.13	0.53
Italy	3.25	3.14	1.70	1.93	0.99
Japan	2.33	2.78	0.43	1.06	1.00
Netherlands	4.56*	2.99	0.30	0.38	0.97
Norway	2.89	0.85	0.50	1.51	0.99
Portugal	3.39	4.56*	0.15	1.68	0.99
Spain	3.56	2.09	0.11	0.00	1.00
Sweden	3.25	3.00	2.28	0.38	1.00
Switzerland	1.98	3.11	0.68	0.63	0.86
UK	3.00	3.36	0.60	1.17	0.38
US	3.14	2.87	0.51	0.80	0.98

Notes: $\chi^2_{SC}(1)$, $\chi^2_{FF}(1)$, $\chi^2_N(2)$ and $\chi^2_H(1)$, are Lagrange multiplier test statistics for residual serial correlation, functional formmis-specification, non normal errors and heteroskedasticity. Significance at 5% denoted by *.
Critical Values for the Chi-distribution with 1 and 2 degree of freedoms are 3.84 and 5.99, respectively.

Table A.3.8 Diagnostic Statistics for the Developing Countries (Financial Development Indicator: Capital Market Development)

COUNTRY	$\chi^2_{SC}(1)$	$\chi^2_{FF}(1)$	$\chi^2_N(2)$	$\chi^2_H(1)$	$\overline{R}^2$
Model 1					
Korea	2.93	0.95	0.79	1.79	0.54
Brazil	1.67	3.68	0.76	0.10	0.61
Chile	0.57	1.59	6.29*	0.22	0.27
Malaysia	0.00	4.64*	0.18	0.00	0.79
Mexico	2.49	3.28	0.91	3.46	0.56
Venezuela	6.25*	2.11	0.22	0.03	0.72
Argentina	7.64*	3.63	1.02	1.05	0.46
South Africa	3.17	3.57	0.90	1.80	0.70
Turkey	6.18*	3.10	0.37	0.31	0.69
Colombia	0.18	2.77	0.22	5.42	0.34
Egypt	0.71	3.43	11.00*	0.24	0.33
Jamaica	2.52	3.27	0.86	0.02	0.43
Jordan	3.23	5.82*	0.20	0.63	0.85
Morocco	3.08	3.09	0.20	0.83	0.51
Peru	0.14	3.71	0.33	0.08	0.65
Philippines	1.58	2.95	1.69	0.01	0.33
Sri Lanka	1.10	3.70	1.03	0.79	0.26
Thailand	1.01	8.54*	0.89	0.29	0.12
Bangladesh	3.56	0.07	0.71	0.13	0.50
Cote d'Ivoire	5.96*	7.69*	0.46	0.16	0.92
India	1.87	0.11	1.49	0.23	0.97
Indonesia	0.30	4.88*	0.42	0.07	0.73
Kenya	0.03	0.58	2.01	0.09	0.50
Nigeria	1.19	3.44	0.95	0.42	0.87
Pakistan	7.21*	3.34	0.63	0.47	0.40
Zimbabwe	3.09	3.26	0.67	0.22	0.59
Model 2					
Korea	3.14	3.04	0.86	0.13	0.68
Brazil	3.02	5.66*	0.65	1.34	0.90
Chile	3.62	0.71	0.87	0.20	0.95
Malaysia	3.69	2.99	6.65*	0.00	0.79
Mexico	3.58	4.32*	0.56	0.14	0.64
Venezuela	3.47	2.95	0.26	1.83	0.98
Argentina	4.13*	3.62	1.84	1.13	0.58
South Africa	2.90	0.16	0.45	0.64	0.88
Turkey	2.23	2.94	0.84	1.18	0.94
Colombia	3.11	3.02	0.82	0.43	0.71
Egypt	4.13*	3.69	9.30*	1.05	0.55
Jamaica	3.22	0.01	4.63	0.52	0.99
Jordan	2.29	0.09	3.45	0.79	0.60
Morocco	3.80	0.71	1.83	0.02	0.83
Peru	3.99*	3.11	0.31	0.70	0.58
Philippines	2.62	3.39	1.79	2.95	0.98
Sri Lanka	3.36	3.78	0.33	0.04	0.94
Thailand	2.45	2.57	0.18	2.25	0.93
Bangladesh	7.26*	8.90*	0.44	0.11	0.98
Cote d'Ivoire	3.52	3.00	0.31	0.23	0.99
India	3.77	3.47	9.94*	0.04	0.98
Indonesia	3.50	3.15	0.79	0.29	0.47
Kenya	5.69*	3.07	0.14	0.08	0.52
Nigeria	3.69	3.06	7.72*	1.02	0.89
Pakistan	3.20	0.06	6.48*	0.41	0.75
Zimbabwe	3.29	2.51	0.30	2.57	0.87

Notes: $\chi^2_{SC}(1)$, $\chi^2_{FF}(1)$, $\chi^2_N(2)$ and $\chi^2_H(1)$, are Lagrange multiplier test statistics for residual serial correlation, functional formmis-specification, non normal errors and heteroskedasticity. Significance at 5% denoted by *.
Critical Values for the Chi-distribution with 1 and 2 degree of freedoms are 3.84 and 5.99, respectively.

CHAPTER FOUR

FINANCIAL DEVELOPMENT, TRADE OPENNESS AND CAPITAL INFLOWS

4.1 Introduction

Financial markets and institutions perform an important function in the economic development process, particularly through their role in allocating finance to various productive activities, including investment in new plant and equipment, working capital for firms etc. As shown in Chapter 3, the empirical results indicate that financial development is statistically significant to promote long-run economic growth, which is consistent with the existing literature (King and Levine, 1993a and 1993b; Demetriades and Hussein, 1996; Levine, 1997; Demirguc-Kunt and Maksimovic, 1998; Rajan and Zingales, 1998; Luintel and Khan, 1999; Demetriades and Andrianova, 2004 and Honohan, 2004). Levine (2003) provides an excellent overview of a large body of empirical literature that suggests that financial development can robustly explain differences in economic growth across countries. Nevertheless, an interesting question remains why, if financial development is so good for growth, have so many countries remained financially under-developed? More broadly, why have some economies developed well-functioning financial markets and institutions, while others have not?

Through arduous data collection from 49 countries and careful analysis, La Porta *et al.* (1997) substantially advance research into the legal determinants of financial development. Specifically, they explore the contribution of a country's legal origin in the formation of its financial structure and its corporate governance institutions. They find that legal origin – be it English common law, or French, German or Scandinavian civil law – partly determines the quality of investor protection and the relative size of the stock market vis-à-vis the banking system. They find that English common law systems generally have the strongest investor protection enforcement, followed by Germany, Scandinavian, and lastly, French civil systems. Another point of view that discusses the differences across countries financial development is the endowment theory of institutions proposed by Acemoglu *et al.* (2001). These authors argue that the disease environment encountered by colonizers

influenced the formation of long-lasting institutions that helped to shape financial development. Beck *et al.* (2003a) examine both the law and endowment historical determinants of financial development, and find that the empirical results provide support for both theories. Nevertheless, initial endowments tend to explain more of the cross-country variation in financial intermediary and stock market development.

Though the law and finance and endowment theory are the two leading explanations for the variance in the proficiency of financial depth across countries, a third rationale is also gaining momentum. Rajan and Zingales (2003) analyse the importance of interest group politics in influencing financial development. According to them, politics, driven by special-interest groups representing established business, can explain this uneven evolution of capital markets. They propose an "interest group" theory of financial development where incumbents oppose financial development because it produces fewer benefits for them than for potential competitors. The incumbents will shape policies and institutions to their own advantage when they gain power. Incumbents can finance investment opportunities mainly with retained earnings, whereas potential competitors need external capital to start up. Thus, when a country is open to trade and capital flows, it is more likely to deliver benefits to financial development because openness to both trade and finance breeds competition and threatens the rents of incumbents. In other words, open borders help to check the political and economic elites and preserve competitive markets. Globalisation forces countries to do what is necessary to make their economies productive, not what is best for incumbent elites.

This chapter provides empirical evidence pertaining to the Rajan and Zingales (2003) hypothesis, namely that openness to both trade and capital flows has a positive influence on financial development. If true, this hypothesis has very important policy implications, namely it calls for simultaneous trade and financial liberalisation. This would run contrary to the sequencing literature, which advocates that trade liberalisation should precede financial liberalisation and that capital account opening should be the last stage in the liberalisation process (e.g. McKinnon, 1991).

So far the evidence on the Rajan and Zingales (2003) hypothesis remains limited. The sample of countries used by Rajan and Zingales themselves, dictated by limited data availability in the pre-World War II period, means that their conclusions are, at best,

tentative. Other authors have examined related questions but have not examined the Rajan-Zingales hypothesis directly. Levine (2001), for example, finds that liberalising restrictions on international portfolio flows tends to enhance stock market liquidity, and allowing greater foreign bank presence tends to enhance the efficiency of the domestic banking system. Chinn and Ito (2002) show that there is a strong relationship between capital controls and financial development. Their finding holds for less developed countries in terms of stock market value traded, and even more so for emerging market economies. Klein and Olivei (1999) point out that capital account liberalisation has a substantial impact on growth via the deepening of a country's financial system in highly industrialised countries, but there is little evidence of financial liberalisation promoting financial development outside members of the OECD. In terms of trade openness, Beck (2003) shows that countries with better-developed financial systems have higher shares of manufactured exports in GDP and in total merchandise exports.

This chapter represents an advance over previous empirical literature in a number of important respects. First, it provides a direct test of the Rajan and Zingales (2003) hypothesis using appropriately specified financial development equations. They state that when a country's borders are open to both capital flows and trade, there would be stronger incentives for financial development. However, in their study, Rajan and Zingales (2003) only test for the role of trade openness in influencing financial development in a group of developed countries. This chapter not only incorporates the role of capital inflows, but also includes the interaction term between capital inflows and trade openness in the model specification. Second, the financial development equations control not only for the conventional determinants of financial development such as real GDP and real interest rate, but also for institutional quality, an emerging important variable in recent studies (See, for example, Demetriades and Andrianova, 2004) or Chapter Three of this thesis. Third, this study uses a much larger data set than Rajan and Zingales (2003), which enables robust conclusions to be drawn from the econometric results; specifically, the sample utilised in this paper consists of annual data from 43 developing countries, covering the period 1980 – 2000. Fourth, the time dimension of our data set allows us to examine whether the estimation results are sensitive to the period under consideration, since the 1990s were

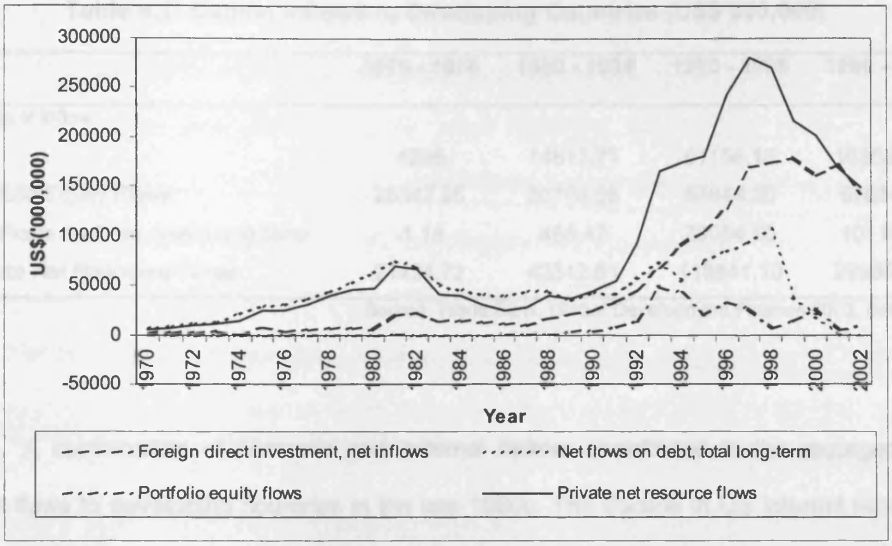
characterised by increasing degrees of liberalisation of domestic financial markets compared to the 1980s[51]. Fifth, the paper utilises a variety of financial development and capital inflows measures, which purport to capture various aspects of financial deepening and capital mobility. Finally, besides using cross-country estimation methods, the paper also employs dynamic panel data analysis - namely the pooled mean group (PMG) estimator (Pesaran *et al.*, 1999), which has a number of econometric advantages compared to traditional panel data estimation.

This chapter is organised into six sections, including introduction and concluding remarks. Section 4.2 describes the capital inflows and trade openness in developing countries. Section 4.3 explains the empirical model and econometric methodology. Section 4.4 explains the data employed in the analysis and section 4.5 reports and discusses the econometric results. Finally, the last section summarises the main results along with the concluding remarks.

4.2 Capital Flows and Trade Openness in Developing Economies

The developing country experience with capital flows has been characterised by cycles of booms and busts. With the onset of the debt crisis in 1982, capital inflows to developing countries declined dramatically and remained small during most of the 1980s (see Figure 4.1). This trend was reversed in the late 1980s, and capital flows to Asia and Latin America increased substantially in the first half of the 1990s. Capital flows, especially to Asia, slowed down considerably in the wake of the East Asian financial crisis in 1997. Capital flows to developing countries remained subdued in the second half of the 1990s, reflecting the effects of the Asian crisis as well as the Russian and Brazilian crises of 1998 and 1999.

[51] Total private capital flows to developing countries increased more than sixfold to reach US$200 billion per year during 1995-97 from around US$30 billion per year during 1984-86 (World Bank, 1997).



Source: World Bank, Global Development Finance 2003, database.

Figure 4.1: Private Capital Flows to Developing Countries

Capital flows to developing countries in the 1970s were associated with the recycling of oil revenues – the so-called petrodollars – by oil producing countries. As the petrodollars were intermediated through international commercial banks, capital flows to developing countries were primarily in the form of syndicated bank loans. Capital inflows to developing countries during 1978 – 1981 averaged US$68 billion, and were comprised mainly of bank loans. This trend came to an abrupt halt in 1982 when Mexico declared a moratorium on its debt-service payments in August of that year. This, combined with the debt service difficulties of other Latin American countries including Argentina and Brazil, led to a rapid decline in capital flows to the region. The decline in total capital flows to developing countries was fully accounted for by the decline in capital flows to Latin America, which as a whole experienced a net outflow during 1983 – 1989. In contrast, capital flows to Asia and developing countries in other regions increased modestly during this period.

Table 4.1: Capital Inflows to Developing Countries (US$'000,000)

	1970 - 1979	1980 - 1989	1990 - 1995	1996 – 2000
By type of inflow				
FDI	4286	14817.77	61156.15	163880.70
Portfolio Equity Flows	25567.25	50708.55	57844.20	57034.30
Net Flows on Debt, total Long-term	-1.16	468.47	23054.65	19119.60
Private Net Resource Flows	21424.72	42312.81	118841.10	229851.30

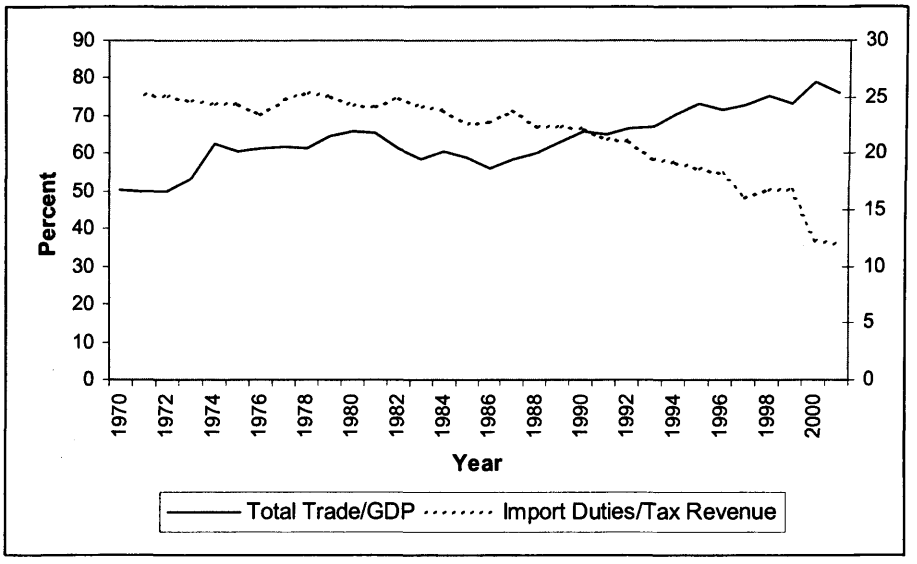
Source: World Bank, Global Development Finance 2003, database.

A combination of domestic and external factors contributed to the resurgence of capital flows to developing countries in the late 1980s. The decline in US interest rates and the growth of institutional investors worldwide in the early 1990s were the primary factors. In addition to the surge in magnitude, there were also important changes in composition of capital flows. While bank flows were dominant during the 1970s, capital flows in this episode consisted mainly of foreign direct investment and portfolio flows (see Table 4.1). Capital flows to Asia were primarily in the form of FDI, whereas portfolio flows were more important in Latin America, accounting for over 60 percent of total inflows. Further, much of the foreign borrowing during the 1970s was done by the public sector, while capital flows in the early 1990s were primarily directed at the private sector.

This new wave of capital flows was perceived as a positive global development. It provided increased diversification opportunities to investors in developed countries. Capital inflows also held the potential of augmenting domestic investment, and hence economic growth in emerging economies that had until then experienced years of tight external financing constraints. For Latin America, in particular, the renewed access to international capital markets seemed to signal an end to the 'lost decade' of the 1980s. At the same time, given the experience of the early 1980s, many voiced concerns about the potential risks of capital flows, especially short-term capital flows. Of particular concern was that, as in the previous episode, capital flows could reverse abruptly and lead to balance-of-payments crises. The Mexican peso crisis of 1994 validated some of these concerns. Other countries affected by the crisis included Argentina and Brazil, and to a lesser extent, Thailand and Hong Kong. The contagion from the Mexican crisis was short-lived and capital flows to developing countries reached a record level of US$212 billion in 1996.

In contrast, the impact of the Asian crisis that followed Thailand's devaluation of the baht in 1997 was more widespread and longer lasting. While FDI and portfolio flows to the five Asian countries most affected by the crisis recovered fairly quickly, these countries continued to experience net outflows as international banks reduced their exposure to the region. The Asian crisis, combined with the Russian and the Brazilian crises in 1998 and 1999, led to a significant decline in capital flows to most developing countries.

In terms of trade openness, developing countries have experienced extensive and rapid trade liberalisation in recent years, undertaken both in the context of multilateral trade negotiations, and as part of the conditionality linked to structural adjustment and stabilisation programmes agreed with the International Monetary Fund and the World Bank. Figure 4.2 shows the time plot of trade/GDP cover 43 developing countries that employed in the analysis. It is averages for the period and indicates the total trade has an upward trend. On the other hand, the import duties in developing countries have decreased over the past three decades. The decline of import duties represents more trade liberalization in these economies.



Source: World Bank, World Development Indicators 2003, database.

Figure 4.2: Total Trade and Import Duties of Developing Countries

4.3 The Empirical Model and Methodology

4.3.1 The Empirical Model

The empirical model is this study is based on McKinnon-Shaw type models and the endogenous growth literature, where both theoretical literature predicts financial development to be a positive function of real income and the real interest rate. McKinnon (1973) and Shaw (1973) argued that financial development could cause economic growth especially via the effective resource allocation channel, unless the government has direct interventions on financial market that degenerates the resource allocation. In the McKinnon-Shaw literature, an increase in financial saving relative to the level of real economic activity increases the extent of financial intermediation and raises productive investment which, in turn, raises income per capita. In the model of McKinnon (1973), the positive relationship between financial development and the level of income results from the complementarity between money and capital. It is assumed that investment is lumpy and self-financed and hence cannot be materialised unless adequate savings are accumulated in the form of bank deposits. In the model of Shaw (1973), financial markets, through debt intermediation, promote investment which, in turn, raises the level of output. A positive real interest rate, in these models, increases financial depth through the increased volume of financial saving mobilisation and promotes growth through increasing the volume and productivity of capital. Higher real interest rates exert a positive effect on the average productivity of physical capital by discouraging investors from investing in low return projects (Fry, 1995b, 1997).

The endogenous growth literature also predicts a positive relationship between real income, financial development, and the real interest rate. As described by Greenwood and Jovanovic (1990), financial intermediaries can economise the cost of acquiring and processing information about investment. Thus, savings channeled through financial intermediaries are allocated more efficiently. The ability to acquire and process information leads to higher economic growth because of the following reasons. First, financial markets and intermediaries can select to allocate funds to the most promising firms and managers. This produces a more efficient allocation of capital and faster growth. In addition, financial

intermediations may also stimulate the rate of technological innovation by providing loans to entrepreneurs with the best chances of successfully initiating new goods and production processes. More recent works, including Bencivenga and Smith (1991), King and Levine (1993b and 1993c), Levine *et al.* (2000) focus on the role of intermediation in cases of market intervention by their services of risk pooling and transmission of information among economic agents in an endogenous framework, where they also suggest a positive effect of financial development on economic development.

Based on these theoretical postulates, a financial development relationship can be specified as:

$$FD = f(RGDPC, R) \tag{4.1}$$

where *FD* is financial development, *RGDPC* is the real GDP per capita, and *R* is the real interest rate.

Recently, the role of institutions in influencing financial development has also received attention in the literature (Acemoglu *et al.* 2001). Arestis and Demetriades (1997) suggest that differences between finance-growth causal patterns may reflect institutional differences. Chinn and Ito (2002) find that financial systems with a higher degree of legal/institutional development on average benefit more from financial liberalisation than those with a lower one. Demetriades and Andrianova (2004) argue that the strength of institutions, such as financial regulation and the rule of law, may determine the success or failure of financial reforms.

Therefore, Equation (4.1) is extended to incorporate institutions. Capital inflows and trade openness are also included in order to examine the possible separate influence of trade and capital account openness. Thus, the basic financial development equation is extended as follows:

$$FD = f(RGDP, R, INS, CIF, TO) \tag{4.2}$$

where *INS* is institutional quality, *CIF* is capital inflows and *TO* is trade openness. In order to examine directly the hypothesis proposed by Rajan and Zingales (2003) an interaction term between the last two variables is also included in the model as follows:

$$FD = f(RGDP, R, INS, CIF, TO, CIF \times TO) \tag{4.3}$$

Equations (4.2) and (4.3) provide the basis for the empirical models that are estimated in this study. Three econometrics methods are employed to estimate the two equations, namely:

(i) Simple ordinary least squares (OLS)

The pure cross-sectional, OLS analysis uses data averaged over 1980 – 2000, such that there is one observation per country. We focus on these time periods because we have complete data for the 43 developing countries over this period[52]. The OLS regression takes the forms:

$$\ln FD_i = \beta_0 + \beta_1 \ln RGDPC_i + \beta_2 R_i + \beta_3 \ln INS_i + \beta_4 \ln CIF_i + \beta_5 \ln TO_i + \varepsilon_i \qquad (4.4)$$

where the dependent variable, *FD* is financial development indicator, *RGDPC* is real GDP per capita, *R* is the real interest rate (deflated by inflation), *INS* is institutional quality, *CIF* is the capital inflows, *TO* is trade openness and ε_i is the residuals.

The model that includes the interaction term between capital inflows and trade openness is as follows:

$$\ln FD_i = \beta_0 + \beta_1 \ln RGDPC_i + \beta_2 R_i + \beta_3 \ln INS_i + \beta_4 \ln CIF_i + \beta_5 \ln TO_i + \beta_6 \ln(CIFxTO)_i + \varepsilon_i \qquad (4.5)$$

If β_6 is found to be positive and statistically significant, then this implies that the combination of financial and trade openness exerts an independent influence on financial development, over and above any influence each of these two variables may separately have on financial development. Thus, $\beta_6 > 0$ provides support to the Rajan and Zingales (2003) hypothesis. Three diagnostic tests are presented in order to check the robustness of cross-sectional analysis, namely the Jarque-Bera normality test, the Breusch-Pagan heteroscedasticity test and the Ramsey RESET test of functional form.

[52] Data on capital inflows for these economies are only available since the 1980s.

(ii) Two-stage least squares (2SLS) instrumental variable estimator within a purely cross-country context

Recent literature has discussed the possibility of bi-directional causal effect between financial development and economic growth (Demetriades and Hussein, 1996; Luintel and Khan, 1999). It is, therefore, likely that OLS produces biased and imprecise estimates. The two-stage least squares (2SLS) estimator is therefore employed to control for potential endogeneity problems in estimating Equations (4.4) and (4.5). A potential good instrument for *RGDPC*, which is likely to be correlated with economic performance but uncorrelated with the error term, is lagged income (real GDP per capita in year 1965, $RGDPC_{1965}$)[53].

(iii) Pooled Mean Group Estimations[54].

4.4 The Data

The data set consists of a panel of observations for a group of developing countries for the period 1980 – 2000. Two groups of financial development indicators are employed in the analysis, namely banking sector development and capital market development. The three conventional variables to measure the banking sector development are liquid liabilities, private sector credit and domestic credit provided by banking sector, whereas the three variables to represent capital market development are stock market capitalisation, total share value traded and number of companies listed[55]. All these financial development variables are expressed as ratios to GDP except for the number of companies listed, which is divided by total population. The main sources of these annual data are the World Development Indicators (World Bank CD-ROM 2003) and Beck *et al.* (2003b). The banking sector development indicators are employed in the cross-country estimation as well as the panel data analysis; whereas the capital market development indicators are only utilised in the panel data analysis because these indicators are only available for 22 developing countries.

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[53] The initial income of year 1970 ($RGDPC_{1970}$) is also used as an instrumental variable and the results are similar with year 1965.

[54] Similar discussion of this estimator can be found on pages 82-85 (Chapter Three).

[55] Similar description of these financial development indicators can be found on pages 87 – 90 (Chapter Two).

Annual data on real GDP per capita and real deposit interest rate (deflated by inflation) are obtained from the World Development Indicators (World Bank CD-ROM 2003) and International Financial Statistics (IFS). The real GDP per capita is converted to US dollars based on 1995 constant prices.

The institutions data set employed in this study was assembled by the IRIS Center of the University Maryland from the International Country Risk Guide (ICRG) – a monthly publication of Political Risk Services (PRS)[56]. Following Knack and Keefer (1995), five PRS indicators are used to measure the overall institutional environment, namely: (i) *Corruption* (ii) *Rule of Law* (iii) *Bureaucratic Quality* (iv) *Government Repudiation of Contracts* and (v) *Risk of Expropriation*. The above first three variables are scaled from 0 to 6, whereas the last two variables are scaled from 0 to 10. Higher values imply better institutional quality and vice versa. The institutions indicator are obtained by summing the above five indicators[57].

4.4.1 Capital Inflows Indicators

Three capital inflows proxies are employed to assess whether capital inflows have any impact on financial development, namely private capital inflows, inflows of capital and capital account liberalisation indicator constructed by Chinn and Ito (2002)[58]. The first indicator is obtained from the World Development Indicators. The inflows of capital indicator, which is obtained from the International Financial Statistics (IFS) is only employed in the panel data analysis because of the data set is available for 16 countries. Nevertheless, the private capital inflows indicator is employed in both cross-country estimation and panel data analysis. The definitions of the capital inflow indicators are presented in Table A.4.2 (see Appendix 4.III).

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[56] See **Appendix B** for more details.

[57] Similar description of institutions indicator can be found on pages 90 – 91 (Chapter Two)

[58] The index on capital account openness from Chinn and Ito (2002) is based on the four binary dummy variables reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER)*. These variables are to provide information on the extent and nature of the restrictions on external accounts for a wide cross-section of countries. See Appendix 4.II for the details. The capital account liberalisation indicator is employed solely in the cross country analysis due to this data set having no variation over time for most of the developing countries, which indicates that the sample developing countries do not embark on programs of capital account liberalisation.

4.4.2 Trade Openness Indicators

Two trade openness proxies are employed in the analysis to explore the relationship between trade openness and financial development. The first measure is calculated using trade volumes, namely the ratio of exports plus imports to GDP. The second measure is based on trade restriction, namely import duties (ID)[59] as a percentage of the value of imports. Both indicators are available from World Development Indicators. Due to the import duties indicator being available for 15 developing countries only, this variable is employed in the panel data analysis alone. Rajan and Zingales (2003) suggest that openness fosters financial development. Therefore, higher import duties would discourage financial development or there is a negative relationship between both variables. As such, the import duties indicator was first converted to (1 – ID/100) in order to have consistent positive relationship with trade openness. In other words, the inverse import duties indicator measures trade openness or low trade barriers, thus the interaction term between capital inflows and trade openness can be quantified since this term has positive impact on financial development as highlighted in the theory. The definitions of the trade openness indicators are presented in Table A.4.2 (see Appendix 4.III).

4.4.3 Descriptive Statistics and Correlations

Table 4.2 reports summary statistics results of banking sector development indicators (N = 43), capital market development indicators (N = 22) and other variables that employed in the analysis, where the sample period is covering from 1980 – 2000[60]. There is considerable variation among these variables especially the financial development indicators, real GDP per capita and institutions. Malaysia, one of the developing countries in this group, has the highest private sector credit, domestic credit, stock market capitalisation, total share value traded, number of companies listed, trade openness and institutions, whereas it ranks second highest in terms of liquid liabilities (after Jordan) and capital inflows

[59] Import duties are the sum of all levies collected on goods at the point of entry into the country and are used as a measure of the average import tariff rate.
[60] Except for the number of companies listed, which is spanning from 1988 – 2000.

(after Chile). These observations indicate that capital inflows and trade openness may be positively correlated with financial development.

Table 4.2: Descriptive Statistics

Banking Sector Development								
N = 43	LL	PRI	DOC	RGDPC	R	INS	CIF	TO
Mean	40.62	31.25	45.44	1812.94	-2.00	27.18	2.47	62.61
Std Dev	20.17	19.55	25.18	1810.59	5.94	4.79	1.77	26.52
Maximum	102.06	91.80	109.33	7723.25	8.21	36.06	7.70	144.56
Minimum	14.88	3.83	-32.27	153.27	-20.50	18.53	0.18	16.89

Capital Market Development								
N = 22	MC	VT	NC	RGDPC	R	INS	CIF	TO
Mean	21.95	9.08	0.00093	2215.59	-0.43	28.75	2.79	66.21
Std Dev	26.39	14.42	0.00087	1940.39	5.07	4.26	1.81	29.43
Maximum	121.87	54.80	0.00296	8082.44	7.31	36.95	7.53	149.14
Minimum	0.79	0.04	0.00010	250.94	-13.97	20.43	0.58	19.57

Note: LL = Liquid Liabilities/GDP; PRI = Private Sector Credit/GDP; DOC = Domestic Credit/GDP; RGDPC = Real GDP Per Capita; R = Real Interest Rate; INS = Institutions; CIF = Private Capital Flows; TO = Trade Openness; MC = Stock Market Capitalisation/GDP; VT = Total Share Value Traded/GDP; NC = Number of Companies Listed/Population

Table 4.3 reports the correlation results and this table reveals that capital inflows and trade openness are indeed positively correlated with the financial development indicators. For example, the correlation results between capital inflows and three banking sector development indicators namely liquid liabilities, private sector credit and domestic credit are 0.41, 0.45 and 0.42, respectively, whereas the correlation results between trade openness and these three indicators are 0.49, 0.46 and 0.30, respectively.

Table 4.3: Correlation Results

Banking Sector Development

N = 43	LL	PRI	DOC	RGDPC	R	INS	CIF	TO
LL	1.00							
PRI	0.70	1.00						
DOC	0.89	0.74	1.00					
RGDPC	0.37	0.55	0.46	1.00				
R	-0.07	0.07	0.12	0.31	1.00			
INS	0.26	0.37	0.35	0.46	0.34	1.00		
CIF	0.41	0.45	0.42	0.51	0.05	0.28	1.00	
TO	0.49	0.46	0.30	0.10	0.45	0.04	0.07	1.00

Capital Market Development

N = 22	MC	VT	NC	RGDPC	R	INS	CIF	TO
MC	1.00							
VT	0.72	1.00						
NC	0.58	0.41	1.00					
RGDPC	0.21	0.49	0.42	1.00				
R	0.37	0.27	0.17	0.11	1.00			
INS	0.53	0.64	0.53	0.63	0.43	1.00		
CIF	0.74	0.64	0.36	0.30	0.21	0.51	1.00	
TO	0.62	0.27	0.38	0.10	0.25	0.27	0.54	1.00

Note: LL = Liquid Liabilities/GDP; PRI = Private Sector Credit/GDP; DOC = Domestic Credit/GDP; RGDPC = Real GDP Per Capita; R = Real Interest Rate; INS = Institutions; CIF = Private Capital Flows; TO = Trade Openness; MC = Stock Market Capitalisation/GDP; VT = Total Share Value Traded/GDP; NC = Number of Companies Listed/Population

4.5 Empirical Results

4.5.1 OLS Cross-Country Results

We first estimate Equations (4.4) and (4.5) on the full sample and two sub-samples on averaged annual data for the 43 developing countries using the OLS cross-country estimator. Two capital inflows proxies are employed, namely private capital inflows and capital account liberalisation. The results are reported in Tables 4.4 and 4.5, respectively. Models 1 – 3 are estimates of Equation (4.4), utilising alternative proxies for financial development, where models 4 – 6 are estimates of Equation (4.5), which includes the interaction term between capital inflows and trade openness.

To start with, it is important to note that the signs of the estimated coefficients on real GDP per capita and the real interest rate are consistent with theory. As shown in Tables 4.4 and 4.5, both variables have a positive relationship with financial development, in all models. It is worth noting that the Jarque-Bera statistic suggests that the residuals of the regressions are normally distributed in all models. The Breusch-Pagan heteroscedasticity

test indicates that the residuals are homoskedastic and independent of the regressors in all models. The Ramsey RESET test reveals that there is no mis-specification error, again, in all models. Thus, the diagnostic results suggest that the models are relatively well specified.

Examining first models 1 – 3 in Table 4.4, where private capital inflows is the proxy for capital account openness and the interaction term is absent, the results reveal that real GDP per capita is a statistically significant determinant of financial development when the full sample is utilised. This continues to be the case in models 1 and 2 in both sub-samples, but not so in model 3 (where the financial indicator is domestic credit) where it is significant only at the 10% level. This result seems to demonstrate that economic performance matters for financial development. Interestingly, the real interest rate is insignificant in all the specifications, a result which is in line with previous findings by Demetriades and Luintel (1997) and Arestis and Demetriades (1997). The institutions variable is statistically significant only in sub-sample period II, which may indicate that institutions began to influence financial development in the 1990s. The impact of capital inflows is also more apparent in the second sub-sample, while the trade openness variable is not significant at conventional levels.

In models 4 – 6 which include the interaction term, real GDP per capita continues to enter as a positive and significant determinant of financial development, except perhaps in model 6 in Sub-Sample Period II, where it is significant only at the 10% level. The real interest rate remains insignificant throughout and the institutional quality proxy is, once again, significant only in the 1990's period. Trade openness is, if anything, even less significant in these regressions. Interestingly, the coefficient on the interaction term is positive and statistically significant in all the specifications in sub-sample period II and in one of the specifications in the full sample (model 1). These findings provide limited support to the Rajan and Zingales hypothesis, in that they are only robust for the 1990's.

Table 4.5 repeats the analysis using, however, the capital account liberalisation indicator constructed by Chinn and Ito (2002) as a proxy for capital inflows. The results are broadly similar to those reported in Table 3. The only notable difference is that the interaction term appears significant in two out of three cases when the full sample is utilised and the same is also true of sub-sample period II. It is clearly the case that the interaction terms work

better in explaining the variation of financial development across countries than either of its separate constituents.

Table 4.4: Results of OLS Regressions
(Dependent Variable: Financial Development)
Capital Inflows Proxy: Private Capital Inflows

	Full Sample Period: 1980 – 2000			Sub-Sample Period I: 1980 - 1989			Sub-Sample Period II: 1990 – 2000		
	Dependent Variable			Dependent Variable			Dependent Variable		
	LL	PRI	DOC	LL	PRI	DOC	LL	PRI	DOC
	Without Interaction Term								
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	0.88 (0.67)	-0.04 (-0.02)	0.55 (0.39)	1.43 (1.26)	-0.42 (-0.29)	1.59 (1.29)	-2.31 (-1.45)	-3.34 (-1.52)	-1.72 (-0.84)
RGDP	0.16 (2.07)**	0.26 (2.37)**	0.17 (2.05)**	0.13 (2.22)**	0.23 (2.06)**	0.17 (1.89)*	0.20 (2.06)**	0.28 (2.29)**	0.19 (1.70)*
R	0.01 (0.17)	0.01 (0.18)	0.01 (0.19)	0.02 (0.62)	0.01 (0.20)	0.02 (0.69)	0.02 (0.52)	0.06 (0.98)	0.05 (1.03)
INS	0.06 (0.15)	0.07 (0.14)	0.38 (0.85)	0.07 (0.25)	0.33 (0.91)	0.09 (0.32)	0.40 (2.04)**	0.35 (2.22)**	0.36 (2.13)**
CIF	-0.01 (-0.09)	0.11 (0.87)	0.03 (0.26)	-0.01 (-0.13)	0.11 (0.79)	0.04 (0.39)	0.14 (2.05)**	0.22 (2.16)**	0.11 (1.90)*
TO	0.32 (2.02)*	0.28 (1.37)	0.18 (1.06)	0.35 (2.02)*	0.24 (1.06)	0.18 (1.00)	0.36 (1.75)*	0.41 (1.86)*	0.22 (1.12)
Adj R^2	0.28	0.36	0.30	0.24	0.37	0.21	0.42	0.48	0.33
Normality	1.52 (0.46)	6.20 (0.06) *	2.41 (0.29)	2.95 (0.23)	0.73 (0.69)	0.04 (0.98)	1.90 (0.38)	4.26 (0.11)	5.15 (0.07)*
B-P	0.45 (0.50)	0.06 (0.81)	0.03 (0.86)	0.27 (0.60)	0.38 (0.53)	0.19 (0.66)	0.12 (0.72)	0.04 (0.83)	0.16 (0.68)
Ramsey	2.10 (0.12)	1.71 (0.18)	0.55 (0.65)	2.27 (0.10)	1.34 (0.27)	1.39 (0.26)	0.84 (0.48)	1.36 (0.27)	0.60 (0.61)
	With Interaction Term								
	Model 4	Model 5	Model 6	Model 4	Model 5	Model 6	Model 4	Model 5	Model 6
Constant	2.53 (1.86)	0.97 (0.51)	1.64 (1.08)	2.14 (1.73)	-1.56 (-0.99)	1.74 (1.29)	-1.97 (-1.23)	-3.18 (-1.41)	-0.86 (-0.42)
RGDP	0.22 (2.73)**	0.29 (2.60)**	0.21 (2.37)**	0.16 (2.14)**	0.18 (2.26)**	0.17 (2.18)**	0.19 (2.09)**	0.21 (2.38)**	0.18 (1.79)*
R	0.02 (0.46)	0.03 (0.46)	0.03 (0.59)	0.03 (0.87)	0.01 (0.11)	0.02 (0.73)	0.03 (0.66)	0.06 (1.01)	0.07 (1.27)
INS	0.08 (0.21)	0.02 (0.03)	0.29 (0.65)	0.16 (0.56)	0.48 (1.30)	0.07 (0.25)	0.46 (2.22)**	0.39 (2.27)**	0.37 (2.14)**
CIF	-0.18 (-1.85)*	-0.22 (-1.11)	-0.43 (-1.67)	-0.27 (-1.36)	-0.25 (1.80)*	-0.28 (-0.36)	-0.24 (-1.25)	-0.22 (-1.20)	-0.20 (-1.91)*
TO	0.02 (0.14)	0.07 (0.25)	0.06 (0.29)	0.19 (0.91)	0.39 (1.86)*	0.14 (0.65)	0.14 (0.61)	0.32 (0.94)	0.19 (0.65)
CIF x TL	0.50 (2.76)***	0.31 (1.22)	0.34 (1.72)*	0.24 (1.76)*	0.50 (1.70)*	0.06 (0.30)	0.42 (2.26)**	0.40 (2.41)**	0.41 (2.18)**
Adj R^2	0.42	0.38	0.36	0.29	0.43	0.22	0.46	0.51	0.40
Normality	1.86 (0.39)	5.21 (0.07)*	0.00 (0.99)	0.89 (0.64)	1.83 (0.40)	0.84 (0.65)	0.99 (0.61)	3.85 (0.15)	2.28 (0.32)
B-P	0.01 (0.92)	0.19 (0.67)	0.00 (0.97)	0.11 (0.73)	2.45 (0.12)	0.11 (0.74)	0.05 (0.82)	0.00 (0.98)	0.10 (0.29)
Ramsey	0.11 (0.95)	0.27 (0.84)	0.33 (0.80)	2.14 (0.12)	2.09 (0.12)	0.63 (0.60)	0.71 (0.55)	1.25 (0.31)	0.28 (0.84)
N	43	43	43	43	43	43	43	43	43

Note: Figures in the parentheses are the t-statistics except for the normality test, Breausch-Pagan (B-P) heteroscedasticity test and Ramsey RESET tests, which are p-values. ***, ** and * denote significant at 1%, 5% and 10%, respectively. LL = liquid liabilities/GDP; PRI = private sector credit/GDP; DOC = domestic credit/GDP; RGDP = real GDP per capita; R = real interest rate; INS = institutional quality; CIF = capital inflows; TO = trade openness.

Table 4.5: Results of OLS Regressions
(Dependent Variable: Financial Development)
Capital Inflows Proxy: Capital Account Liberalisation (Chinn and Ito, 2002)

	Full Sample Period: 1980 – 1999			Sub-Sample Period I: 1980 - 1989			Sub-Sample Period II: 1990 – 1999		
	Dependent Variable			Dependent Variable			Dependent Variable		
	LL	PRI	DOC	LL	PRI	DOC	LL	PRI	DOC
	Without Interaction Term								
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	0.24 (0.19)	-1.21 (-0.69)	0.14 (0.11)	0.97 (1.04)	-0.97 (-0.74)	1.10 (1.12)	-2.34 (-1.52)	-4.45 (-2.02)	-1.01 (-0.54)
RGDP	0.21 (2.67)**	0.32 (2.95)***	0.22 (2.85)***	0.17 (2.32)**	0.30 (3.05)***	0.20 (2.74)***	0.18 (2.04)**	0.31 (2.47)**	0.24 (2.04)**
R	0.02 (0.45)	0.01 (0.13)	0.01 (0.19)	0.01 (0.40)	0.02 (0.43)	0.01 (0.37)	0.02 (0.49)	0.07 (1.18)	0.03 (0.58)
INS	0.11 (0.27)	0.28 (0.48)	0.35 (0.81)	0.04 (0.14)	0.22 (0.63)	0.12 (0.46)	0.31 (2.19)**	0.42 (2.27)**	0.57 (1.83)*
CIF	-0.09 (-1.13)	0.05 (0.47)	-0.13 (-1.68)	-0.09 (-1.24)	0.05 (0.49)	-0.16 (1.79)*	0.11 (2.09)**	0.17 (2.15)**	0.14 (1.53)
TO	0.36 (2.25)**	0.31 (1.40)	0.21 (1.33)	0.37 (2.24)**	0.35 (1.76)*	0.21 (1.45)	0.37 (2.26)**	0.44 (1.88)*	0.25 (1.25)
Adj R^2	0.32	0.37	0.33	0.28	0.36	0.29	0.53	0.50	0.35
Normality	1.50 (0.47)	5.29 (0.07)	1.83 (0.40)	3.21 (0.20)	2.30 (0.32)	0.52 (0.77)	1.78 (0.41)	2.68 (0.26)	0.18 (0.91)
B-P	0.06 (0.80)	0.42 (0.52)	0.00 (0.95)	0.25 (0.62)	2.57 (0.11)	0.00 (0.96)	0.14 (0.71)	0.02 (0.89)	3.68 (0.05)
Ramsey	1.96 (0.14)	1.62 (0.20)	0.93 (0.43)	2.41 (0.08)	1.49 (0.23)	1.96 (0.14)	0.77 (0.52)	1.98 (0.13)	0.62 (0.61)
	With Interaction Term								
	Model 4	Model 5	Model 6	Model 4	Model 5	Model 6	Model 4	Model 5	Model 6
Constant	0.52 (0.43)	-0.92 (-0.53)	0.54 (0.44)	0.50 (0.51)	-1.11 (-0.78)	0.57 (0.57)	-1.65 (-1.02)	-4.25 (-1.79)	-0.51 (-0.25)
RGDP	0.24 (3.19)***	0.35 (3.24)***	0.26 (3.50)***	0.17 (2.47)**	0.31 (3.02)***	0.21 (2.92)***	0.22 (2.42)**	0.32 (2.37)**	0.24 (2.15)**
R	0.05 (1.06)	0.02 (0.30)	0.04 (0.90)	0.01 (0.36)	0.02 (0.42)	0.01 (0.34)	0.03 (-0.50)	0.06 (0.67)	0.01 (0.09)
INS	0.16 (0.38)	0.01 (0.01)	0.02 (0.04)	0.13 (0.51)	0.20 (0.53)	0.02 (0.05)	0.26 (2.15)**	0.34 (2.31)**	0.41 (1.56)
CIF	-0.28 (-2.23)**	-0.23 (-1.39)	-0.60 (-1.66)	-0.24 (-1.54)	-0.19 (-0.22)	-0.08 (-1.78)*	-0.16 (-1.27)	-0.22 (-0.20)	-0.23 (-0.89)
TO	0.32 (2.10)**	0.40 (1.74)*	0.30 (1.97)*	0.54 (2.93)***	0.39 (1.49)	0.23 (1.54)	0.22 (1.27)	0.26 (0.64)	0.21 (1.00)
CIF x TL	0.45 (2.80)***	0.31 (1.46)	0.36 (2.45)**	0.21 (1.40)	0.51 (1.78)*	0.39 (2.12)**	0.35 (2.46)**	0.42 (2.28)**	0.32 (1.74)*
Adj R^2	0.40	0.41	0.33	0.32	0.36	0.34	0.43	0.45	0.35
Normality	1.33 (0.51)	5.41 (0.07)	0.44 (0.80)	2.87 (0.23)	9.43 (0.01)**	2.29 (0.31)	1.54 (0.46)	2.63 (0.26)	0.09 (0.95)
B-P	0.21 (0.64)	0.85 (0.35)	0.18 (0.67)	0.25 (0.62)	2.68 (0.10)	0.01 (0.91)	0.25 (0.62)	0.02 (0.88)	3.24 (0.07)
Ramsey	0.09 (0.96)	0.33 (0.80)	1.16 (0.34)	5.10 (0.01)**	1.80 (0.17)	0.40 (0.75)	0.63 (0.59)	2.01 (0.13)	0.67 (0.57)
N	43	43	43	43	43	43	43	43	43

Note: Figures in the parentheses are the t-statistics except for the normality test, Breausch-Pagan (B-P) heteroscedasticity test and Ramsey RESET tests, which are p-values. ***, ** and * denote significant at 1%, 5% and 10%, respectively. LL = liquid liabilities/GDP; PRI = private sector credit/GDP; DOC = domestic credit/GDP; RGDP = real GDP per capita; R = real interest rate; INS = institutional quality; CIF = capital inflows; TO = trade openness.

4.5.2 Two-Stage Least Squares (2SLS) Estimations

The 2SLS results are reported in Tables 4.6 and 4.7. Table 4.6 utilises private capital inflows as a proxy for capital account openness and we discuss those results first. The first-stage regression results indicate that initial income is a statistically significant determinant of real GDP per capita (RGDP). This implies that RGDP in year 1965 is a valid instrument in the analysis[61]. As shown in this table, the results are similar to the OLS results reported in Table 4.4. With just one exception, real GDP per capita remains a statistically significant determinant of financial development in both the full sample and the two sub-samples in all specifications; the exception is Model 1 in the full sample, where it is only significant at the 10% level. The real interest rate remains insignificant throughout. The impact of institutions on financial development remains more apparent during the 1990s. The coefficients on the interaction term are similar to those obtained with the OLS regression, and they are larger than those on capital inflows and trade liberalization. The Hausman test results reveal that the null hypothesis is not rejected, which indicates that there is no difference between the estimates from OLS and 2SLS, and real GDP per capita can be treated as exogenous. This finding also strengthens the argument that the interaction between capital inflows and trade openness is positive and statistically significant, highlighting that capital and trade openness has larger effects on financial development. Overall, the 2SLS results demonstrate that the OLS results are robust since both estimations indicate similar findings.

Table 4.7 reports the 2SLS when the capital account liberalization is employed as a proxy for capital inflows. Again, the Hausman test results indicate that there is no different between the estimates from OLS and 2SLS. The results are similar to that obtained with the OLS regression, with the only notable difference being that the interaction terms is statistically significant in all except two specifications. The exceptions are Model 2 in the full sample and the first sub-sample; note however, that in the full sample it is significant at the 10% level, probably reflecting the strength of the relationship in the 1990s. Thus, if anything, the 2SLS results provide somewhat greater support to the Rajan-Zingales hypothesis.

[61] The first-stage regression results, however, are not reported.

Table 4.6: Results of Instrumental 2SLS Regressions
(Dependent Variable: Financial Development)
Capital Inflows Proxy: Private Capital Inflows

	Full Sample Period: 1980 – 2000			Sub-Sample Period I: 1980 - 1989			Sub-Sample Period II: 1990 – 2000		
	Dependent Variable			Dependent Variable			Dependent Variable		
	LL	PRI	DOC	LL	PRI	DOC	LL	PRI	DOC
	Without Interaction Term								
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	1.03 (0.77)	0.04 (0.02)	0.81 (0.56)	1.64 (1.40)	-0.59 (-0.39)	2.03 (1.60)	-2.76 (-1.68)	-4.04 (-1.78)*	-2.28 (-1.07)
RGDP	0.18 (1.81)*	0.21 (2.36)**	0.19 (1.99)**	0.11 (2.13)**	0.25 (2.04)**	0.11 (2.09)**	0.17 (2.16)**	0.19 (2.37)**	0.14 (2.03)**
R	-0.01 (-0.02)	0.01 (0.25)	0.02 (0.42)	0.02 (0.66)	0.01 (0.18)	0.02 (0.76)	0.02 (0.53)	0.06 (0.98)	0.06 (1.01)
INS	0.21 (0.47)	0.15 (0.28)	0.60 (1.29)	0.06 (0.19)	0.32 (0.87)	0.13 (0.42)	0.46 (2.42)**	0.51 (1.80)*	0.55 (2.06)**
CIF	-0.04 (-0.37)	0.14 (1.03)	0.10 (0.94)	-0.01 (-0.03)	0.09 (0.67)	0.01 (0.08)	0.13 (2.26)**	0.25 (2.15)**	0.04 (0.29)
TO	0.31 (1.90)*	0.28 (1.33)	0.15 (0.88)	0.33 (1.91)*	0.25 (1.10)	0.15 (0.81)	0.34 (2.03)**	0.37 (1.61)	0.16 (0.74)
Hausman Test	2.62 (0.85)	0.56 (0.99)	6.66 (0.35)	0.54 (0.99)	0.20 (0.99)	2.55 (0.86)	2.69 (0.84)	3.44 (0.75)	6.52 (0.36)
	With Interaction Term								
	Model 4	Model 5	Model 6	Model 4	Model 5	Model 6	Model 4	Model 5	Model 6
Constant	2.53 (1.84)	0.97 (0.51)	1.65 (1.06)	2.28 (1.81)	-1.65 (-1.02)	2.09 (1.52)	-2.35 (-1.43)	-3.86 (-1.66)	-1.28 (-0.61)
RGDP	0.16 (2.67)**	0.25 (2.19)**	0.20 (2.40)**	0.14 (2.09)**	0.17 (2.23)**	0.11 (2.10)**	0.15 (2.06)**	0.16 (2.23)**	0.14 (2.18)**
R	0.02 (0.53)	0.03 (0.49)	0.03 (0.70)	0.03 (0.89)	0.01 (0.12)	0.02 (0.76)	0.03 (0.67)	0.06 (1.01)	0.07 (1.26)
INS	0.04 (0.06)	0.04 (0.08)	0.50 (1.10)	0.15 (0.49)	0.47 (1.26)	0.12 (0.38)	0.57 (2.57)**	0.56 (1.80)*	0.70 (2.32)**
CIF	-0.17 (-2.48)**	-0.13 (-1.01)	-0.37 (-1.20)	-0.21 (-1.25)	-0.20 (-1.74)*	-0.11 (-0.14)	-0.17 (-1.19)	-0.15 (-0.14)	-0.18 (-1.92)*
TO	0.02 (0.07)	0.07 (0.27)	0.05 (0.26)	0.18 (0.88)	0.38 (1.87)*	0.13 (0.59)	0.13 (0.51)	0.28 (0.81)	0.25 (0.84)
CIF x TO	0.47 (2.54)***	0.29 (1.14)	0.27 (1.85)*	0.23 (1.28)	0.50 (2.01)*	0.26 (0.13)	0.43 (2.23)**	0.39 (2.38)**	0.42 (2.19)**
Hausman Test	1.43 (0.98)	2.35 (0.93)	5.72 (0.57)	0.38 (0.99)	5.72 (0.57)	2.49 (0.92)	2.06 (0.95)	3.24 (0.86)	5.25 (0.63)
N	43	43	43	43	43	43	43	43	43

Note: Figures in the parentheses are the t-statistics except for the Hausman test, which are p-values. ***, ** and * denote significant at 1%, 5% and 10%, respectively. LL = liquid liabilities/GDP; PRI = private sector credit/GDP; DOC = domestic credit/GDP; RGDP = real GDP per capita; R = real interest rate; INS = institutional quality; CIF = capital inflows; TO = trade openness.

Table 4.7: Results of Instrumental 2SLS Regressions
(Dependent Variable: Financial Development)
Capital Inflows Proxy: Capital Account Liberalisation (Chinn and Ito, 2002)

	Full Sample Period: 1980 - 1999			Sub-Sample Period I: 1980 – 1989			Sul
	Dependent Variable			Dependent Variable			
	LL	PRI	DOC	LL	PRI	DOC	LL
	Without Interaction Term						
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1
Constant	0.27 (0.22)	-1.19 (-0.67)	0.23 (0.17)	1.13 (1.18)	-1.06 (-0.79)	1.39 (1.39)	-2.89 (-1.8
RGDP	0.18 (2.49)**	0.28 (2.26)**	0.22 (2.15)**	0.14 (2.17)**	0.32 (2.93)***	0.18 (2.21)**	0.21 (2.03)
R	0.01 (-0.26)	0.01 (0.20)	0.01 (0.11)	0.01 (0.49)	0.02 (0.39)	0.02 (0.53)	0.03 (0.63)
INS	0.28 (0.65)	0.37 (0.61)	0.60 (1.36)	0.10 (0.08)	0.42 (0.60)	0.14 (0.54)	0.40 (2.37)
CIF	-0.06 (-0.76)	0.07 (0.59)	-0.09 (-1.08)	-0.08 (-1.14)	0.05 (0.45)	-0.14 (-1.91)*	0.03 (0.38)
TO	0.35 (2.13)**	0.31 (1.36)	0.19 (1.14)	0.37 (2.63)**	0.35 (1.76)*	0.20 (1.42)	0.33 (1.99)
Hausman Test	2.76 (0.83)	0.44 (0.99)	7.43 (0.28)	0.76 (0.99)	0.26 (0.99)	2.94 (0.82)	2.35 (0.88)
	With Interaction Term						
	Model 4	Model 5	Model 6	Model 4	Model 5	Model 6	Model 4
Constant	0.53 (0.43)	-0.92 (-0.53)	0.57 (0.45)	0.64 (0.64)	-1.21 (-0.84)	0.85 (0.82)	-2.35 (-1.4
RGDP	0.17 (1.97)*	0.32 (2.56)**	0.25 (2.35)**	0.18 (1.96)*	0.33 (2.92)***	0.16 (2.13)**	0.02 (2.15)
R	-0.04 (-0.83)	-0.01 (-0.23)	-0.02 (-0.52)	0.01 (0.44)	0.02 (0.38)	0.01 (0.48)	0.03 (0.67)
INS	0.02 (0.03)	0.09 (0.14)	0.29 (0.66)	0.12 (0.45)	0.19 (0.50)	0.04 (0.15)	0.57 (2.57)
CIF	-0.24 (-1.96)*	-0.16 (-1.29)	-0.37 (-2.19)**	-0.19 (-1.50)	-0.21 (-0.24)	-0.14 (-1.69)*	-0.17 (-1.1
TO	0.28 (1.87)*	0.30 (1.38)	0.27 (1.69)*	0.21 (1.37)	0.20 (1.30)	0.22 (1.47)	0.13 (0.51)
CIF x TO	0.42 (2.63)***	0.39 (1.69)*	0.31 (2.06)**	0.44 (2.90)***	0.40 (1.50)	0.39 (2.06)**	0.43 (2.23)
Hausman Test	2.32 (0.94)	0.26 (0.99)	6.75 (0.45)	0.55 (0.99)	0.46 (0.99)	2.54 (0.92)	2.06 (0.95)
N	43	43	43	43	43	43	43

Note: Figures in the parentheses are the t-statistics except for the Hausman test, which are p-values. ***, ** and * denote significant at 1%, 5% and 10
= private sector credit/GDP; DOC = domestic credit/GDP; RGDP = real GDP per capita; R = real interest rate; INS = institutional quality; CIF = capital i

4.5.3 Pooled Mean Group Estimations Results

Table 4.8 reports estimates of models (4.2) and (4.3) that utilize the pooled mean group estimator, which imposes common long-run effects. This table presents estimates of the long-run coefficients, the error-correction coefficients and Hausman test statistics. The lag order is first chosen in each country on the unrestricted model by the Schwarz Baysian Criterion (SBC), subject to a maximum lag of 1. Then, using these SBC-determined lag orders, homogeneity is imposed. The results indicate that the joint Hausman test statistic fails to reject the null hypothesis and this reveals that the data do not reject the restriction of common long-run coefficients. Moreover, the Hausman test also indicates that the pooling restrictions cannot be rejected for five independent variables. The coefficients of real GDP per capita and institutions are positive and statistically significant throughout. The private capital inflows variable also enters significantly in models 2 and 3. On the other hand, in models 4 –6 when the interaction term is included in the model, the capital inflows variable loses significance at conventional levels. Note, however, that the interaction term enters with a large and highly significant positive coefficient in models 4 – 6. These results, therefore, provide strong support for the Rajan-Zingales hypothesis. The joint Hausman test of these models also indicates that the data do not reject the restriction of common long-run coefficients, but the poolability of real interest rate coefficient is rejected.

Table 4.8: Pooled Mean Group Estimation for ARDL
Dependent Variable: Financial Development (Banking Sector Development)
Openness Proxy: Total Trade/GDP
Capital Inflows Proxy: Private Capital Flows

	Liquid Liabilities		Private Sector Credit		Domestic Credit	
Without Interaction Term	Model 1	Hausman Test	Model 2	Hausman Test	Model 3	Hausman Test
RGDPC	0.16	1.20	0.18	0.87	0.19	0.03
	(2.52)**	(0.27)	(2.27)**	(0.35)	(2.35)**	(0.85)
R	0.01	2.15	0.34	7.50	0.01	0.11
	(1.62)	(0.14)	(1.49)	(0.01)**	(1.26)	(0.74)
INS	0.18	1.22	0.21	0.28	0.25	0.12
	(8.80)***	(0.27)	(2.31)**	(0.60)	(2.23)**	(0.73)
CIF	0.06	0.40	0.15	0.85	0.24	2.07
	(0.38)	(0.53)	(2.81)***	(0.36)	(3.16)***	(0.15)
TO	0.04	0.69	0.05	1.76	0.06	1.25
	(1.74)*	(0.41)	(0.53)	(0.18)	(1.08)	(0.26)
Error Correction Coefficients	-0.16		-0.16		-0.18	
	(-5.67)***		(-5.32)***		(-6.96)***	
Joint Hausman Test for long-run homogeneity	2.79		8.50		2.85	
	(0.73)		(0.20)		(0.71)	
With Interaction Term	Model 4	Hausman Test	Model 5	Hausman Test	Model 6	Hausman Test
RGDPC	0.23	2.79	0.27	0.97	0.20	0.06
	(4.22)***	(0.09)	(4.76)***	(0.32)	(2.09)**	(0.81)
R	0.01	0.32	0.01	7.78	0.03	0.07
	(0.81)	(0.57)	(0.74)	(0.01)**	(1.46)	(0.79)
INS	0.25	1.17	0.30	0.44	0.39	0.65
	(2.23)**	(0.28)	(2.26)**	(0.51)	(2.16)**	(0.42)
CIF	0.15	0.85	0.05	3.17	0.19	1.49
	(1.86)*	(0.36)	(1.55)	(0.07)	(1.16)	(0.22)
TO	0.31	0.36	0.28	1.86	0.27	0.02
	(1.81)*	(0.55)	(0.95)	(0.17)	(1.32)	(0.88)
CIF x TO	0.46	1.19	0.40	3.00	0.43	1.60
	(2.81)***	(0.27)	(3.02)***	(0.08)	(3.29)***	(0.21)
Error Correction Coefficients	-0.26		-0.20		-0.42	
	(-8.25)***		(-8.04)***		(-6.824)***	
Joint Hausman Test for long-run homogeneity	4.51		2.50		8.55	
	(0.61)		(0.76)		(0.20)	
N x T	903		903		903	

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 4.9 repeats the pooled mean group estimator analysis with three capital market development indicators, namely stock market capitalization, total share value traded and number of companies listed. These indicators are only available for 22 developing countries[62] and the sample period spans the period 1980 – 2000, except for the number of companies listed, for which data is only available for the period 1988 – 2000. Both the real GDP per capita and real interest rate retain their positive sign, but only real GDP per capita is statistically significant in all models. The institutional quality variable is statistically significant in determining market capitalization and total share value traded, but is significant only at the 10% in the regression that explains total number of companies listed. The capital inflows variable is a statistically significant determinant of stock market capitalization and total share value traded. In contrast, trade openness has a significant influence on market capitalization and number of companies listed. In models 4 – 6, the interaction term is statistically significant at the 1% level in two out of three models and significant at the 10% level in the third. Interestingly, trade openness and capital inflows each have an independent statistically significant influence in two out of three specifications. These findings suggest that the Rajan-Zingales hypothesis applies not only to the development of the banking system, but also to the development of the capital market.

[62] The cross-country analysis is not conducted for these capital market development indicators - stock market capitalisation, total share value traded and number of companies listed due to small sample size (N = 22).

Table 4.9: Pooled Mean Group Estimation for ARDL
Dependent Variable: Financial Development (Capital Market Development)
Openness Proxy: Total Trade/GDP
Capital Inflows Proxy: Private Capital Flows

	Market Capitalisation		Total Share Value Traded		Number of Companies Listed	
Without Interaction Term	Model 1	Hausman Test	Model 2	Hausman Test	Model 3	Hausman Test
RGDPC	0.31	0.88	0.15	2.03	0.59	0.19
	(3.35)***	(0.35)	(2.54)**	(0.15)	(9.17)***	(0.66)
R	0.11	7.89	0.03	0.33	-0.01	0.14
	(1.74)*	(0.00)***	(0.49)	(0.57)	(-0.31)	(0.70)
INS	0.14	0.12	0.08	0.42	0.08	0.88
	(1.97)**	(0.73)	(3.99)***	(0.52)	(1.76)*	(0.35)
CIF	0.40	0.43	0.33	2.23	0.25	1.83
	(2.11)**	(0.51)	(4.71)***	(0.13)	(1.07)	(0.18)
TO	0.27	0.08	0.05	0.42	0.18	3.62
	(2.76)***	(0.77)	(1.34)	(0.52)	(3.32)***	(0.06)
Error Correction Coefficients	-0.16		-0.03		-0.29	
	(-5.67)***		(-2.19)***		(-4.32)***	
Joint Hausman Test for long-run homogeneity	9.66		6.98		10.42	
	(0.09)		(0.32)		(0.06)	
With Interaction Term	Model 4	Hausman Test	Model 5	Hausman Test	Model 6	Hausman Test
RGDPC	0.26	0.04	0.24	0.07	0.32	0.64
	(2.38)**	(0.84)	(2.17)**	(0.79)	(2.63)***	(0.42)
R	0.04	8.36	0.10	0.00	-0.01	0.99
	(0.47)	(0.00)***	(1.47)	(0.98)	(-1.17)	(0.32)
INS	0.16	0.56	0.12	2.05	0.08	1.06
	(2.18)**	(0.45)	(2.29)**	(0.15)	(0.59)	(0.30)
CIF	0.25	0.59	0.28	1.37	0.32	1.00
	(2.32)**	(0.44)	(4.47)***	(0.24)	(1.83)*	(0.32)
TO	0.17	2.06	0.16	2.05	0.28	1.04
	(2.38)**	(0.15)	(1.71)*	(0.15)	(4.16)***	(0.31)
CIF x TO	0.41	0.59	0.44	1.47	0.49	1.00
	(3.33)***	(0.44)	(3.04)***	(0.23)	(2.62)**	(0.32)
Error Correction Coefficients	-0.33		-0.25		-0.27	
	(-2.77)***		(-2.66)***		(-4.23)***	
Joint Hausman Test for long-run homogeneity	6.90		12.86		5.58	
	(0.44)		(0.05)		(0.47)	
N x T	462		462		286	

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 4.10 repeats the analysis carried out in Table 4.8, using a different capital inflows proxy, namely inflows of capital that consists of foreign direct investment and portfolio investment[63]. This variable is only available for 16 developing countries. The lag order of AIC is restricted to a maximum lag of 1 and the Hausman test statistic fails to reject the null hypothesis of common long-run coefficients. Real GDP per capita and institutions retain their positive sign and are both statistically significant. The inflows of capital is significant at the 10% level in models 2 and 3. The estimated coefficients of the interaction term in models 4 – 6 are both large and highly significant. These findings suggest that the results obtained in Table 4.8 are robust to changes in the measurement of capital account openness.

[63] The capital account liberalization proxy constructed by Chinn and Ito (2002) is not employed in the panel data analysis even though the data is available from 1977 - 1999. This indicator is computed using the principal component analysis and most of the countries have no variation of capital account liberalization measurement throughout the year except in the mid 1990s.

Table 4.10: Pooled Mean Group Estimation for ARDL
Dependent Variable: Financial Development (Banking Sector Development)
Openness Proxy: Total Trade/GDP
Capital Inflows Proxy: Inflows of Capital

	Liquid Liabilities		Private Sector Credit		Domestic Credit	
Without Interaction Term	Model 1	Hausman Test	Model 2	Hausman Test	Model 3	Hausman Test
RGDPC	0.26	3.70	0.25	1.95	0.22	0.88
	(2.77)***	(0.05)	(2.68)***	(0.16)	(2.93)***	(0.35)
R	0.14	6.38	0.18	0.29	0.17	0.77
	(1.57)	(0.01)	(1.63)	(0.59)	(1.68)*	(0.38)
INS	0.24	0.02	0.20	1.57	0.29	1.98
	(3.23)***	(0.88)	(2.24)**	(0.21)	(2.75)***	(0.16)
CIF	0.03	2.89	0.01	1.58	0.06	2.05
	(2.47)**	(0.09)	(1.89)*	(0.21)	(1.79)*	(0.15)
TO	0.02	0.78	0.11	0.02	0.19	1.51
	(0.33)	(0.38)	(1.85)*	(0.90)	(1.66)	(0.22)
Error Correction Coefficients	-0.43		-0.40		-0.44	
	(-4.40)***		(-4.17)***		(-3.87)***	
Joint Hausman Test for long-run homogeneity	10.80		5.94		8.01	
	(0.13)		(0.31)		(0.17)	
With Interaction Term	Model 4	Hausman Test	Model 5	Hausman Test	Model 6	Hausman Test
RGDPC	0.19	0.52	0.15	1.33	0.18	0.99
	(2.90)***	(0.47)	(2.58)***	(0.25)	(3.57)***	(0.32)
R	0.14	29.20	0.10	3.92	0.18	0.89
	(1.21)	(0.00)***	(1.25)	(0.05)	(1.29)	(0.35)
INS	0.24	0.05	0.28	0.12	0.30	0.85
	(2.11)**	(0.83)	(2.08)**	(0.72)	(2.26)**	(0.36)
CIF	0.09	0.13	0.20	0.16	0.21	0.21
	(1.75)*	(0.72)	(1.82)*	(0.69)	(1.60)	(0.65)
TO	0.20	11.83	0.16	0.00	0.14	0.60
	(1.54)	(0.00)***	(0.25)	(0.99)	(1.87)*	(0.44)
CIF x TO	0.37	0.10	0.33	0.13	0.46	0.14
	(2.68)***	(0.75)	(2.93)***	(0.72)	(2.69)***	(0.71)
Error Correction Coefficients	-0.40		-0.35		-0.48	
	(-4.25)***		(-3.83)***		(-4.75)***	
Joint Hausman Test for long-run homogeneity	8.32		6.53		9.50	
	(0.18)		(0.28)		(0.15)	
N x T	336		336		336	

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 4.11 repeats the analysis of Table 4.9 with the alternative proxy for capital inflows. Again, real GDP per capita remains statistically significant in all specifications, while institutional quality is now significant in all but one models (the exception being model 6 where it is significant at the 10% level). Interestingly, the new capital inflows proxy, which consists of foreign direct investment and portfolio investment, is positive and highly significant

in all specifications. In addition, the interaction term is highly significant in all three models. These findings suggest that support for the Rajan-Zingales hypothesis is, if anything, even stronger when the alternative proxy for capital account openness is utilised.

Table 4.11: Pooled Mean Group Estimation for ARDL
Dependent Variable: Financial Development (Capital Market Development)
Openness Proxy: Total Trade/GDP
Capital Inflows Proxy: Inflows of Capital

	Market Capitalisation		Total Share Value Traded		Number of Companies Listed	
Without Interaction Term	Model 1	Hausman Test	Model 2	Hausman Test	Model 3	Hausman Test
RGDPC	0.35 (2.98)***	1.59 (0.21)	0.26 (1.99)**	0.54 (0.46)	0.19 (9.54)***	3.76 (0.05)
R	0.12 (0.88)	0.57 (0.45)	0.01 (0.08)	0.33 (0.56)	0.01 (1.17)	1.13 (0.29)
INS	0.32 (3.70)***	1.17 (0.28)	0.07 (2.17)**	2.44 (0.12)	0.06 (2.06)**	0.14 (0.71)
CIF	0.27 (3.10)***	1.19 (0.27)	0.19 (2.94)***	0.02 (0.88)	0.26 (1.78)*	0.66 (0.42)
TO	0.33 (3.28)***	0.00 (0.95)	0.11 (1.09)	0.02 (0.90)	0.29 (3.89)***	0.23 (0.63)
Error Correction Coefficients	-0.20 (-2.17)**		-0.19 (-2.23)***		-0.30 (-2.89)***	
Joint Hausman Test for long-run homogeneity	9.59 (0.09)		7.23 (0.13)		11.15 (0.08)	
With Interaction Term	Model 4	Hausman Test	Model 5	Hausman Test	Model 6	Hausman Test
RGDPC	0.42 (4.09)***	0.07 (0.79)	0.34 (3.47)***	0.52 (0.47)	0.25 (4.53)***	1.81 (0.18)
R	-0.10 (-0.81)	1.79 (0.18)	-0.15 (-1.02)	0.86 (0.36)	0.01 (0.76)	0.02 (0.88)
INS	0.39 (5.28)***	0.00 (1.00)	0.08 (3.78)***	0.81 (0.37)	0.02 (1.76)*	0.01 (0.91)
CIF	0.21 (3.87)***	0.58 (0.45)	0.23 (3.49)***	0.00 (0.98)	0.32 (2.46)**	0.01 (0.91)
TO	0.19 (2.34)**	0.07 (0.79)	0.02 (1.78)*	0.02 (0.89)	0.35 (4.63)***	0.42 (0.52)
CIF x TO	0.36 (3.23)***	0.87 (0.35)	0.33 (3.01)***	0.01 (0.94)	0.46 (5.83)***	0.02 (0.89)
Error Correction Coefficients	-0.29 (-2.59)***		-0.21 (-1.75)*		-0.32 (-3.03)***	
Joint Hausman Test for long-run homogeneity	7.62 (0.12)		4.50 (0.74)		3.91 (0.69)	
N x T	231		231		182	

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

The estimated pooled mean group results when the import duties indicator[64] is employed as an alternative proxy for trade openness are reported in Table 4.12. This indicator is found to be statistically insignificant while real GDP per capita, institutions and capital inflows are statistically significant in all models. However, models containing the interaction term demonstrate that the interaction between capital inflows and import duties has a positive and highly significant influence on financial development. Table 4.13 reports the analysis of Table 4.12 with the alternative proxy for financial development, namely capital market development indicators. The import duties and institutions are statistically significant for three models, whereas real GDP per capita and capital inflows are significant in two out of three models. Again, the estimated coefficients of the interaction term are both large and significant in models 4 and 6. Thus, the main finding of this chapter, namely that the trade openness has an independent influence on financial development is robust to changes in the measurement of both capital and trade account openness.

[64] The import duties/total imports (ID) indicator was first converted using this formula: (1 – ID/100).

Table 4.12: Pooled Mean Group Estimation for ARDL
Dependent Variable: Financial Development (Banking Sector Development)
Openness Proxy: Import Duties/Total Imports
Capital Inflows Proxy: Private Capital Flows

	Liquid Liabilities		Private Sector Credit		Domestic Credit	
Without Interaction Term	Model 1	Hausman Test	Model 2	Hausman Test	Model 3	Hausman Test
RGDPC	0.46	0.05	0.27	2.44	0.21	1.14
	(3.53)***	(0.82)	(2.35)**	(0.12)	(2.19)**	(0.29)
R	0.15	1.15	0.13	4.71	0.11	10.57
	(1.79)*	(0.28)	(0.92)	(0.03)**	(1.45)	(0.00)***
INS	0.28	0.11	0.20	0.66	0.22	0.09
	(1.77)*	(0.74)	(2.28)**	(0.42)	(2.33)**	(0.77)
CIF	0.22	0.48	0.24	0.08	0.20	1.62
	(3.28)***	(0.49)	(2.91)***	(0.77)	(2.07)**	(0.20)
ID	0.13	0.40	0.12	0.47	0.10	2.91
	(0.70)	(0.53)	(0.91)	(0.49)	(0.98)	(0.09)
Error Correction Coefficients	-0.21		-0.36		-0.39	
	(-4.76)***		(-3.51)***		(-3.78)***	
Joint Hausman Test for long-run homogeneity	3.57		11.36		8.23	
	(0.61)		(0.04)**		(0.14)	
With Interaction Term	Model 4	Hausman Test	Model 5	Hausman Test	Model 6	Hausman Test
RGDPC	0.39	0.81	0.23	1.33	0.19	1.08
	(3.01)***	(0.37)	(2.27)**	(0.25)	(2.41)**	(0.30)
R	0.06	0.10	0.05	3.92	0.04	0.43
	(1.33)	(0.75)	(0.88)	(0.05)	(1.56)	(0.51)
INS	0.30	5.39	0.24	0.12	0.25	1.61
	(2.85)***	(0.02)**	(2.08)**	(0.72)	(2.26)**	(0.21)
CIF	0.23	1.10	0.30	0.16	0.21	0.01
	(1.93)*	(0.29)	(1.25)	(0.69)	(1.66)*	(0.94)
ID	0.11	1.51	0.25	0.00	0.16	0.29
	(1.45)	(0.22)	(1.31)	(0.99)	(1.28)	(0.59)
CIF x ID	0.48	0.19	0.42	0.13	0.40	0.00
	(2.16)**	(0.67)	(2.56)***	(0.72)	(2.89)***	(0.98)
Error Correction Coefficients	-0.39		-0.40		-0.32	
	(-3.27)***		(-3.74)***		(-2.76)***	
Joint Hausman Test for long-run homogeneity	4.85		3.90		6.50	
	(0.56)		(0.68)		(0.29)	
N x T	315		315		315	

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which is p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. ID = import duties.

Table 4.13: Pooled Mean Group Estimation for ARDL
Dependent Variable: Financial Development (Capital Market Development)
Openness Proxy: Import Duties/Total Imports
Capital Inflows Proxy: Private Capital Flows

	Market Capitalisation		Total Share Value Traded		Number of Companies Listed	
Without Interaction Term	Model 1	Hausman Test	Model 2	Hausman Test	Model 3	Hausman Test
RGDPC	0.53	0.32	0.02	0.94	0.62	0.56
	(5.13)***	(0.57)	(0.33)	(0.33)	(3.38)***	(0.46)
R	0.15	1.90	0.11	1.96	0.05	0.70
	(0.66)	(0.17)	(1.59)	(0.16)	(1.52)	(0.40)
INS	0.15	0.99	0.15	1.79	0.29	0.94
	(2.27)**	(0.32)	(5.97)***	(0.18)	(6.39)***	(0.33)
CIF	0.33	1.15	0.64	0.76	0.08	0.03
	(2.30)**	(0.28)	(3.13)***	(0.38)	(0.28)	(0.86)
ID	0.39	0.18	0.50	0.00	0.73	1.50
	(3.39)***	(0.67)	(2.69)***	(0.97)	(4.56)***	(0.22)
Error Correction Coefficients	-0.20		-0.20		-0.31	
	(-2.28)**		(-2.26)**		(-3.62)***	
Joint Hausman Test for long-run homogeneity	11.33		7.93		3.39	
	(0.05)		(0.16)		(0.64)	
With Interaction Term	Model 4	Hausman Test	Model 5	Hausman Test	Model 6	Hausman Test
RGDPC	0.19	0.17	0.02	1.78	0.39	0.00
	(0.58)	(0.68)	(0.31)	(0.18)	(7.12)***	(0.95)
R	0.24	0.26	0.11	0.21	0.02	0.10
	(1.32)	(0.61)	(1.49)	(0.65)	(1.67)	(0.75)
INS	0.48	0.00	0.15	0.21	0.42	0.15
	(3.11)***	(0.98)	(6.09)***	(0.65)	(1.79)	(0.70)
CIF	0.23	5.51	0.54	1.11	0.25	1.96
	(2.38)**	(0.02)	(2.34)**	(0.29)	(1.77)	(0.16)
ID	0.55	0.01	0.55	0.55	0.46	3.44
	(3.16)***	(0.94)	(2.69)***	(0.46)	(4.73)***	(0.06)
CIF x ID	0.43	0.17	0.35	0.14	0.57	2.43
	(2.49)**	(0.68)	(0.65)	(0.71)	(3.21)***	(0.12)
Error Correction Coefficients	-0.30		-0.35		-0.22	
	(-3.72)***		(-3.60)***		(-2.35)**	
Joint Hausman Test for long-run homogeneity	9.20		8.93		7.02	
	(0.26)		(0.12)		(0.32)	
N x T	252		252		182	

Notes: Figures in parentheses are t-statistics except for Hausman test (H), which are p-values. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. ID = import duties.

Overall, the pooled mean group estimation results indicate that trade openness and capital inflows are statistically significant to determine financial development. Besides, the interaction between both variables has a positive and highly statistically significant. This finding is consistent with Rajan and Zingales (2003), who find that openness has a positive and statistically significant effect on financial development[65]. This result is similar with

[65] The financial development indicators employed by Rajan and Zingales (2003) are stock market capitalisation/GDP, number of domestic companies listed/population and security issues/GDP.

Svaleryd and Vlachos (2002), who find evidence that openness can cause financial development and they do not find evidence in the opposite direction.

4.6 Conclusions

This chapter examines the determinants of financial development from the trade openness and capital inflows perspectives in the developing countries. Although trade openness and capital inflows have been gaining popularity in recent years, there has been no available econometric evidence to trace the link between both variables with financial development. As financial and economic integration become a reality for an increasing number of developing countries, it is important to understand how the interaction between capital flows and trade openness affect financial development.

The evidence presented utilising cross-country regressions and panel data analysis in a group of developing countries, provides varying degrees of support to the Rajan and Zingales (2003) hypothesis – that simultaneous opening of both the capital and trade accounts will promote financial development. The evidence is at its strongest when we utilise dynamic panel estimation techniques, and is robust to alternative measures of both trade account and capital account openness. The evidence remains valid for a variety of financial development indicators, including 3 indicators of banking system development and 3 indicators of capital market development.

These findings also suggest that among the conventional determinants of financial development real GDP per capita is the most robust one, while as suspected by several authors in the past, the influence of the real interest rate is, at best, very weak and statistically insignificant. We also find that institutional quality is a robust and statistically significant determinant of financial development, providing support to the case made by Arestis and Demetriades (1997, 1999). There is also some evidence to suggest that capital inflows have an independent positive influence on financial development, independently of their influence through the interaction term, especially so in the case of capital market development. Finally, trade openness is not found to have a separate independent influence on financial development, irrespective of which measure is employed. In terms of policy implications,

these findings suggest that simultaneously stimulating foreign capital inflows and trade openness, improving institutions and economic development will encourage the development of the financial system.

Appendix 4.I The List of Developing Countries in the Sample

Table A.4.1: The List of Developing Countries for Banking Sector Development and Capital Market Development Indicators

Banking sector Development (N = 43)

1. Algeria	12. Gambia	23. Malta	34. Sri Lanka
2. Bangladesh	13. Ghana	24. Malaysia	35. Syrian Arab Republic
3. Bolivia	14. Guatemala	25. Mexico	36. Thailand
4. Botswana	15. Honduras	26. Morocco	37. Togo
5. Cameroon	16. India	27. Niger	38. Trinidad and Tobago
6. Chile	17. Indonesia	28. Nigeria	39. Tunisia
7. Costa Rica	18. Jamaica	29. Pakistan	40. Turkey
8. Cote d'Ivoire	19. Jordan	30. Papua New Guinea	41. Uruguay
9. Ecuador	20. Kenya	31. Philippines	42. Venezuela
10. Egypt	21. Korea	32. Senegal	43. Zimbabwe
11. El Salvador	22. Malawi	33. Sierra Leone	

Note: Argentina and Brazil are not included in the sample due to these two countries have very high interest rate in 1990s and this may create an outlier and distort the model equilibrium.

Capital Market Development (N = 22)

1. Chile	12. Morocco
2. Cote d'Ivoire	13. Nigeria
3. Egypt	14. Pakistan
4. India	15. Philippines
5. Indonesia	16. Sri Lanka
6. Jamaica	17. Thailand
7. Jordan	18. Trinidad and Tobago
8. Kenya	19. Turkey
9. Korea	20. Uruguay
10. Malaysia	21. Morocco
11. Mexico	22. Nigeria

Appendix 4.II Notes on the Calculation of the Chinn and Ito (2002) Financial Openness Variable

Construction of Capital Account Openness (KAOPEN)

The index on capital account openness from Chinn and Ito (2002) is based on the four binary dummy variables reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER)*. These variables are to provide information on the extent and nature of the restrictions on external accounts for a wide cross-section of countries. These variables are:

i. k_1: variable indicating the presence of multiple exchange rates;

ii. k_2: variable indicating restrictions on current account transactions;

iii. k_3: variable indicating restrictions on capital account transactions; and

iv. k_4: variable indicating the requirement of the surrender of export proceeds.

In order to focus on the effect of *financial openness* – rather than *controls* – they reverse the values of these binary variables, such that the variables are equal to one when the capital account restrictions are non-existent. Moreover, for controls on capital transitions (k_3), they use the share of a five-year window that capital controls were not in effect ($SHAREk_3$). More specifically, the capital account openness variable for year t is proportion of five years encompassing year t and the preceding four years that the capital account was open:

$$Share_{3,t} = \left(\frac{k_{3,t} + k_{3,t-1} + k_{3,t-2} + k_{3,t-3} + k_{3,t-4}}{5} \right)$$

Then they construct an index for capital "openness" (*KAOPENt*), which is the first standardized principal component of k_{1t}, k_{2t} $SHAREk_3$, k_{4t}. This index takes on higher values the more open the country is to cross-border capital transactions. By construction, the series has a mean of zero. The average value of *KAOPEN* in the full sample of countries in Chinn

and Ito is growing at 3.8% annually. The first eigenvector for *KAOPEN* was found to be ($SHAREk_3$, k_1, k_2, k_4)' = (0.563, 0.280, 0.516, 0.582)', indicating that the variability of *KAOPEN* is not merely driven by the $SHAREk_3$ series.

The incorporate the $k_{1,t}$, $k_{2,t}$, and $k_{4,t}$ variables in their KAOPEN variable instead of focusing on k_3 which refers to restrictions on capital account transactions. They believe the incorporation of $k_{1,t}$, $k_{2,t}$, and $k_{4,t}$ in this index allows them to more accurately capture the intensity of the capital controls. This point can be made more concrete by considering a country with an open capital account. It may still restrict the flow of capital by limiting transactions on the current account restrictions or other systems such as multiple exchange rates and requirements to surrender export proceeds. Alternatively, countries that already have closed capital accounts might try to increase the stringency of those controls by imposing k_1, k_2, and k_4 types of restrictions so that the private sector cannot circumvent the capital account restrictions.

Appendix 4.III Definition and Source of the Data

Table A.4.2: Definition and Data Sources Employed in the Analysis

Variable	Definition	Source
Liquid Liabilities/GDP (1980 – 2000, N = 43)	- Liquid liabilities the sum of currency and deposits in the central bank (M0), plus transferable deposits and electronic currency (M1), plus time and savings deposits, foreign currency transferable deposits, certificates of deposit, and securities repurchase agreements (M2), plus travelers checks, foreign currency time deposits, commercial paper, and shares of mutual funds or market funds held by residents.	World Development Indicators (World Bank CD-ROM, 2003)
Private Sector Credit/GDP (%) (1980 – 2000, N = 43)	- financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment.	World Development Indicators, 2003
Domestic Credit Provided by Banking Sector/GDP (%) (1980 – 2000, N = 43)	- includes all credit to various sectors on a gross basis. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits).	World Development Indicators, 2003
Stock Market Capitalisation/GDP (%) (1980 – 2000, N = 22)	Market capitalization (also known as market value) is the share price times the number of shares outstanding.	Beck *et al.* (2003b). World Development Indicators, 2003
Total Share Value Traded/GDP (%) (1980 – 2000, N = 22)	Stocks traded refers to the total value of shares traded during the period.	Beck *et al.* (2003b). World Development Indicators, 2003
Listed Domestic Companies/Population (%) (1988 – 2000, N = 22)	Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year.	World Development Indicators, 2003
Private capital flows, net total (US$) (1980 – 2000, N = 43)	Net private capital flows consist of private debt and nondebt flows. Private debt flows include commercial bank lending, bonds, and other private credits; nondebt private flows are foreign direct investment and portfolio equity investment. Data are in current U.S. dollars.	World Development Indicators, 2003
Deposit Interest Rate (%) (1980 – 2000, N = 43)	Deposit interest rate is the rate paid by commercial or similar banks for demand, time, or savings deposits.	World Development Indicators, 2003
Inflows of Capital/GDP (%) (1980 – 2000, N = 16)	Capital inflows (sum of foreign direct investment and portfolio inflows) divided by GDP	International Financial Statistics (IFS), lines 78bed + 78 bgd
Total Trade/GDP (%) (1980 – 2000, N = 43)	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	World Development Indicators, 2003
Import Duties/Total Imports (%) (1980 – 2000, N = 15)	Import duties comprise all levies collected on goods at the point of entry into the country. The levies may be imposed for revenue or protection purposes and may be determined on a specific or ad valorem basis, as long as they are restricted to imported products. Data are shown for central government only.	World Development Indicators, 2003

CHAPTER FIVE

FINANCIAL LIBERALSIATION AND STOCK MARKET VOLATILITY IN EAST ASIA

5.1 Introduction

As discussed in Chapter Two, financial markets and systems play a key role in the economy by allocating funds from savers to investors. Volatility in the prices of financial assets becomes a normal part of the process of allocating investable funds among competing uses. Nevertheless, excessive financial volatility such as stock prices, interest rates and exchange rates may be detrimental because such volatility may impair the smooth functioning of the financial system and adversely affect economic performance.

In the last two decades nearly all emerging economies[66] gradually liberalised their financial markets in terms of opening up their stock market to foreign investors – a process termed financial or stock market liberalisation. For most emerging markets, liberalisation is regarded as an essential policy tool that attracts much needed foreign funds for investment purposes. In the cases of East Asian emerging economies, namely South Korea, Taiwan, Malaysia, Thailand and the Philippines have changed their laws to allow foreigners to invest legally in their stock markets in the late 1980s and early 1990s. The expansion of stock markets in these markets has been truly impressive after the opening of stock markets. In the late 1980s, the flow of foreign portfolio investment into Asia economies was only US$1 million. However, by 1993, the flow had increased to $25 billion (an increase of over 1,900% in that period). In parallel, the ratio of market capitalisation in relation to GDP of East Asian emerging markets tripled between 1987 and 1990 and grew at an even more rapid pace in the years 1991-1994 (see Figure 5.1).

[66] The International Finance Corporation (IFC) defines an 'emerging market' as a stock market that is in transition, increasing in size, activity, or level of sophistication (IFC, 2000). In general, the IFC classifies a stock market as 'emerging' if it meets at least one of two general criteria: (i) it is located in a low- or middle-income economy as defined by the World Bank, and (ii) its investable market capitalisation is low relative to its most recent GNP figures. Stock markets that retain or introduce investment restrictions such as foreign limits, capital controls, extensive government involvement with listed companies, and other legislated restraints on activity, particularly on foreign investors, are generally considered emerging. According to the IFC, pervasive investment restrictions on foreign portfolio investment should not exist in developed stock markets, and their presence is a sign that the market is not yet 'developed'.

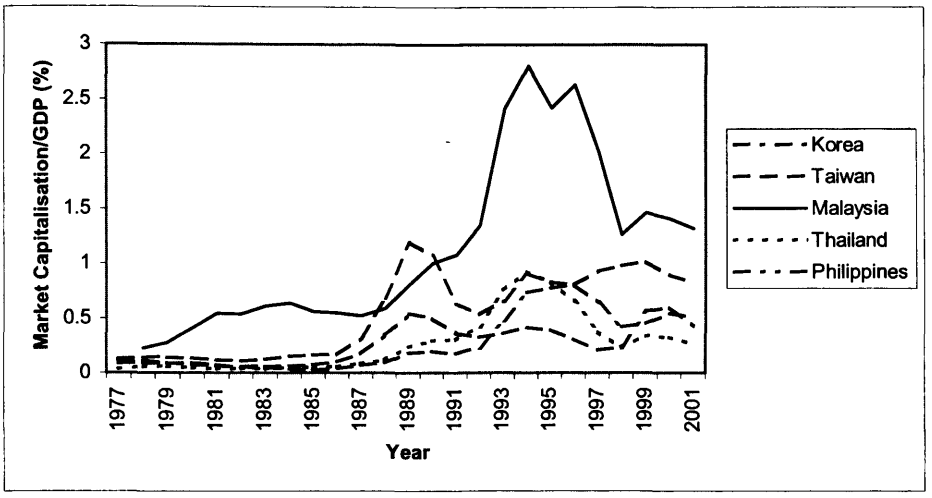

Figure 5.1: Stock Market Capitalization/GDP of East Asian Emerging Markets

Besides the formation of stock markets in emerging markets after liberalisation, the foreign inflow of portfolio investment also helped spark a boom in stock prices, where they did not previously exist. According to Henry (2000), on average, a country's first market liberalisation caused an average 38 percent increase in stock market value in real dollar terms[67]. This increase in valuation implies an average 38 percent decrease in the cost of equity capital. Eun and Janakiramanan (1986), Alexander *et al.* (1987), Bekaert and Harvey (1997) and Stulz (1999) predict that stock market liberalisation may reduce the liberalizing country's cost of equity capital by allowing for risk sharing between domestic and foreign investors, then, holding expected future cash flows constant, a country's equity price index should increase when the market learns that a stock market liberalisation is going to occur. The physical investment also tends to increase as a result of stock market liberalisation, because a fall in a country's cost of equity capital will transform some investment projects that had a negative net present value (NPV) before liberalisation into positive NPV activities after liberalisation.

Most empirical studies have shown that liberalisation has had an unmitigated benefit for emerging markets, such as the decreased cost of equity, increased returns and increased private physical investment. Nevertheless, liberalisation could make an economy susceptible to economic and political turmoil abroad making the domestic stock markets more volatile.

[67] Henry (2000) provides an excellent chronology of emerging markets stock market liberalisation programmes and important dates.

Singh (1993) argues that the expansion of less developed countries stock markets threatens to induce speculation and financial crises and a misallocation of savings and investment, to the detriment of real sector growth and stability. Granger *et al.* (1999) point out that short-term capital outflows in East Asian economies caused the market crisis, to a large extent. As such, a legitimate question is whether financial liberalisation in terms of opening their stock market leads to the stock market becoming more volatile as international investors have increased access to the market and liberalised international capital flows.

The objective of this study is to examine whether financial liberalisation has created excess stock market volatility in five East Asian emerging markets. In other words, it investigates how the stock market volatility has changed in the wake of the movement towards financial liberalisation. The choice of these countries makes the analysis especially relevant. The sample period is covering pre-financial liberalisation, post-financial liberalisation and post-financial crisis eras. By the end of the sample, such as in year 2001, the ratio of market capitalisation over GDP in Malaysia, South Korea and Taiwan was comparable to that of the developed countries (see Figure 5.2). The sample, therefore, covers the years of development of stock market and of economic and financial opening of the countries.

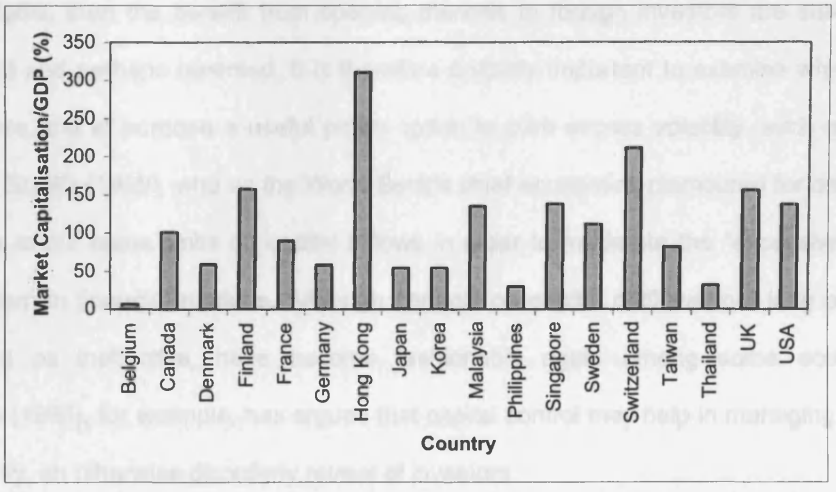

Figure 5.2: Stock Market Capitalization/GDP of Developed and East Asian Emerging Markets, 2001

The recent attention given to volatility in stock markets is understandable in the light of rapid developments in world financial markets and the occurrence of the several financial crises, such as Latin America, East Asia and Russia in the early and late 1990s. Stock market volatility represents the variability of stock price changes during a period of time. Investors, investment analysts, brokers, dealers and regulators care about stock market volatility not just because it is perceived as a measure of risk, but because they worry about "excessive" volatility in which observed fluctuations in stock prices do not appear to be accompanied by any important news about the firm or market as a whole. In addition, volatility has adverse implications for decisions pertaining to the effective allocation of resources and, hence for investment. For example, volatility makes investors more averse to holding stocks due to uncertainty. Investors in turn demand a higher risk premium in order to insure against the increased uncertainty. A greater risk premium results in a higher cost of capital, which then leads to less private physical investment. In addition, greater volatility may increase the value of the 'option to wait' thereby delaying investment, which might have an impact on economic growth.

Since volatility is an unattractive feature, the emerging market economies must take into consideration of the behaviour of stock market volatility before opening up their markets to foreign investors. If financial liberalisation indeed can cause stock markets to become more volatile, then the benefit from opening markets to foreign investors are substantially weakened and perhaps reversed. It is therefore crucially important to examine whether this is the case and to purpose a useful policy option to curb excess volatility, such as capital controls. Stiglitz (1999), who as the World Bank's chief economist, clamoured for developing countries to put some limits on capital inflows in order to moderate the "excessive" boom-bust pattern in financial markets. Although controls on capital outflows, not long ago were dismissed as ineffective, have become fashionable again among some economists. Krugman (1998), for example, has argued that capital control may help in managing, at least temporarily, an otherwise disorderly retreat of investors.

This study represents an advance over previous empirical literature in a number of important respects First, three sub-sample periods are used to better dissect the impact of financial liberalisation on stock market volatility. Pre-liberalisation covers five years before liberalisation, post-liberalisation before the 1997-98 East Asian financial crisis and post-

liberalisation after crisis periods. By extending the sample period further, this study aims to examine the impact of financial liberalisation on stock market volatility in longer time horizon. Second, the Exponential GARCH (EGARCH) model combined with the sudden changes of unconditional variance is employed in the analysis in order to capture all the variance effects. Third, the GARCH model is also employed in the analysis by dividing the sample period based on the structural break dates, which are identified correspond closely to dates of official financial liberalisation reforms. We are interested to look for changes in conditional volatility, that is, the value of volatility given a specific realisation of past returns, and also interested in changes in unconditional volatility, i.e. in the data generating process.

This Chapter is organized as follows. Section 5.2 describes the econometric methodology employed in the analysis. Section 5.3 explains the sources of data collected, section 5.4 reports the empirical results and the last section contains the conclusion.

5.2 Econometric Methodology

5.2.1 Estimation of Unpredictable Stock Returns

Before examining the impact of financial liberalisation on stock market volatility, the stock returns series of five East Asian emerging markets are constructed from the continuously compounded stock returns[68]. There is a long history of arguments in the analysis of stock returns that the mean return exhibits little predictability from the past (Bekaert and Harvey, 1995). Qualifications to this conclusion are the existence of a possible moving average error term induced by calendar effects. The unpredictable part of the stock returns will be obtained through a procedure similar to the one in Pagan and Schwert (1990). The procedure involves a day-of-the-week effect adjustment and autoregressive regression, which removes the predictable part of the return series. Therefore, the returns for some days are removed from the sample to avoid having regular and predictable market closures, which affect the characterisation of the volatility dynamics.

[68] The daily return stock price index series on day t (RPI_t) is generated as follows:

$$RPI_t = (100) \times (\log PI_t - \log PI_{t-1})$$

where PI_t represents the closing value of the five East Asian emerging stock price indices on day t. The return series is therefore the time series of continuously compounded daily returns expressed as a percentage.

Let RPI_t be the daily return of the stock price index for day t. Returns are regressed on a constant and four day-of-the-week dummy variables to get the residual, u_t.

$$RPI_t = \alpha + \beta_1 \text{TUE}_t + \beta_2 \text{WED}_t + \beta_3 \text{THU}_t + \beta_4 \text{FRI}_t + u_t \quad (5.1)$$

where TUE_t, WED_t, THU_t and FRI_t are dummy variables for Tuesday, Wednesday, Thursday and Friday respectively. The u_t is then regressed on a constant and $u_{t-1},\ldots. u_{t-5}$ to obtain the residual, ε_t, which is the unpredictable stock return data.

$$u_t = a + b_1 u_{t-1} + b_2 u_{t-2} + b_3 u_{t-3} + b_4 u_{t-4} + b_5 u_{t-5} + \varepsilon_t \quad (5.2)$$

5.2.2 Detecting Break Points of Sudden Changes in Variance

Once the unpredictable stock returns series have been estimated, the next step is to identify the change points in the time series. Detecting variation or sudden changes in variance is central to understanding and proper interpretation of time series behaviour. Numerous tests have been proposed to detect the existence of multiple changes in the variance of time series. One of them is that of Inclan and Tiao (1994), which is based on the Iterated Cumulative Sum of Squares (ICSS) algorithm. The Inclan and Tiao (1994) procedure applies to independent and identically distributed processes and is designed to find a break in the unconditional variance with unknown location. This test has been widely used to detect changes in the volatility of financial time series. Among others, Wilson *et al.* (1996), Aggarwal *et al.* (1999), Huang and Yang (2001) and Malik (2003). Andreou and Ghysels (2002) demonstrate that the Inclan and Tiao test has nevertheless power and only minor size distortions when applied to strongly dependent data via Monte Carlo. Sanso *et al.* (2002) point out that the detected changes obtained by Aggarwal *et al.* (1999) with the Inclan and Tiao (1994) ICSS procedure are spurious.

Aggarwal *et al.* (1999) point out that the time series of interest displays a stationary variance over an initial period until a sudden change in variance occurs. The variance is then stationary again for a time until the next sudden change. This process is repeated through time, yielding a time series of observations with an unknown number of changes in the variance. In order to estimate the number of changes in variance and the point in time of each variance shift, a cumulative sum of squares proposed by Inclan and Tiao (1994) is

employed. Their method can be applied to squared returns or to absolute returns, and are designed to test for the most likely location of a change in the unconditional variance of the series. Let $C_k = \sum_{t=1}^{k} \varepsilon_t^2$, k = 1, ...,T, be the cumulative sum of the squared (mean-centered) observations of ε_t from the start of the series to the kth point in time. Then define the statistic D_k as follows:

$$D_k = \left[\frac{C_k}{C_T}\right] - \frac{k}{T} \qquad k = 1,....T \text{ with } D_0 = D_t = 0 \qquad (5.3)$$

If there are no changes in variance over the sample period, the D_k statistic oscillates around zero (a horizontal line when the D_k values are plotted against k). On the other hand, if there are one or more sudden variance changes in the series, the D_k values drift either up or down from zero. Critical values based on the distribution of D_k under the null hypothesis of homogenous variance provide upper and lower boundaries to detect a significant change in variance with a known level of probability. When the maximum of the absolute value of D_k is greater than the critical value, the null hypothesis of no changes is rejected. Let k^* be the value of k at which $\max_k |D_k|$ is attained. If $\max_k \sqrt{(T/2)}|D_k|$ exceeds the predetermined boundary, then k^* is taken as an estimate of the change point. The factor $\sqrt{(T/2)}$ is needed to standardize the distribution and to identify the change points. The critical values at the 95th percentile and 99th percentile are 1.36 and 1.628, thus the upper and lower boundaries are ±1.36 and ±1.628, respectively in the D_k plot. Exceeding these boundaries indicates a significant change in variance in the series analysed.

If we were concerned only with the possible existence of a single point of change, then the D_k function would provide a satisfactory procedure. However, when we are interested in finding multiple points of variance change on an observed series, the usefulness of the D_k function alone is not enough because of masking effects. In order to avoid that problem, Inclan and Tiao (1994) designed an algorithm pieces of the series. The ICSS algorithm is based on successive evaluation of D_k at different parts of the series, dividing consecutively after a possible change point is found. The Inclan and Tiao (1994) procedure for multiple breaks is described in Appendix 5.I.

5.2.3 GARCH and EGARCH Models

Since the introduction of autoregressive conditional heteroscedasticity (ARCH) model by Engle (1982) to explain the volatility of inflation rates, much research applies ARCH with various model extensions to financial time series. One of them is the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model developed by Bollerslev (1986). The GARCH framework is an extension to the basic Autoregressive Conditional Heteroskedasticity (ARCH) model of Engle (1982). Both models employ the volatility clustering which helps to determine the magnitude but not the sign of the shocks. In the GARCH representation the conditional mean and conditional variance equations are written as

$$y_t = \delta_0 + \sum_{i=1}^{k} \delta_i y_{t-i} + \varepsilon_t \qquad \varepsilon_t | \psi_{t-1} = N(0, h_t) \tag{5.4}$$

$$h_t = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \beta_j h_{t-j} \tag{5.5}$$

where y_t is the variable to be modeled and it is assumed to be following an autoregressive model, ε_t is the disturbance with variance h_t, ω, α_i, and β_i are constant parameters, where $\omega > 0$, $\alpha \geq 0$, for $i = 1,....,p$, and $\beta \geq 0$, for $j = 1,...,q$. If $\sum_{i=1}^{p} \alpha_i + \sum_{j=1}^{q} \beta_j < 1$, then $\{\varepsilon_t\}$ is covariance stationary and its unconditional variance is equal to $\omega\left(1 - \sum_{i=1}^{p} \alpha_i - \sum_{j=1}^{q} \beta_i\right)^{-1}$. The GARCH model containing only three parameters in the conditional variance equation is very parsimonious model that allows an infinite number of past squared shocks to influence the current conditional variance. This implies that the GARCH model is capable of capturing the volatility clustering in the financial markets that a large conditional variance tends to be followed by another large conditional variance.

Even though the ARCH and GARCH models are able to capture the volatility clustering in the financial data, these models cannot capture some important features of the data. The most interesting feature not addressed by these models is the leverage or

asymmetric effect found by Black (1976)[69], and confirmed by the findings of French *et al.* (1987), Campbell and Hentschel (1992), Nelson (1991), Schwert (1990), Glosten *et al.* (1993) and Koutmos *et al.* (1993), among others. Statistically, this effect occurs when an unexpected decrease in price (bad news) increases predictable volatility more than an unexpected increase in price (good news) of similar magnitude. This effect suggests that a symmetry constraint on the conditional variance function in past ε's is inappropriate due to the negative and positive innovations have different impacts on volatility. The GARCH model cannot generate asymmetric conditional volatility to the different sign of the residuals. This is because the conditional variance in the GARCH model is the function of previous squared residuals so that the sign of residuals does not have any role in determining the conditional variance.

One method proposed to capture such asymmetric effects that takes into account the leverage effect is Nelson's (1991) exponential GARCH or EGARCH model[70]. In the EGARCH model, the specified conditional variance h_t depends on both the size and the sign of lagged residual and is formulated as

$$\log(h_t) = \omega + \beta \log(h_{t-1}) + \gamma \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \alpha \left[\frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} - \sqrt{\frac{2}{\pi}} \right] \qquad (5.6)$$

where ω, β, γ and α are constant parameters. The model has several advantages over the pure GARCH specification. First, since the $\log(h_t)$ is modelled, then even if the parameters are negative, h_t will be positive. There is thus no need to artificially impose non-negatively constraints on the model parameters. Second, asymmetries are allowed for under the EGARCH formulation, since if the relationship between volatility and returns is negative, γ, will be negative. The EGARCH model is asymmetric because the level of $\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}$ is included with a coefficient γ. The conditional variance has asymmetry if the leverage-effect term, γ, is significantly different from zero ($\gamma \neq 0$).

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[69] Black reasons that when the price of a company's stock falls, its value of the equity also falls, as a result, the company's leverage, or its debt-to-equity ratio, increase. Leverage is generally interpreted as an indicator of a company riskiness: when the leverage ratio increase, the company is consider more risky, and a higher degree of risk is associated with higher volatility.

[70] Besides EGARCH model, several empirical volatility models have developed with various nonlinear specifications in the conditional variance equation. Among those asymmetric volatility models are the GJR model by Glosten *et al.* (1993), the threshold ARCH (TARCH) by Zakoian (1994) and the quadratic ARCH (Q-ARCH) by Sentana (1995).

5.2.4 The Combined Model with Exponential GARCH and Sudden Changes in Variance

It has long been conjectured that stock market volatility exhibit occasional breaks. Diebold (1986) suggests that conditional heteroskedastic models tend to over-estimate persistence of volatility when there are instabilities at the unconditional second moment. Lamoureux and Lastrapes (1990), among others, find that this persistence may originate from structural changes in the variance process. For instance, if the variance is high but constant for some time and low but constant otherwise, persistence of such high- and low-volatility homeskedastic periods already results in volatility persistence.

Most of the researchers in analysing the impact of financial liberalisation on stock market volatility are employed the ARCH and GARCH types model without taking consideration of sudden changes of unconditional variance such as Huang and Yang (2000), Spyrou and Kassimatis (1999) and Kassimatis (2002). Recent financial literature that volatility display structural breaks has attracted much interest of the researchers. For instance, Andreou and Ghysels (2002) evaluate the performance of several recently proposed tests for structural breaks in the conditional variance dynamics of returns. These recent tests can be applied to GARCH models that are typically proposed for financial time series. In addition, the tests can be used to identify both the location and the number of structural breaks.

The empirical approach in this study first detects the change points by using the Inclan and Tiao (1994) ICSS algorithm and then dummy variables are introduced into the variance equation of the EGARCH model to account for the sudden changes in variance. This is because in modelling the stock return volatility, the EGARCH model by itself may not capture all of the variance effects. For example, there may still be sudden changes in the variance of standardized residuals after fitting an EGARCH model. Therefore, it is crucial to include the break points of sudden changes in variance that can capture some of the time varying volatility or breaks in the volatility process. The combined model with EGARCH(1,1) and dummy variables is given by

$$R_t = \delta_0 + \delta_i \sum_{i=1}^{k} R_{t-i} + \varepsilon_t \qquad (5.7)$$

$$\varepsilon_t | \Omega_{t-i} \sim N(0, \sigma_t^2) \tag{5.8}$$

$$\log(\sigma_t^2) = \omega + \sum_{i=1}^{p} \beta_i \log(\sigma_{t-i}^2) + \sum_{j=1}^{q} \left[\alpha_j \left| \frac{\varepsilon_{t-j}}{\sigma_{t-j}} \right| + \gamma_j \frac{\varepsilon_{t-j}}{\sigma_{t-j}} \right] + d_1 D_1 + \ldots . d_n D_n \tag{5.9}$$

where R_t represents weekly stock returns and it is assumed to be following an autoregressive model, ε_t is the market innovation or residuals, σ_t^2 is the conditional variance of the returns process based on the information set Ω_{t-1} of relevant and available past data; ω, β, γ and α are constant parameters, $D_1,\ldots,D_n$ are the dummy variables taking a value of one from each point of sudden change of variance, zero otherwise. The conditional variance has asymmetry if the leverage-effect term, γ, is significantly different from zero ($\gamma \neq 0$).

Parameters of the variance (Equation 5.9) are obtained by the maximum likelihood method namely the Berndt, Hall, Hall and Hausman (1974) algorithm (BHHH) nonlinear method with robust standard errors. The choice of the GARCH orders for the lag lengths p and q was based on the minimisation of the BIC criterion. Finally, the adequacy of the EGARCH model is examined by employing three diagnostic tests, namely the Ljung Box Q-statistics and Ljung Box Q-statistics residuals squared for detecting autorcorrelation and heterockedasticity of the standardized residuals. Besides, the sign and size bias tests proposed by Engle and Ng (1993) are employed to examine whether an asymmetric model is required for the stock return series, or whether the symmetric GARCH model can be deemed adequate.

5.2.5 News Impact Curve (NIC) of EGARCH Model

The news impact curves suggested by Engle and Ng (1993) based on the parameters of EGARCH model is constructed to determine the impact of financial liberalisation on stock market volatility. In the asymmetric volatility models such as EGARCH, good news and bad news have different predictability for future volatility. The news impact curve characterises the impact of past return shocks on the return volatility which is implicit in a volatility model. This curve measures how new information is incorporated into volatility estimates.

The news impact curve is the plot of the current conditional volatility, h_t, over the previous innovation (ε_{t-1}) with the lagged h_t being evaluated as its unconditional variance (σ^2) of the stock return. In other words, it relates past return shocks (news) to current volatility. For the EGARCH model, the curve is minimum and centred at $\varepsilon_{t-i} = 0$ and has different exponential functions for $\varepsilon_{t-i} < 0$ and $\varepsilon_{t-i} > 0$ respectively, such that the NIC of the EGARCH model reflects the asymmetric impact on volatility. The following is the function of the news impact curve for EGARCH model:

NIC: $$h_t = C.\exp\left[\frac{(\gamma+\alpha)}{\sigma}\varepsilon_{t-1}\right] \text{ for } \varepsilon_{t-1} > 0 \quad (5.10)$$

and

$$h_t = C.\exp\left[\frac{(\gamma-\alpha)}{\sigma}\varepsilon_{t-1}\right] \text{ for } \varepsilon_{t-1} < 0 \quad (5.11)$$

where $C = \sigma^{2\beta}\exp\left(\varpi - \alpha\sqrt{\frac{2}{\pi}}\right)$, σ is the unconditional return standard deviation, γ is the parameter for the $\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}$ term and α is the parameter for the $\frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}}$ in the EGARCH equation. The level of volatility is represented by the vertical axis for $\varepsilon_{t-i} = 0$ of the news impact curve.

5.3 The Data

The data in this study consists of the daily closing stock price index, expressed in the local currency of the Korea Stock Price Index (KOSPI), Taiwan Weighted Stock Index (TWI), Kuala Lumpur Composite Index (KLCI), Stock Exchange of Thailand Index (SETI) and the Philippines Stock Exchange Composite Index (PSECI). The stock price index in terms of US dollar is not employed in order to study the effect on stock markets from a local perspective and to isolate the study from exchange rate volatility effects. The sample period starts from 5 years prior to financial liberalisation, and until December 2002. Daily data (5

days a week) in total are collected from *Datastream*. The impact of the financial liberalisation on the stock market volatility is conducted over three sub-sample periods, namely pre-liberalisation, post liberalisation before 1997-98 financial crisis and post-liberalisation after crisis (May 1997 - 2002) periods. The comparisons across different sub-sample periods will determine whether the volatility of East Asian emerging stock market of the three dates have increased or decreased significantly after financial liberalisation as well as after East Asian financial crisis.

5.3.1 Financial Liberalisation Dates of East Asian Emerging Markets

The dating of financial liberalisation in terms of stock market opening up to foreign investors has always been a contested issue[71]. At the heart of the issue is whether it is exogenously or endogenously determined. An exogenously determined date is one set by policy makers (the official decree date), whereas an endogenously determined date is one derived from the actions of economic agents following an economic or political event not directly linked to stock market liberalisation.

Numerous studies have conducted to examine the opening dates of emerging stock markets. Among others, Bekaert (1995), Bekaert and Harvey (1997), Henry (2000) and Kim and Singal (2000). Henry (2000) and Kim and Singal (2000) use the most sophisticated methods to determine these opening dates. Kim and Singal (2000) first survey the previous literature including Bekaert (1995) and Buckberg (1995) and then identify the liberalisation date as the most significant liberalisation of the market. They use actual opening dates, not the announcement dates. On the other hand, Henry (2000) uses the establishment of the first country fund or a sharp increase in the investability ratio (ratio of the market capitalization of stocks that foreigners can legally hold to total market capitalization) to identify the first opening date.

Kim and Singal (2000) and Henry (2000) state the difficulties in identifying the opening dates. First, liberalisation is often a gradual process where restrictions to foreign investors are removed gradually. In addition, a once-open market may temporarily restrict

[71] see for example Brooks *et al.*, 1997; Errunza and Miller, 2000; Bekaert and Harvey, 2000; Henry 2000; Bekaert *et al.*, 2001.

foreign investment under unusual circumstances. Second, the announcement of the opening dates typically precede the actual opening dates. If investors have rational expectations, the effect of market liberalisation may appear around the announcement dates rather than the actual opening dates.

Empirical work that makes an attempt in resolution the dating problem is that of Bekaert *et al.* (2002). They make a distinction between dates of regulatory liberalisations and the dates that are defining events for market integration. Defining the effective liberalisation date as that results in market integration they exploit an econometric technique suggested by Bai *et al.* (1998) to estimate endogenous break dates for 20 emerging markets. They find that structural breaks usually occur later than official decree dates suggesting the policy regime has to earn credibility first.

Table 5.1 provides a comparison of the liberalisation dates in the literature. It demonstrates that there is a different of views on dates of stock market opening. By and large, all liberalisation dates are exogenously determined, that is, determined on the basis of an important policy announcement date. Most studies use liberalisation dates that are invariably the dates of the official policy decree.

Table 5.1: Comparisons of Official Financial Liberalisation Dates in East Asian Emerging Markets Across Authors

Country	Kassimatis (2000)	Henry (2000)	Kim & Singal (2000)	Bekaert & Harvey (2000)	Santis & Imrohoroglu (1997)	Bhattacharya & Daouk (2002)	Fuchs-Schundeln & Funke (2001)
Korea	1-92	6-87	1-92	1-92	1-92	1-92	1-92
Taiwan	1-91	5-86	1-91	1-91	1-91	1-91	1-91
Malaysia	NA	5-87	12-88	12-88	12-88	12-88	12-88
Thailand	NA	1-88	8-88	9-87	12-88	9-87	9-87
Philippines	11-91	5-86	7-86	6-91	10-89	6-91	6-91

Note: NA = not available in the study

In this study, the approach to identifying the opening dates is to combine the dates identified by official documents with data-based methods and most widely employed in the literature. Therefore, the official liberalisation dates for five Asian emerging markets are based on Bekaert and Harvey (2000), Santis and Imrohoroglu (1997), Bhattacharya and Daouk (2002) and Fuchs-Schundeln and Funke (2001), namely: January 1992 for South Korea, January 1991 for Taiwan, December 1988 for Malaysia, September 1987 for Thailand

and June 1991 for the Philippines. The discussion of the choices for official liberalisation dates in East Asian emerging markets is presented in Appendix 5.II. Although these are not the only liberalisation policies implemented in these economies, they are considered of great importance in opening up their respective stock markets to foreign investment.

5.3.2 Descriptive Statistics

Table 5.2 presents the descriptive statistics for stock returns of five East Asian emerging markets in each sub-sample period (pre-, post-liberalisation and post crisis). The statistics – arithmetic returns and standard deviations, skewness, kurtosis and the number of observations – are reported for local currency returns. The mean of stock return is decreased in the cases of five East Asian emerging markets after liberalisation except for the case Thailand. In parallel, stock return volatility (as measure by standard deviation) has reduced after liberalisation prior to the 1997-98 East Asian financial crisis, except for the case of Thailand. However, the stock return volatility has increased in the post crisis period. The coefficient of skewness indicates that the stock returns in the East Asian emerging markets are not equal to zero, as expected for a normal distribution. The kurtosis for Malaysia, Thailand and the Philippines exceeds three, indicating a leptokurtic distribution. This finding confirms previous researchers' conclusion that stock returns are actually not normally distributed (Harvey, 1995; Claessens *et al.*, 1995 and Bekaert and Harvey, 1997).

Table 5.2: Summary Statistics of Stock Index Returns

	Pre-Liberalisation	Post-Liberalisation	Post-Crisis
Korea Stock Price Index			
Sample Period	Jan 87 – Dec 91	Jan 92 – Apr 97	May 97 – Dec 02
Mean	0.0269	0.0044	0.0035
Standard Deviation	0.6268	0.5664	1.0603
Max	2.4983	3.5555	4.3533
Min	-3.6395	-2.4861	-5.5610
Skewness	0.1402	0.3579	-0.0781
Kurtosis	2.4709	2.3838	2.2857
No. of Observation	1304	1391	1479
Taiwan Weighted Index			
Sample Period	Jan 86 – Dec 90	Jan 91 – Apr 97	May 97 – Dec 02
Mean	0.0564	0.0165	-0.0091
Standard Deviation	1.1070	0.7429	0.7624
Max	5.5745	3.9342	3.7001
Min	-4.4682	-3.3796	-4.3151
Skewness	-0.1337	-0.0618	0.0242
Kurtosis	1.6607	3.3315	1.9086
No. of Observation	1304	1652	1479
Kuala Lumpur Composite Index			
Sample	Nov 83 – Oct 88	Nov 88 – Apr 97	May 97 – Dec 02
Mean	-0.0032	0.0223	-0.0077
Standard Deviation	0.6909	0.5036	0.8608
Max	4.8039	4.2179	9.0408
Min	-7.4124	-5.3118	-10.489
Skewness	-2.0362	-0.5295	0.5557
Kurtosis	23.4701	12.4217	32.531
No. of Observation	1305	2217	1479
Stock Exchange of Thailand Index			
Sample	Sept 82 – Aug 87	Sept 87 - Apr 97	May 97 – Dec 02
Mean	0.0348	0.0108	0.0038
Standard Deviation	0.2840	0.7043	0.8545
Max	1.7143	3.7624	4.9290
Min	-2.2083	-4.0366	-4.3551
Skewness	-0.4457	-0.4786	0.5661
Kurtosis	10.0839	6.1027	3.7913
No. of Observation	1304	2522	1479
The Philippines Composite Index			
Sample	Jun 86 – May 91	Jun 91 – Apr 97	May 97 – Dec 02
Mean	0.0652	0.0229	-0.0152
Standard Deviation	1.0416	0.5553	0.7297
Max	6.7996	0.5739	7.0258
Min	-6.8559	-2.5389	-4.2318
Skewness	-0.1001	0.0994	0.9625
Kurtosis	7.3991	2.6199	12.181
No. of Observation	1305	1543	1479

Notes: Skewness measures the asymmetry of the distribution of the series around its mean. The skewness of of a normal distribution is zero. Kurtosis measures the peakedness or flatness of the distribution of the series. The kurtosis of the normal distribution is 3. If the kurtosis exceeds 3, the distribution is leptokurtic and if less than 3 platykurtic relative to the normal distribution.

5.4 Empirical Results

5.4.1 Structural Breaks in the East Asian Emerging Markets

In this section we report the evidence for structural changes in the process that generates stock market volatility, that is, the evidence for changes in unconditional variance using the Inclan and Tiao (1994) ICSS algorithm.

Single Structural Break

Table 5.3 reports the sudden changes in variances with one break for the unpredictable squared stock returns series using $\max_k \sqrt{(T/2)}|D_k|$ that describe in Section 5.2.2. The analysis to detect a single break point is carried out based on two sample periods, namely (i) pre- and post-liberalisation before the East Asian financial crisis, and (ii) pre- and post-liberalisation after crisis (full sample period), in order to examine the impact of stock market liberalisation and the 1997-98 East Asian financial crisis on structural break separately. The results indicate that the structural break date is later than official liberalisation date in Korea, Taiwan and the Philippines[72] but before the official financial liberalisation date in Malaysia, whereas in the case of Thailand, the break date is corresponded to liberalisation programme period. This finding is consistent with Bekaert *et al.* (2002), who find that structural breaks usually occur later than official decree dates in emerging markets.

On the other hand, when the sample period is extended to include the financial crisis period, the break points in the cases of Thailand, Malaysia and Korea are detected in year 1997, the occurrence of the East Asian financial crisis, whereas the break point in Taiwan is remain unchanged. This finding is not surprisingly since the stock markets of Thailand,

[72] For the case of the Philippines, we have excluded the first 350 observations for the single break detection (or selected the second from the ICSS). The high volatility episode in the Philippines covered the full year of 1987 – the year when the economy was just recovering from the worst BOP crisis in its history (1983 – 1985). It was also a transition period – the economy was moving away from a centralised form of government under martial rule to a decentralised and democratic government. More significantly, it was also the year when a series of failed military coup attempts took place. This political instability was what caused the uncertainty in the environment and the large fluctuations in the prices of equity assets. The following year, 1988, was a quiet year until another coup attempts in December 1989 that likewise failed, disturbed the tranquillity. Bekaert and Harvey's (1998) Appendix A provides a listing of major political and economic events in various countries including the East Asian emerging markets from 1980 – 1997.

Malaysia and Korea were hit by the financial turmoil severely in 1997 compared to Taiwan and the Philippines.

Table 5.3: Testing for a Single Change-Point of Stock Return Volatility using Inclan and Tiao (1994) Procedure

East Asian Emerging Market Indices	Financial Liberalisation Date	Single Break Date (exclude crisis period)	Single Break Date (Full Sample)
		Pre Liberalisation – Post Liberalisation before Crisis	Full Sample
Korea Stock Price Index	Jan 92	10 Dec 1992	14 Oct 1997
Taiwan Weighted Price Index	Jan 91	17 May 1991	17 May 1991
Kuala Lumpur Composite Index	Nov 88	19 Jan 1988	01 Aug 1997
Stock Exchange of Thailand	Sept 87	30 Sept 1987	05 May 1997
Philippines Composite Index	Jun 91	25 Sept 1991	26 Jan 1999

Multiple Structural Breaks

Table 5.3 reports the number of multiple structural breaks in variances as identified by the ICSS algorithm for the unpredictable stock returns series. The Inclan and Tiao (1994) test tends to give evidence of too many breaks[73] if the critical value is based on 5% significant level. Thus, this study employs 1% critical value to identify the multiple structural break points. The results indicate that Korea, Taiwan, Malaysia and Thailand have two change points, whereas the Philippines have three change points during the whole sample period of study.

Table 5.4: Testing for a Multiple Breaks of Stock Return Volatility using Inclan and Tiao (1994) ICSS Algorithm

East Asian Emerging Market Indices	Financial Liberalisation Date	Number of Breaks	Break Dates (Pre Liberalisation – Post Liberalisation After Crisis)
Korea Stock Price Index	Jan 92	2	10 Dec 1992 14 Oct 1997
Taiwan Weighted Price Index	Jan 91	2	30 Mar 1990 17 May 1991
Kuala Lumpur Composite Index	Nov 88	2	19 Jan 1988 01 Aug 1997
Stock Exchange of Thailand	Sept 87	2	30 Sept 1987 05 May 1997
Philippines Composite Index	Jun 91	3	03 Feb 1988 25 Sept 1991 26 Jan 1999

[73] See Aggarwal *et al.* (1999) for an analysis of emerging markets volatility that employs this test.

The time plots of the East Asian emerging markets stock price index with multiple structural breaks are presented in Figures 5.3 – 5.7. The vertical lines show the pre- and post- liberalisation and the 1997-98 East Asian financial crisis. As depicted in the East Asian emerging markets stock price index plots, the stock price indices show an upward trend (except for the case of Taiwan) after these economies opening up their stock markets to foreign investors. However, the 1997 – 98 Asian financial and currency crisis have rocked these markets severely and this was reflected the sharp declines in the East Asian stock prices. On the other hand, the dotted lines indicate the structural break points detected by ICSS algorithm procedure. As shown in these figures, the periods of sudden changes of variance are corresponded closely to date of country liberalisation programme, either before or after the official date. Besides, the 1997-98 East Asian financial crisis has also caused a structural break in these emerging markets.

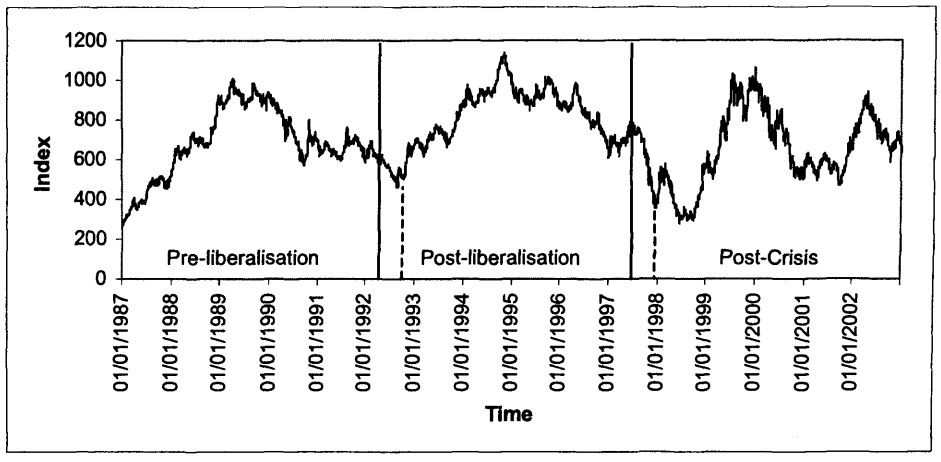


Figure 5.3 Korea Stock Price Index with Structural Breaks

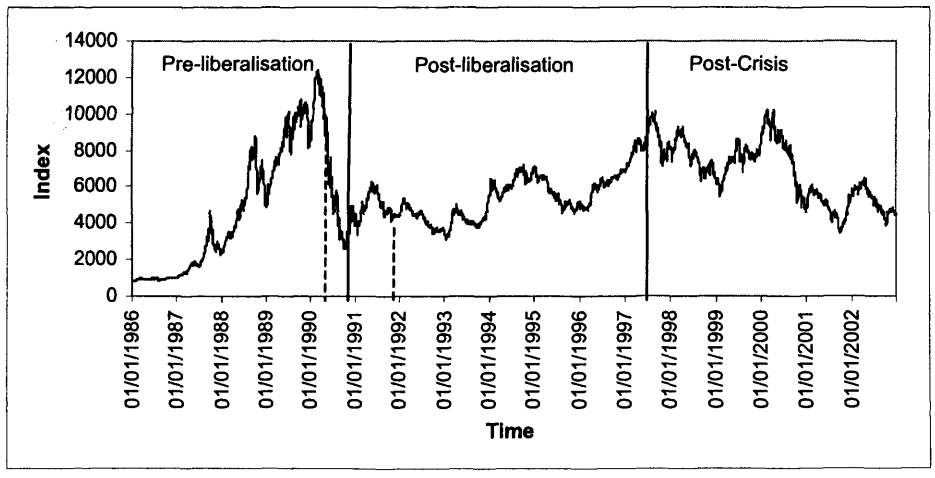


Figure 5.4 Taiwan Weighted Price Index with Structural Breaks

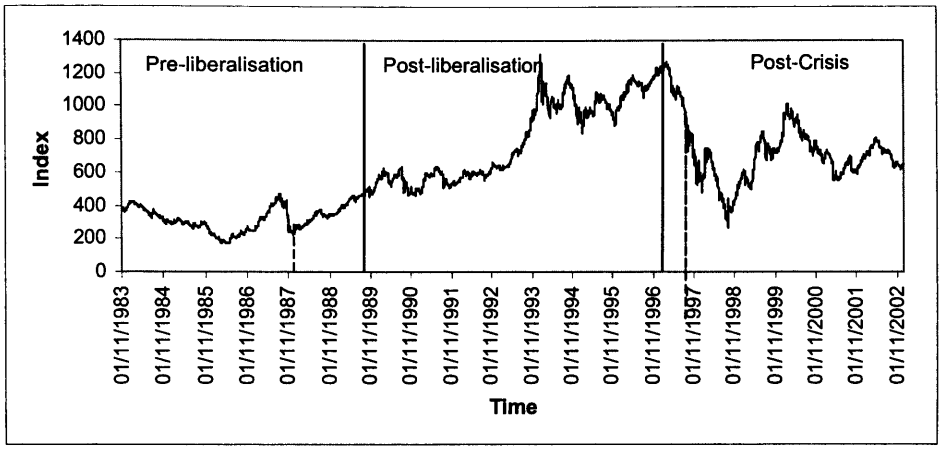


Figure 5.5 Kuala Lumpur Stock Exchange Composite Index with Structural Breaks

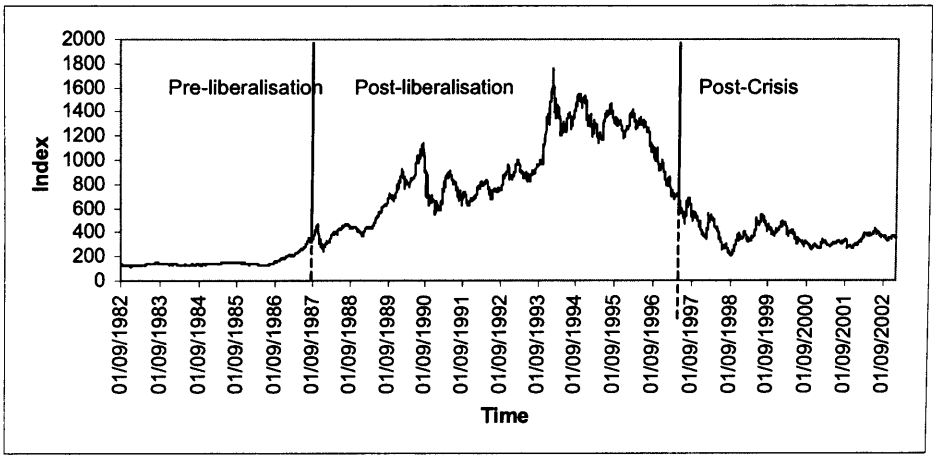


Figure 5.6 Stock Exchange of Thailand Price Index with Structural Breaks

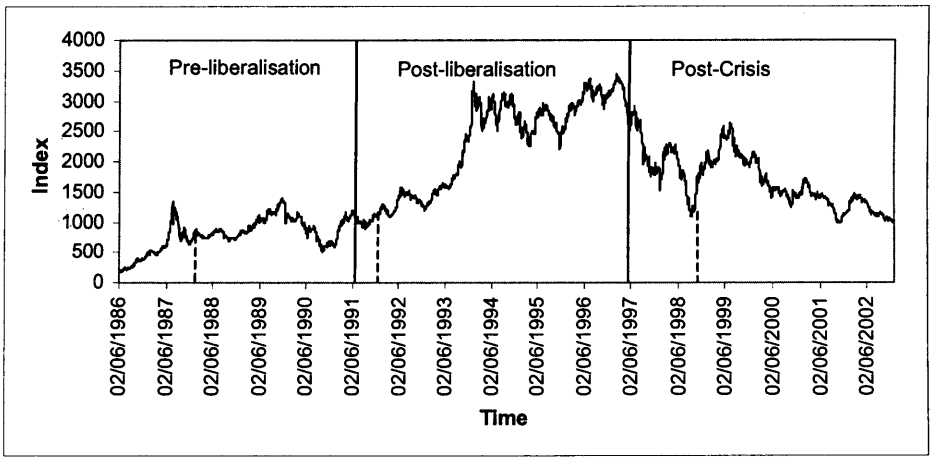


Figure 5.7 The Philippines Stock Exchange Composite Index with Structural Breaks

5.4.2 Day-of-the-Week and Autocorrelation Adjustments Results

The results for the day-of-the-week and autocorrelation adjustments, as well as some summary statistics for the residuals (unpredictable stock return series) for the pre-liberalisation, post-liberalisation before financial crisis and post-crisis periods are reported in Table 5.5, Table 5.6 and Table 5.7, respectively. For the pre-liberalisation period, Taiwan has a significant negative Wednesday, Thursday and Friday effect; Malaysia has a significant positive Thursday effect; Thailand has a significant positive Thursday and Friday effect and the Philippines has significant positive Friday effect. The Ljung Box test statistic for twelfth-order serial correlation for the levels indicates that there is no significant serial correlation in the unpredictable stock return series after the adjustment procedure for the five East Asian emerging markets except for Malaysia and Thailand. However, the Ljung Box test statistic for twelfth-order serial correlations for the squared residuals strongly suggests the existence of autocorrelation in the squared residuals (and hence time-varying conditional volatility of the autoregressive type).

The sign and size bias tests[74] are applied to the unpredictable stock return series (residuals of the autocorrelation adjustment model) in order to detect whether an asymmetric is present. The sign bias test statistic is significant for the case of Taiwan, this suggests that positive and negative shocks to ε_{t-1} impact differently upon the conditional variance. The two size test statistics namely negative and positive size bias tests are highly significant, with the negative size bias test statistic having a higher value (except for South Korea). This implies a size effect of news, which is stronger for bad news than for good news. The Chi-square test statistics for the joint test also demonstrate a clear rejection of the null of no asymmetries. This result confirms that volatility asymmetries are present and need to be incorporated into the model.

[74] The procedure for the sign and size bias tests are described in Appendix 5.III.

Table 5.5: Mean Adjustment Regressions (Pre-Liberalisation)

	KOSPI (Korea)	TWI (Taiwan)	KLCI (Malaysia)	SETI (Thailand)	PSECI (Philippines)
	Day of the Week Effect Adjustment (Model: $RPI_t = \alpha + \beta_1 TUE_t + \beta_2 WED_t + \beta_3 THU_t + \beta_4 FRI_t + u_t$)				
α	-0.0077	0.2141	-0.0566	-0.0057	-0.0322
	(-0.1991)	(3.1328)	(-1.3301)	(-0.3278)	(-0.4994)
TUE	0.0597	-0.0965	-0.0121	0.0083	0.0511
	(1.0873)	(-0.9975)	(-0.2023)	(0.3371)	(0.5614)
WED	0.0225	-0.2057	0.0933	0.0412	0.1159
	(0.4099)	(-2.1290)**	(1.5509)	(1.6702)	(1.2723)
THU	0.0247	-0.2897	0.1854	0.0612	0.1293
	(0.4498)	(-2.9982)***	(3.0795)***	(2.4785)**	(1.4197)
FRI	0.0660	-0.1964	0.0005	0.0918	0.1905
	(1.2010)	(-2.0326)**	(0.0082)	(3.7141)***	(2.0904)**
	Autocorrelation Adjustment (Model: $u_t = a + b_1 u_{t-1} + b_2 u_{t-2} + b_3 u_{t-3} + b_4 u_{t-4} + b_5 u_{t-5} + \varepsilon_t$)				
A	-0.0002	-0.0002	0.0009	-0.0005	-0.0009
	(-0.0133)	(-0.0068)	(0.0519)	(-0.0734)	(-0.0336)
b_1	0.0172	0.1287	0.1661	0.1785	0.1593
	(0.6231)	(4.6315)***	(5.9903)***	(6.4010)***	(5.7360)***
b_2	0.0346	0.0746	-0.0289	-0.0001	-0.0391
	(1.2483)	(2.6638)***	(-1.0280)	(-0.0007)	(-1.3914)
b_3	-0.0176	0.0600	0.0365	0.1103	-0.0156
	(-0.6393)	(2.1366)**	(1.2999)	(3.9355)***	(-0.5557)
b_4	0.0502	0.0421	-0.0011	0.0139	0.0548
	(1.8151)	(1.5004)	(-0.0386)	(0.4940)	(1.9523)
b_5	-0.0082	-0.0241	0.0656	0.0295	-0.0278
	(0.2945)	(-0.8675)	(2.3656)**	(1.0710)	(-1.0028)
Mean	0.0000	0.0000	0.0000	0.0000	0.0000
Variance	0.3883	1.1729	0.4556	0.0737	1.0534
Ljung Box (12) for the levels	8.68	11.25	22.80**	25.67**	17.61
	(0.7295)	(0.5068)	(0.0294)	(0.0119)	(0.1279)
Ljung Box (12) for the squares	272.87***	1002.47***	928.46***	258.77***	380.08***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Sign Bias	-0.0272	0.2939	-0.0114	-0.0116	0.0212
	(-0.5874)	(2.2704)**	(-0.0955)	(-0.7750)	(0.1122)
Negative Size Bias	-0.3132	-0.6354	-1.3629	-0.2917	-1.3452
	(-4.9495)***	(-6.7738)***	(-11.132)***	(-6.7669)***	(-9.3430)***
Positive Size Bias	0.2908	0.3853	0.6653	0.1326	0.3293
	(5.0863)***	(3.8506)***	(4.3241)***	(3.0096)***	(2.2652)**
Joint test $\chi^2_{(3)}$	75.9253***	88.7889***	169.33***	74.1339***	115.6628***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Notes: Figures in parentheses indicate the t-statistics (except for Ljung Box (12) for the levels, Ljung Box (12) for the squares and Joint test $\chi^2_{(3)}$, which are p-values). The critical value of the $\chi^2_{(3)}$ is 11.3 for 1% and 7.81 for 5% significance level. ** significant at 5% level. *** significant at 1% level.

For the post-liberalisation before crisis period (Table 5.6) less day-of-the-week effects are detected if compared to the pre-liberalisation period. Taiwan and the Philippines have shown significant negative Tuesday return and positive Thursday return, respectively. Surprisingly, Malaysia has more day-of-the-week effect after liberalisation, which shown significant positive Wednesday, Thursday and Friday effect. The Ljung Box test statistic for twelfth-order serial correlation for the levels indicates that there is no significant serial correlation in the unpredictable stock return. Similar to the pre-liberalisation period, the Ljung Box test statistic for twelfth-order serial correlations for the squared residuals strongly indicates the presence of time-varying volatility. The sign bias test statistic is not significant for all five East Asian emerging markets. The negative size test statistics are significant for the cases of Malaysia, Thailand, South Korea and Taiwan, whereas the positive size test statistic is significant for the cases of Taiwan, Thailand and Malaysia. The Chi-square test statistics for the joint test reveal a clear rejection of the null of no asymmetries except for the case of the Philippines.

For the post-liberalisation after crisis period (Table 5.7), Malaysia has positive Wednesday effect, whereas Thailand has positive Tuesday, Wednesday, Thursday and Friday effect. Similar to the post-liberalisation before crisis period, the Ljung Box test statistic for twelfth-order serial correlation for the levels indicates that there is no significant serial correlation in the unpredictable stock return. Nevertheless, the Ljung Box test statistic for twelfth-order serial correlations for the squared residuals strongly indicates the presence of time-varying volatility. The sign bias test statistic is significant for Taiwan, the negative size test statistics is significant for the cases of Malaysia, Thailand, South Korea and Taiwan, whereas the positive size test statistic is significant for the cases of Malaysia, Thailand and the Philippines. The Chi-square test statistics for the joint test reveal a clear rejection of the null of no asymmetries in all markets.

Table 5.6: Mean Adjustment Regressions (Post-Liberalisation Before Crisis)

	KOSPI (Korea)	TWI (Taiwan)	KLCI (Malaysia)	SETI (Thailand)	PSECI (Philippines)
	Day of the Week Effect Adjustment				
	(Model: $RPI_t = \alpha + \beta_1 TUE_t + \beta_2 WED_t + \beta_3 THU_t + \beta_4 FRI_t + u_t$)				
α	0.0224	0.0418	-0.0367	-0.0004	-0.0193
	(0.6493)	(0.8597)	(-1.2588)	(-0.0083)	(-0.5445)
TUE	-0.0712	-0.1765	0.0696	-0.0503	0.0012
	(-1.4589)	(-2.5674)**	(1.6877)	(-0.7297)	(0.0253)
WED	0.0215	-0.0586	0.0897	0.0264	0.0850
	(0.4409)	(-0.8520)	(2.1758)**	(0.3841)	(1.6942)
THU	-0.0242	0.0356	0.0945	0.0169	0.0992
	(-0.4963)	(0.5186)	(2.2917)**	(0.2461)	(1.9774)**
FRI	-0.0275	0.0120	0.1016	0.1334	0.0806
	(-0.5636)	(0.1748)	(2.4625)**	(1.9342)	(1.6065)
	Autocorrelation Adjustment				
	(Model: $u_t = a + b_1 u_{t-1} + b_2 u_{t-2} + b_3 u_{t-3} + b_4 u_{t-4} + b_5 u_{t-5} + \varepsilon_t$)				
a	-0.0017	0.0026	0.0002	-0.0011	0.0002
	(-0.1138)	(0.1190)	(0.0169)	(-0.0552)	(0.0156)
b_1	0.0063	0.0123	0.1341	0.1950	0.1721
	(0.2296)	(0.4453)	(4.8135)***	(7.0179)***	(6.1916)***
b_2	0.0544	0.0189	0.0799	-0.0409	0.0513
	(1.9659)**	(0.6828)	(2.8427)***	(-1.4468)	(1.8208)
b_3	0.0337	0.0349	-0.0942	0.0467	0.0141
	(1.2173)	(1.2665)	(-3.3559)***	(1.6543)	(0.5000)
b_4	-0.0236	-0.0097	0.0108	0.0369	0.0203
	(-0.8521)	(-0.3531)	(0.3854)	(1.3076)	(0.7196)
b_5	0.0028	-0.0204	-0.0091	-0.0147	-0.0023
	(0.1034)	(-0.7378)	(-0.3269)	(-0.5298)	(-0.0860)
Mean	0.0000	0.0000	0.0000	0.0000	0.0000
Variance	0.3058	0.6035	0.2136	0.5946	0.3154
Ljung Box (12) for the levels	2.49	19.29	5.22	2.25	9.79
	(0.9918)	(0.0815)	(0.9499)	(0.9988)	(0.6343)
Ljung Box (12) for the squares	285.74***	320.85***	188.79***	490.73***	101.37***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Sign Bias	0.0163	-0.0090	0.0094	0.0945	-0.0261
	(0.4585)	(-0.1232)	(0.1703)	(1.0172)	(-0.7069)
Negative Size Bias	-0.0962	-0.1491	-0.8545	-0.8853	-0.0628
	(-1.7057)*	(-1.9362)*	(-9.7431)***	(-10.014)***	(-1.1182)
Positive Size Bias	0.0701	0.1903	0.1741	0.3450	0.0499
	(1.3771)	(2.4888)**	(1.7768)*	(3.4781)***	(0.9504)
Joint test $\chi^2_{(3)}$	7.8740**	14.4266***	116.8562***	134.1111***	4.6622
	(0.0486)	(0.0023)	(0.0000)	(0.0000)	(0.1982)

Notes: Figures in parentheses indicate the t-statistics (except for Ljung Box (12) for the levels, Ljung Box (12) for the squares and Joint test $\chi^2_{(3)}$, which are p-values). The critical value of the $\chi^2_{(3)}$ is 11.3 for 1% and 7.81 for 5% significance level. * significant at 10% level. ** significant at 5% level. *** significant at 1% level.

Table 5.7: Mean Adjustment Regressions (Pre-Liberalisation After Crisis)

	KOSPI (Korea)	TWI (Taiwan)	KLCI (Malaysia)	SETI (Thailand)	PSECI (Philippines)
	Day of the Week Effect Adjustment (Model: $RPI_t = \alpha + \beta_1 TUE_t + \beta_2 WED_t + \beta_3 THU_t + \beta_4 FRI_t + u_t$)				
α	-0.0079	-0.0239	-0.1037	-0.1632	0.0048
	(-0.1132)	(-0.5275)	(-1.7680)	(-4.0650)	(0.1000)
TUE	-0.0287	-0.0339	0.0296	0.1414	-0.1315
	(-0.2890)	(-0.5281)	(0.3569)	(2.4926)**	(-1.9132)
WED	0.0334	0.0570	0.1683	0.2467	-0.0025
	(0.3358)	(0.8860)	(2.0288)**	(4.3499)***	(-0.0374)
THU	0.0437	0.0156	0.0191	0.1417	-0.0518
	(0.4397)	(0.2429)	(0.2298)	(2.4988)**	(-0.7540)
FRI	0.0018	0.0674	0.1560	0.2195	0.0218
	(0.0182)	(1.0473)	(1.8808)	(3.8707)***	(0.3178)
	Autocorrelation Adjustment (Model: $u_t = a + b_1 u_{t-1} + b_2 u_{t-2} + b_3 u_{t-3} + b_4 u_{t-4} + b_5 u_{t-5} + \varepsilon_t$)				
a	0.0017	0.0025	0.0009	-0.0012	-0.0003
	(0.0565)	(0.1235)	(0.0348)	(-0.0702)	(-0.0146)
b_1	0.0767	0.0167	0.0267	0.1720	0.1901
	(2.7648)***	(0.6059)	(0.9642)	(6.1881)***	(6.8471)***
b_2	-0.0331	0.0582	0.0279	0.0011	-0.0662
	(-1.1908)	(2.1200)**	(1.0137)	(0.0406)	(-2.3458)**
b_3	-0.0299	0.0105	0.0158	0.0314	-0.0186
	(-1.0753)	(0.3826)	(0.5738)	(1.1154)	(-0.6585)
b_4	-0.0086	-0.1120	-0.1229	0.0535	0.0447
	(-0.3125)	(-4.0721)***	(-4.4649)***	(1.8997)	(1.5848)
b_5	-0.0587	0.0367	0.0586	0.0082	-0.0575
	(-2.1173)**	(1.3272)	(2.1156)**	(0.2960)	(-2.0739)**
Mean	0.0000	0.0000	0.0000	0.0000	0.0000
Variance	1.2756	0.5243	0.8792	0.4038	0.5924
Ljung Box (12) for the levels	4.119	13.955	11.880	11.91	11.518
	(0.981)	(0.304)	(0.455)	(0.4525)	(0.485)
Ljung Box (12) for the squares	123.94***	210.65***	534.88***	423.05***	37.820***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Sign Bias	0.2403	0.1436	-0.3228	-0.0225	0.0558
	(1.6866)	(2.2598)**	(-1.2465)	(-0.4418)	(0.4536)
Negative Size Bias	-0.3541	-0.4783	-0.9734	-0.2529	-0.2363
	(-3.4572)***	(-6.7638)***	(-4.3396)***	(-3.7833)***	(-1.7402)
Positive Size Bias	0.0866	-0.0162	2.6395	0.4188	0.4668
	(0.8336)	(-0.2251)	(13.9053)***	(6.6279)***	(3.8886)***
Joint test $\chi^2_{(3)}$	17.0528***	49.5797***	220.96***	84.625***	25.625***
	(0.0007)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Notes: Figures in parentheses indicate the t-statistics (except for Ljung Box (12) for the levels, Ljung Box (12) for the squares and Joint test $\chi^2_{(3)}$, which are p-value). The critical value of the $\chi^2_{(3)}$ is 11.3 for 1% and 7.81 for 5% significance level. ** significant at 5% level. *** significant at 1% level.

Since the joint test statistic indicates the presence of asymmetries effect, thus, the EGARCH model that takes into account of sudden changes of variance is employed to capture the unpredictable stock return volatility. The adequacy of this volatility model is then checked using the sign bias, the negative size bias, and the positive size bias tests, joint test

as well as the commonly used Ljung-Box (Q) test for serial correlation in the residuals and Ljung Box (Q^2) to diagnose serial correlation in the squared residuals (heteroscedasticity).

5.4.3 EGARCH(1,1) Parameter Estimation and Sudden Changes in Variance

Tables 5.8 – 5.10 report the results of the EGARCH specification with sudden changes in variance of five East Asian emerging markets unpredictable stock returns for the pre-liberalisation, post-liberalisation before crisis and post-liberalisation after crisis periods. Since there is one break or without break in the sub-sample periods, the EGARCH (1,1) model is combined with one break in intercept or without break. The γ coefficient reveals whether asymmetric news impacts have been observed.

The estimated results indicate that all γ coefficients are statistically significant except for the case of the Philippines in the post-liberalisation before crisis period. This result is consistent with the Chi-square test statistics for the joint test of stock return series in the post-liberalisation before crisis period, which indicates that there is no asymmetries effect. Most of the γ coefficients are statistically significant at 1% level. Therefore, evidence for the presence of a "leverage effect" is overwhelming. Bad and good news indeed have different effects on the conditional volatility in this model.

Tables 5.8 – 5.10 also show the results of fitting an EGARCH model with one dummy variable (D_1) that correspond to the break point of sudden changes in the variance of returns with respect to different sub-sample periods. The dummy variables indicate statistically significant results and this implies that the dummy variables for sudden changes in variance do capture the time varying volatility displayed by the five East Asian emerging markets. The diagnostic checking results of the Ljung-Box (12) statistic for the residuals indicate no significant serial correlation except for Malaysia (during pre-liberalisation and post-crisis periods) and Thailand (during pre-liberalisation period). However, the Ljung-Box(12) for the square residuals indicate no significant serial correlation. The joint test is significant for the cases of Taiwan and Malaysia during the pre-liberalisation period. Overall, the EGARCH model is able to capture the asymmetry in the effect of news on volatility.

Table 5.8: Asymmetric Volatility based on EGARCH Modelling (Pre-Liberalisation)

	KOSPI (Korea)	TWI (Taiwan)	KLCI (Malaysia)	SETI (Thailand)	PSECI (Philippines)
ω	-0.3399	-0.1175	-0.1312	-0.2393	-0.0663
	(-9.9113)***	(-7.1727)***	(-19.5387)***	(-19.2071)***	(-12.7708)***
α	0.2914	0.1482	0.1585	0.1867	0.0868
	(10.0173)***	(7.2097)***	(16.7932)***	(12.2165)***	(11.1691)***
γ	-0.0569	-0.0418	-0.0483	0.0589	-0.0119
	(-3.0713)***	(-3.0426)***	(-8.2338)***	(6.8979)***	(-2.0965)**
β	0.8845	0.9775	0.9810	0.9674	0.9919
	(42.3697)***	(247.97)***	(272.54)***	(376.93)***	(533.85)***
D_1	-	1.5536	1.6897	2.2606	-0.8219
		(3.3743)***	(3.0256)***	(2.3750)**	(-4.5849)***
Diagnostic Test Results					
Ljung Box (12)	12.119	11.117	31.701***	24.301**	18.076
for the levels	(0.436)	(0.464)	(0.002)	(0.019)	(0.113)
Ljung Box (12)	16.895	12.680	15.613	8.0331	21.129
for the squares	(0.154)	(0.393)	(0.210)	(0.783)	(0.056)
ARCH LM Test	17.0356	12.2417	15.5972	7.6444	18.1925
	(0.1482)	(0.4264)	(0.2104)	(0.8122)	(0.1099)
Sign Bias	-0.0023	0.2876	-0.2012	-0.0938	0.0436
	(-0.0214)	(2.7019)***	(-0.9761)	(-0.6532)	(0.4071)
Negative Size	0.0076	-0.2407	-0.3409	-0.1322	-0.1571
Bias	(0.0803)	(-2.7393)***	(-2.1136)**	(-1.1158)	(-1.7343)
Positive Size	0.0297	-0.1965	0.0859	0.1261	0.0462
Bias	(0.3488)	(-2.1609)**	(0.4929)	(1.0696)	(0.5187)
Joint Test	0.1976	9.2651**	10.7810**	4.3929	4.5293
	(0.9779)	(0.0259)	(0.0129)	(0.2220)	(0.2097)

Notes: KOSPI = Korea Composite Stock Price Index; TWI = Taiwan Weighted Index; KLCI = Kuala Lumpur Composite Index; SETI = Stock Exchange of Thailand Index; PSECI = The Philippines Stock Exchange Composite Index. **/*** denotes statistical significance at the 5%/1% level of significance. The values in parentheses indicate t-statistics, except for the Ljung-Box tests, ARCH LM test and joint test, which are p-values.

Table 5.9: Asymmetric Volatility based on EGARCH Modelling (Post Liberalisation before Crisis)

	KOSPI (Korea)	TWI (Taiwan)	KLCI (Malaysia)	SETI (Thailand)	PSECI (Philippines)
ω	-0.1561	-0.1005	-0.5329	-0.2450	-0.1157
	(-5.5511)***	(-9.1455)***	(-5.8034)***	(-18.3055)***	(-6.3297)***
α	0.1388	0.1159	0.2181	0.2919	0.1324
	(5.9667)***	(8.3988)***	(6.3067)***	(16.3207)***	(6.6529)***
γ	-0.0291	-0.0237	-0.0819	-0.0851	-0.0081
	(-2.3402)**	(-2.9876)***	(-3.8697)***	(-6.6688)***	(-1.0241)
β	0.9628	0.9778	0.7714	0.9600	0.9863
	(89.8337)***	(232.96)***	(17.8121)***	(180.510)***	(176.72)***
D_1	1.8191	-0.9392	-	1.0256	-1.2442
	(2.3931)**	(-2.6101)***		(2.5958)***	(-2.6642)***
Diagnostic Test Results					
Ljung Box (12)	13.159	11.983	16.943	13.147	11.788
for the levels	(0.358)	(0.447)	(0.152)	(0.358)	(0.463)
Ljung Box (12)	10.703	14.777	0.7539	5.246	17.691
for the squares	(0.297)	(0.254)	(0.999)	(0.949)	(0.125)
ARCH LM Test	0.5209	0.7445	0.7453	5.2169	17.0814
	(0.4704)	(0.999)	(0.999)	(0.9503)	(0.1465)
Sign Bias	0.0094	0.0582	-0.3045	-0.0468	-0.1441
	(0.1018)	(0.5188)	(-0.8931)	(-0.3514)	(-1.2498)
Negative Size	0.0562	-0.0071	-0.0038	-0.0796	0.0211
Bias	(0.6921)	(-0.0783)	(-0.0149)	(-0.7572)	(0.2097)
Positive Size	-0.0591	-0.1669	0.1784	-0.1434	-0.0132
Bias	(-0.7827)	(-1.7865)	(0.6030)	(-1.2707)	(-0.1443)
Joint Test	1.8744	3.7304	1.0528	4.8662	3.4439
	(0.5988)	(0.2920)	(0.7884)	(0.1818)	(0.3281)

Note: see notations in Table 5.8

Table 5.10: Asymmetric Volatility based on EGARCH Modelling (Post-Crisis)

	KOSPI (Korea)	TWI (Taiwan)	KLCI (Malaysia)	SETI (Thailand)	PSECI (Philippines)
ω	-0.0454	-0.1418	-0.1106	-0.1643	-0.1021
	(-4.9899)***	(-10.7384)***	(-17.2368)***	(-9.2644)***	(-20.1479)***
α	0.0610	0.1357	0.1447	0.1789	0.1312
	(4.7746)***	(8.4366)***	(14.9020)***	(9.3868)***	(28.1307)***
γ	-0.0147	-0.0863	-0.0449	-0.0320	-0.0823
	(-2.6734)***	(-6.5018)***	(-5.9691)***	(-2.9013)***	(-11.8477)***
β	0.9840	0.9520	0.9847	0.9940	0.9795
	(495.75)***	(119.16)***	(1172.21)***	(143.83)***	(255.938)***
D_1	1.9567	-	1.0719	-	2.8441
	(4.7978)***		(2.6175)***		(15.1886)***
Diagnostic Test Results					
Ljung Box (12)	5.087	16.387	28.368***	12.191	8.912
for the levels	(0.955)	(0.174)	(0.005)	(0.430)	(0.710)
Ljung Box (12)	12.310	17.824	7.5697	20.681	2.912
for the squares	(0.421)	(0.121)	(0.818)	(0.055)	(0.996)
ARCH LM Test	11.7764	17.2922	7.2248	19.289	2.7997
	(0.4637)	(0.1389)	(0.8424)	(0.0817)	(0.9968)
Sign Bias	0.1705	0.1568	-0.0511	-0.1032	0.1875
	(1.4023)	(1.4509)	(-0.3553)	(-1.0606)	(0.7055)
Negative Size	-0.1686	-0.0816	-0.0280	-0.0877	0.0695
Bias	(-1.7041)	(-0.9007)	(-0.2304)	(-1.0540)	(0.2987)
Positive Size	-0.0490	-0.0804	0.0774	0.0767	0.1704
Bias	(-0.4746)	(-0.9093)	(0.6692)	(0.9656)	(0.8520)
Joint Test	3.3818	2.1065	0.7717	6.1962	3.2897
	(0.3364)	(0.5506)	(0.8562)	(0.1024)	(0.3491)

Notes: KOSPI = Korea Composite Stock Price Index; TWI = Taiwan Weighted Index; KLCI = Kuala Lumpur Composite Index; SETI = Stock Exchange of Thailand Index; PSECI = The Philippines Stock Exchange Composite Index. **/*** denotes statistical significance at the 5%/1% level of significance. The values in parentheses indicate t-statistics, except for the Ljung-Box tests, ARCM LM test and joint test, which are p-values.

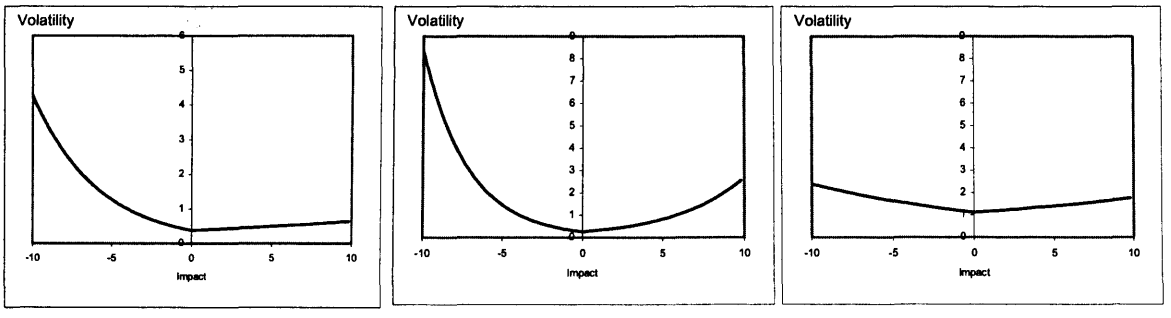
5.4.4 News Impact Curve

The new impact curves are plotted in Figures 5.8 – 5.12 to determine the impact of financial liberalisation on stock market volatility. In addition, it can be used to visualize the degree of asymmetry effect based on the estimated parameters from the EGARCH specification (which most of them have one structural break). The curves are corresponded to the three sub-periods. The vertical axes of the news impact curves represent the impact on volatility and the horizontal axes represent the positive and negative return shocks from the EGARCH models. The news impact curves in most cases are asymmetric, with negative shocks having more impact on future volatility than positive shocks of the same magnitude. The curves confirm that 'good news' and 'bad news' of the same magnitude result in different levels of volatility. The slope of the impact curve is steeper on its negative sign than on its positive side. In fact, the leverage effects are captured by allowing slopes of two sides of the news impact curve to differ.

During post-liberalisation before crisis period, the level of volatility for $\varepsilon_{t-1} = 0$ (figures in parentheses) has been reduced in four countries namely Korea, Taiwan, Malaysia and the Philippines, whereas it has been increased for the case of Thailand. The news impact curve of South Korea, Taiwan and the Philippines are flatter during post-liberalisation before crisis period, this indicates that news has a different impact on volatility pre- and post-liberalisation before crisis, indicating that 'big news' causes less volatility during that period than pre-liberalisation. On the other hand, in the case of Thailand, the curve is flatter in pre-liberalisation and the minimum point of the curve is closed to zero, which could indicate that during that period the stock market was relatively inactive, whereas the curve is more steeper during post-liberalisation before crisis revealing that higher level of stock return volatility.

During post-liberalisation after crisis period, the volatility of East Asian emerging markets has changed, compared to pre-liberalisation and post-liberalisation before crisis periods. For instance, Korea and Malaysia have the highest volatility during post-liberalisation after crisis period, the volatility of the Philippines stock market also increase in post-liberalisation after crisis period compared to post-liberalisation before crisis period. Only the volatility in Taiwan and Thailand remain slightly unchanged for post-liberalisation before and after crisis periods. Overall, the results suggest that the stock market volatility in East Asian emerging markets fell after opening up their markets to foreign investors except for Thailand prior to the 1997-98 East Asian financial crisis, but the pattern of volatility has increased in the financial crisis period.

Figure 5.8: News Impact Curve for KOSPI (Korea)

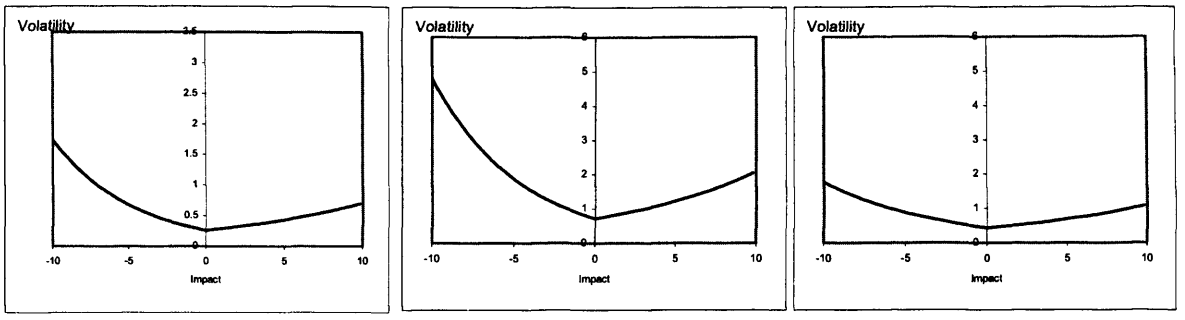


(a) Pre-liberalisation ($\varepsilon_{t-1} = 0$) = 0.2568

(b) Post-liberalisation before crisis ($\varepsilon_{t-1} = 0$) = 0.2370

(c) Post-liberalisation after crisis ($\varepsilon_{t-1} = 0$) = 1.1225

Figure 5.9: News Impact Curve for TWI (Taiwan)

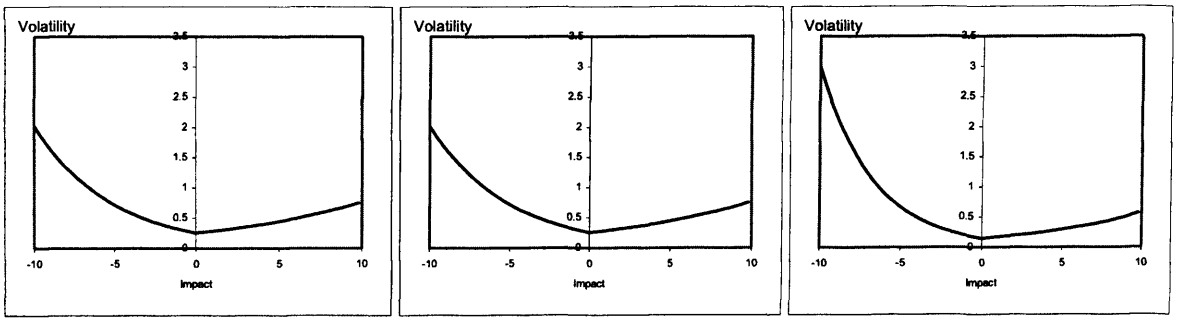


(a) Pre-liberalisation ($\varepsilon_{t-1} = 0$) = 0.7168

(b) Post-liberalisation before crisis ($\varepsilon_{t-1} = 0$) = 0.4369

(c) Post-liberalisation after crisis ($\varepsilon_{t-1} = 0$) = 0.3773

Figure 5.10: News Impact Curve for KLCI (Malaysia)

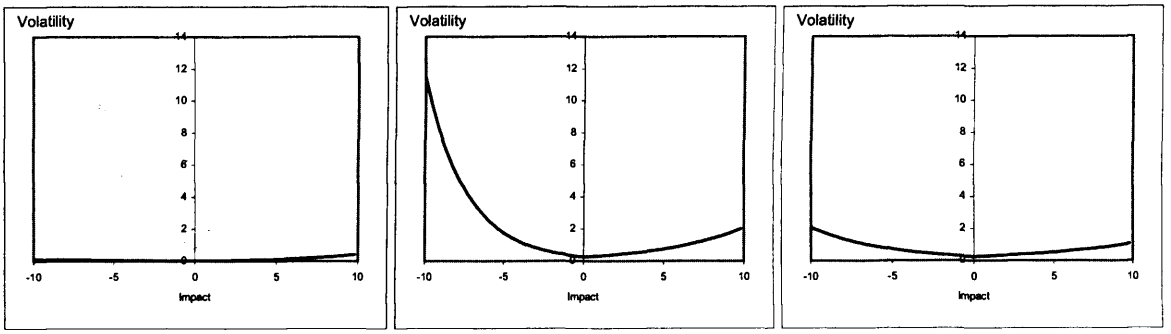


(a) Pre-liberalisation ($\varepsilon_{t-1} = 0$) = 0.2553

(b) Post-liberalisation before crisis ($\varepsilon_{t-1} = 0$) = 0.1487

(c) Post-liberalisation after crisis ($\varepsilon_{t-1} = 0$) = 1.2609

Figure 5.11: News Impact Curve for SETI (Thailand)

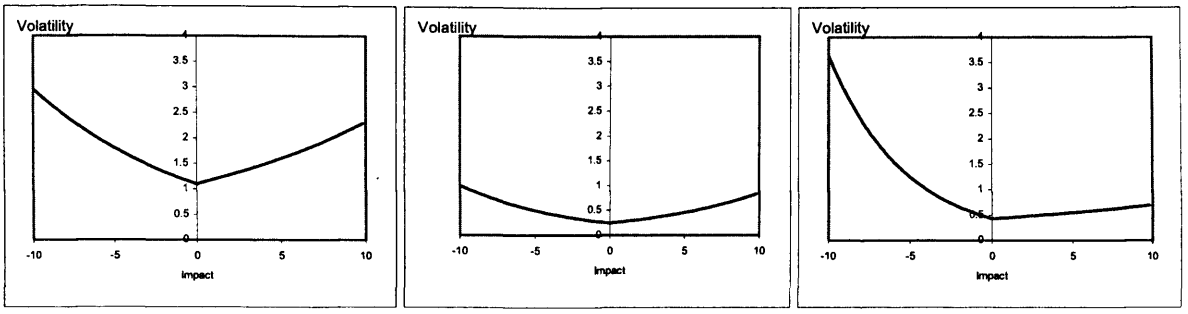


(a) Pre-liberalisation ($\varepsilon_{t-1} = 0$) = 0.0372

(b) Post-liberalisation before crisis ($\varepsilon_{t-1} = 0$) = 0.2653

(c) Post-liberalisation after crisis ($\varepsilon_{t-1} = 0$) = 0.2625

Figure 5.12: News Impact Curve for PSECI (The Philippines)



(a) Pre-liberalisation ($\varepsilon_{t-1} = 0$) = 1.0997

(b) Post-liberalisation before crisis ($\varepsilon_{t-1} = 0$) = 0.2456

(c) Post-liberalisation after crisis ($\varepsilon_{t-1} = 0$) = 0.4298

5.4.5 Robustness Check Using GARCH(1,1) Estimations

Besides using the EGARCH model, this study also employs the GARCH model to examine the impact of financial liberalisation on stock market volatility. According to Pagan and Schwert (1990) and Pagan (1996), the GARCH models perform quite well in comparison with alternative methods for modelling conditional volatility of stock returns and that, except for a possible asymmetric leverage effect, a GARCH(1,1) is enough to account for the volatility dynamics of most financial time series[75].

In this section, the sample period is only covering four years prior to and after the official financial liberalisation date. Figures 5.13 – 5.17 plots the 10-day rolling variance, together with the GARCH forecasts of the conditional variance for the full sample period. The rolling variance is calculated as follows:

$$\sigma^2(RPI_t) = \left[\sum_{k=1}^{10} (RPI_{t-k} - \mu_{10})^2 / 9 \right] \qquad (5.10)$$

where RPI_t is the daily return of the stock market index over period t and μ_{10} is the sample mean over the 10-day window.

As shown in these figures, the GARCH-fitted variance very closely approximates the rolling variance, especially during periods of high volatility (Schwert, 2002). This provides evidence that the GARCH model is able to replicate quite nicely a model-free local estimate of the variance. However, one should not interpret the rolling variance as being the true

[75] Most recently, Schwert (2002) used a GARCH(1,1) to model conditional variance for the Nasdaq.

variance. It is a model-free estimate of the local behaviour of stock market volatility. The fact that one simple parametric model – the GARCH with three parameters is able to replicate so closely the local behaviour of volatility for the full sample as good evidence in favour of the model.

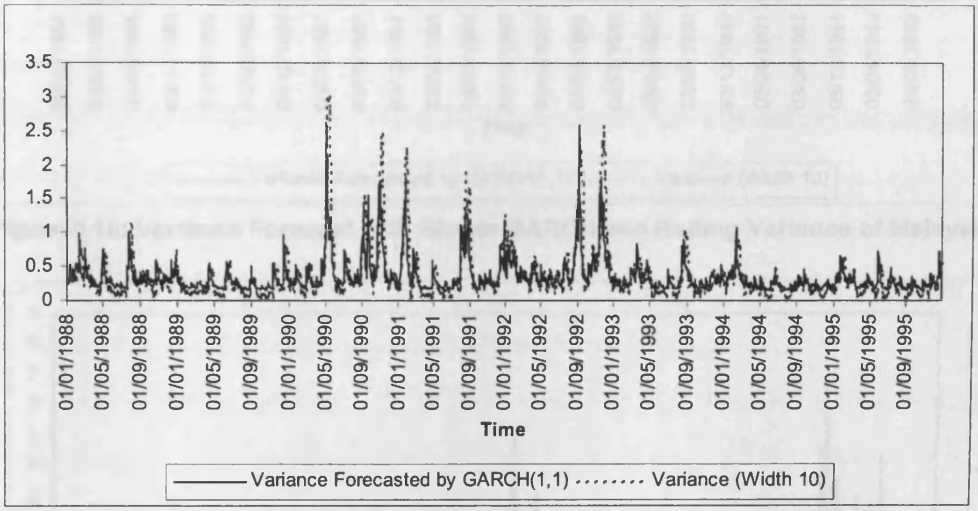


Figure 5.13: Variance Forecast with Simple GARCH and Rolling Variance of Korea

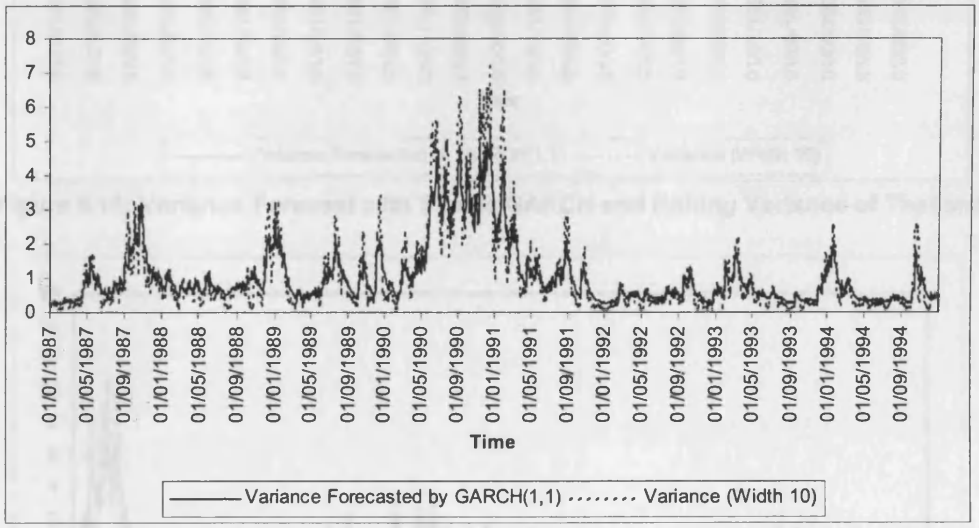


Figure 5.14: Variance Forecast with Simple GARCH and Rolling Variance of Taiwan

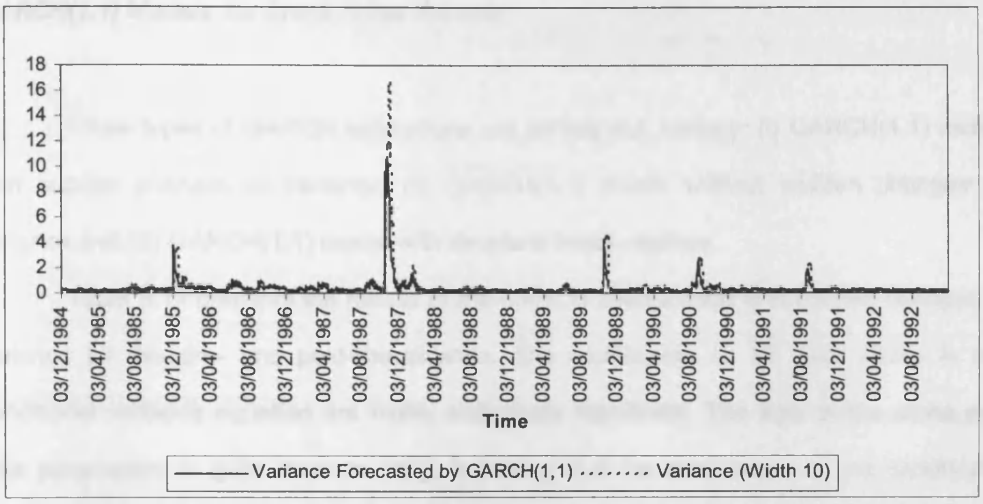


Figure 5.15: Variance Forecast with Simple GARCH and Rolling Variance of Malaysia

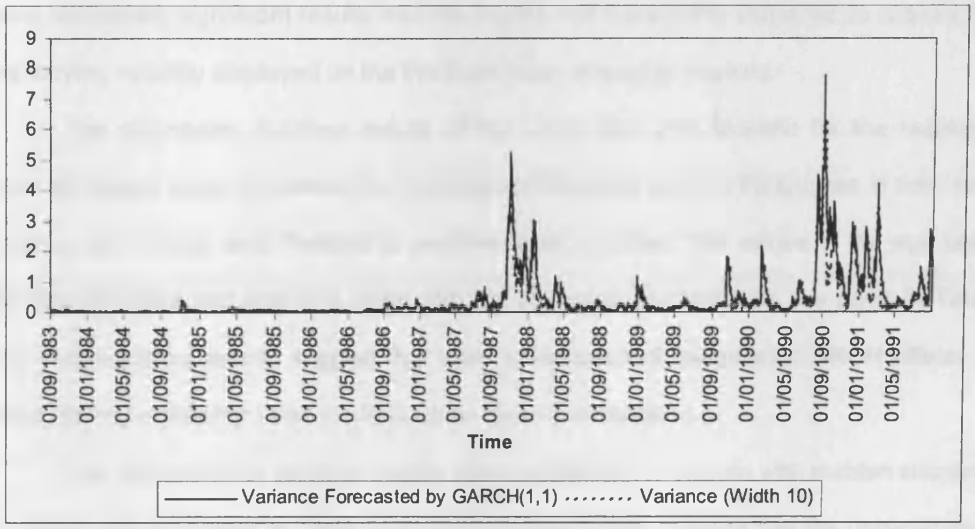


Figure 5.16: Variance Forecast with Simple GARCH and Rolling Variance of Thailand

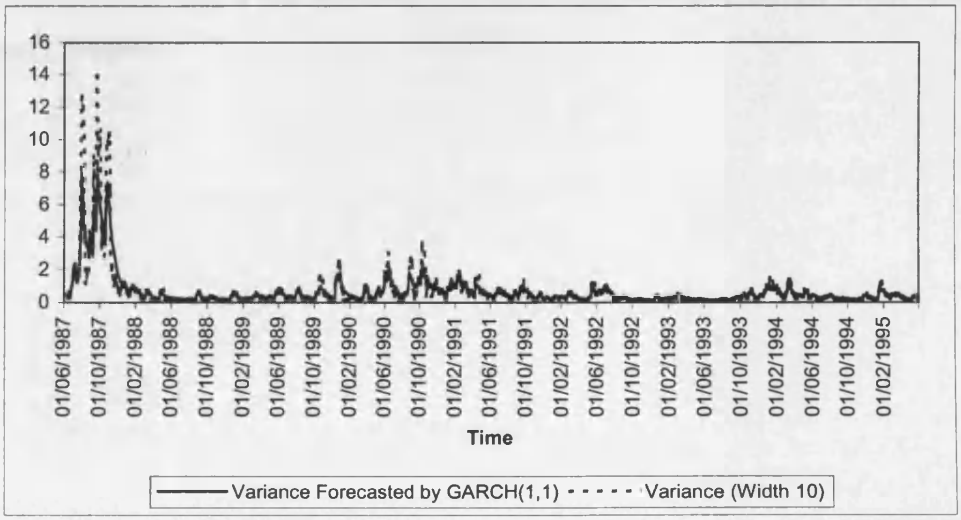


Figure 5.17: Variance Forecast with Simple GARCH and Rolling Variance of the Philippines

GARCH(1,1) Models for Stock Index Returns

Three types of GARCH estimations are carried out, namely: (i) GARCH(1,1) model with sudden changes of variance, (ii) GARCH(1,1) model without sudden changes of variance and (iii) GARCH(1,1) model with structural break regimes.

Table 5.11 presents the results of the GARCH specification with sudden changes in variance for the pre- and post-liberalisation. The coefficients on all three terms in the conditional variance equation are highly statistically significant. The sum of the alpha and beta parameters is quite close to unity, indicating that the persistence of the conditional variance of the stock returns are high in East Asian emerging markets. The dummy variables reveal statistically significant results and this implies that the dummy variables do capture the time varying volatility displayed by the five East Asian emerging markets.

The diagnostic checking results of the Ljung Box (12) statistic for the residuals reveal significant serial correlation for the cases of Malaysia and the Philippines in both sub-samples, and Taiwan and Thailand in pre-liberalisation period. The values of the sign bias, size bias and joint test statistics along with the corresponding p-values are given in Table 5.11. The empirical results suggest that there is evidence of asymmetric ARCH effects in Taiwan (pre-liberalisation) and the Philippines (post-liberalisation).

The unconditional variance results of the GARCH(1,1) models with sudden changes of variance are presented in Table 5.12. The empirical results indicate that the unconditional variance of stock returns has decreased in the East Asian emerging markets except for the case of Thailand.

Table 5.11: GARCH(1,1) Parameter Estimation with Sudden Changes of Variance

Cut off Point: Official Liberalisation Date

	Pre-Lib	Post-Lib
Korea		
ω	0.042 (6.024)***	0.019 (2.622)***
α	0.165 (8.292)***	0.109 (4.330)***
β	0.724 (29.52)***	0.828 (22.86)***
D_1	-	-0.127 (-2.291)**
$\alpha + \beta$	0.889	0.937
Ljung Box (12) for the levels	18.346 (0.105)	10.938 (0.534)
Ljung Box (12) for the squares	19.366 (0.080)	16.109 (0.182)
Sign Bias	0.084 (0.651)	0.092 (0.845)
Negative Size Bias	-0.116 (-1.009)	0.040 (0.412)
Positive Size Bias	-0.017 (-0.173)	-0.126 (-1.447)
Joint Test	1.112 (0.774)	3.557 (0.313)
Taiwan		
ω	0.024 (3.076)***	0.015 (1.792)*
α	0.118 (5.051)***	0.058 (2.797)***
β	0.867 (35.31)***	0.915 (30.58)***
D_1	-	-0.289 (-2.773)***
$\alpha + \beta$	0.985	0.973
Ljung Box (12) for the levels	24.551 (0.017)**	12.109 (0.436)
Ljung Box (12) for the squares	20.422 (0.059)	16.178 (0.183)
Sign Bias	0.322 (3.608)	0.125 (0.952)
Negative Size Bias	-0.294 (-4.066)***	0.012 (0.122)
Positive Size Bias	-0.317 (-3.899)***	-0.226 (-2.055)**
Joint Test	21.529 (0.00)***	5.018 (0.170)
Malaysia		
ω	0.014 (2.804)***	0.090 (8.826)***
α	0.075 (2.426)**	0.266 (6.146)***
β	0.898 (24.03)***	0.357 (4.894)***
D_1	-0.075 (-2.064)**	-
$\alpha + \beta$	0.973	0.623
Ljung Box (12) for the levels	37.136 (0.000)***	25.716 (0.011)**
Ljung Box (12) for the squares	8.455 (0.748)	1.254 (0.999)
Sign Bias	0.264 (0.910)	-0.233 (-0.598)
Negative Size Bias	-0.425 (-2.028)**	0.009 (0.031)
Positive Size Bias	-0.091 (-0.346)	0.046 (0.133)
Joint Test	4.211 (0.239)	0.508 (0.917)
Thailand		
ω	0.001 (5.907)***	0.007 (4.457)***
α	0.141 (10.56)***	0.129 (4.322)***
β	0.829 (70.05)***	0.855 (30.11)***
D_1	-	2.545 (3.139)***
$\alpha + \beta$	0.970	0.999
Ljung Box (12) for the levels	25.697 (0.012)**	14.222 (0.286)
Ljung Box (12) for the squares	6.109 (0.910)	5.981 (0.917)
Sign Bias	-0.200 (-1.341)	0.120 (0.757)
Negative Size Bias	0.080 (0.625)	-0.260 (-2.111)**
Positive Size Bias	0.240 (1.936)	-0.279 (-2.012)**
Joint Test	3.852 (0.277)	8.479 (0.037)**
Philippines		
ω	0.022 (5.148)***	0.009 (1.893)*
α	0.094 (8.519)***	0.066 (3.889)***
β	0.880 (64.13)***	0.911 (36.42)***
D_1	-	-0.665 (-3.873)***
$\alpha + \beta$	0.974	0.977
Ljung Box (12) for the levels	23.217 (0.025)**	23.014 (0.027)**
Ljung Box (12) for the squares	9.426 (0.666)	14.840 (0.250)
Sign Bias	0.069 (0.458)	-0.003 (-0.020)
Negative Size Bias	-0.145 (-1.189)	0.053 (0.468)
Positive Size Bias	-0.037 (-0.293)	-0.062 (-0.559)
Joint Test	1.481 (0.686)	0.863 (0.834)

Notes: */**/*** denotes statistical significance at the 10%/5%/1% level of significance. The values in parentheses indicate t-statistics, except for the Ljung-Box tests and joint test, which are p-values.

Table 5.12: Unconditional Variance of the GARCH(1,1) Model with Sudden Changes of Variance

Country	Cut off Point: Official Liberalisation Date		
	Pre-Lib	Post-Lib	% change
Korea	0.378	0.301	-20.37
Taiwan	1.600	0.555	-65.31
Malaysia	0.518	0.238	-54.05
Thailand	0.033	0.437	1224.24
Philippines	0.846	0.391	-53.78

Table 5.13 reports estimates of GARCH(1,1) models without sudden changes of variance for stock returns on the East Asian emerging markets over the full sample period, pre- and post-financial liberalisation. As shown in this table, the parameter estimates demonstrate the typical findings in empirical applications of the GARCH(1,1) model. The coefficients on all three terms in the conditional variance equation are highly statistically significant. For all sample periods, the estimate of alpha is fairly small, the estimate of beta is large and the sum of alpha and beta is close to unity. This implies that conditional volatility is persistent, in the sense that shocks to the conditional variance die out very slowly. Nevertheless, the volatility persistence in the Malaysian stock market is decreased after financial liberalisation.

Table 5.13: GARCH(1,1) Parameter Estimation of East Asian Stock Returns (without sudden Changes of variance)

	Full Sample	Cut off Point: Official Liberalisation Date		Cut off Point: Structural Break Date	
		Pre-Lib	Post-Lib	Pre-Lib	Post-Lib
Korea					
ω	0.028 (7.793)***	0.042 (6.024)***	0.020 (3.403)***	0.035 (6.472)***	0.028 (2.196)**
α	0.139 (10.44)***	0.165 (8.292)***	0.114 (4.962)***	0.165 (9.112)***	0.077 (3.030)***
β	0.782 (47.41)***	0.724 (29.52)***	0.820 (22.14)***	0.756 (37.79)***	0.803 (11.071)***
$\alpha + \beta$	0.921	0.889	0.934	0.921	0.880
Ljung Box (12) for the levels	23.62 (0.023)**	18.346 (0.105)	10.963 (0.532)	18.260 (0.108)	7.473 (0.825)
Ljung Box (12) for the squares	50.46 (0.000)***	19.366 (0.080)	44.259 (0.00)***	18.186 (0.110)	30.582 (0.002)***
Sign Bias	0.092 (1.108)	0.084 (0.651)	0.092 (0.838)	0.125 (1.014)	0.066 (0.533)
Negative Size Bias	-0.056 (-0.768)	-0.116 (-1.009)	0.044 (0.449)	-0.138 (-1.221)	0.031 (0.285)
Positive Size Bias	-0.061 (-0.942)	-0.017 (-0.173)	-0.127 (-1.455)	-0.015 (-0.162)	-0.139 (-1.396)
Joint Test	1.340 (0.719)	1.112 (0.774)	3.685 (0.297)	1.948 (0.583)	2.802 (0.423)
Taiwan					
ω	0.015 (5.236)***	0.024 (3.076)***	0.015 (4.671)***	0.021 (3.199)***	0.022 (4.109)***
α	0.081 (9.421)***	0.118 (5.051)***	0.060 (7.044)***	0.101 (5.644)***	0.063 (6.318)***
β	0.904 (96.58)***	0.867 (35.31)***	0.913 (84.54)***	0.886 (49.05)***	0.895 (55.08)***
$\alpha + \beta$	0.985	0.985	0.985	0.987	0.958
Ljung Box (12) for the levels	19.374 (0.079)	24.551 (0.017)**	12.525 (0.404)	19.576 (0.075)	8.372 (0.755)
Ljung Box (12) for the squares	34.935 (0.00)***	20.422 (0.059)	15.616 (0.209)	29.625 (0.000)***	15.885 (0.196)
Sign Bias	0.243 (3.158)***	0.322 (3.608)	0.128 (0.973)	0.294 (3.393)***	0.164 (1.169)
Negative Size Bias	-0.139 (-2.231)**	-0.294 (-4.066)***	0.007 (0.072)	-0.255 (-3.579)***	-0.007 (-0.067)
Positive Size Bias	-0.259 (-3.92)***	-0.317 (-3.899)***	-0.226 (-2.055)**	-0.285 (-3.711)***	-0.260 (-2.211)**
Joint Test	16.035 (0.00)***	21.529 (0.000)***	4.929 (0.177)	18.116 (0.000)***	5.442 (0.142)
Malaysia					
ω	0.034 (16.59)***	0.014 (5.253)***	0.090 (8.826)***	0.027 (4.915)***	0.075 (7.091)***
α	0.131 (17.18)***	0.075 (8.916)***	0.266 (6.146)***	0.082 (8.194)***	0.197 (6.404)***
β	0.773 (77.56)***	0.895 (88.168)***	0.357 (4.894)***	0.870 (52.70)***	0.464 (6.371)***
$\alpha + \beta$	0.904	0.970	0.623	0.952	0.661
Ljung Box (12) for the levels	48.097 (0.00)***	34.147 (0.000)***	25.716 (0.011)**	31.030 (0.001)***	30.224 (0.002)***
Ljung Box (12) for the squares	2.121 (0.999)	8.324 (0.759)	1.254 (0.999)	7.276 (0.838)	1.152 (0.999)
Sign Bias	0.065 (0.274)	0.266 (0.915)	-0.233 (-0.598)	0.310 (0.930)	-0.196 (-0.609)
Negative Size Bias	-0.201 (-1.180)	-0.424 (-2.023)**	0.009 (0.031)	-0.487 (-2.029)**	-0.010 (-0.045)
Positive Size Bias	-0.051 (-0.235)	-0.093 (-0.355)	0.046 (0.133)	-0.108 (-0.350)	0.010 (0.037)
Joint Test	1.510 (0.679)	4.172 (0.243)	0.508 (0.917)	4.218 (0.238)	0.690 (0.875)

Table 5.13 (Continued.... next page)

Table 5.13 (Continued)

	Full Sample	Cut off Point: Official Liberalisation Sample		Cut off Point: Structural Break Sample	
		Pre-Lib	Post-Lib	Pre-Lib	Post-Lib
Thailand					
ω	0.001 (5.670)***	0.001 (5.907)***	0.008 (4.384)***	0.001 (5.842)***	0.007 (4.375)***
α	0.136 (17.15)***	0.141 (10.56)***	0.139 (11.59)***	0.138 (10.54)***	0.130 (11.04)***
β	0.860 (149.8)***	0.829 (70.05)***	0.841 (82.82)***	0.833 (70.58)***	0.849 (87.01)***
$\alpha + \beta$	0.996	0.970	0.980	0.971	0.979
Ljung Box (12) for the levels	50.907 (0.00)***	25.697 (0.012)**	16.663 (0.162)	32.653 (0.001)***	13.289 (0.348)
Ljung Box (12) for the squares	7.042 (0.855)	6.109 (0.910)	4.228 (0.978)	5.791 (0.926)	4.545 (0.971)
Sign Bias	-0.088 (-0.796)	-0.200 (-1.341)	0.116 (0.721)	-0.162 (-1.083)	0.137 (0.841)
Negative Size Bias	-0.125 (-1.367)	0.080 (0.625)	-0.257 (-2.049)**	0.074 (0.568)	-0.267 (-2.110)**
Positive Size Bias	-0.032 (-0.342)	0.240 (1.936)	-0.292 (-2.073)**	0.241 (1.994)**	-0.296 (-2.071)**
Joint Test	6.718 (0.081)*	3.852 (0.277)	8.636 (0.034)**	4.017 (0.259)	8.396 (0.038)**
Philippines					
ω	0.008 (5.806)***	0.022 (5.148)***	0.009 (3.227)***	0.020 (4.976)***	0.014 (3.345)***
α	0.067 (14.31)***	0.094 (8.519)***	0.063 (5.027)***	0.085 (8.979)***	0.086 (4.952)***
β	0.918 (172.1)***	0.880 (64.13)***	0.912 (53.98)***	0.891 (73.22)***	0.874 (36.42)***
$\alpha + \beta$	0.985	0.974	0.975	0.976	0.960
Ljung Box (12) for the levels	32.918 (0.00)***	23.217 (0.025)**	21.606 (0.042)**	21.513 (0.043)**	22.871 (0.028)**
Ljung Box (12) for the squares	9.174 (0.688)	9.426 (0.666)	14.725 (0.256)	7.943 (0.789)	15.164 (0.232)
Sign Bias	0.077 (0.743)	0.069 (0.458)	0.004 (0.032)	0.045 (0.312)	-0.015 (-0.105)
Negative Size Bias	-0.085 (–0.995)	-0.145 (-1.189)	0.032 (0.280)	-0.115 (-0.988)	0.037 (0.314)
Positive Size Bias	-0.053 (-0.622)	-0.037 (-0.293)	-0.069 (-0.621)	-0.062 (-0.509)	-0.025 (-0.220)
Joint Test	1.075 (0.783)	1.481 (0.686)	0.729 (0.866)	1.228 (0.746)	0.244 (0.970)

Table 5.14 reports the unconditional variance of the stock market returns in five East Asian emerging markets for full sample period, pre- and post-financial liberalisation periods. The results suggest that the unconditional variance is decreased in the cases of Korea, Taiwan, Malaysia and the Philippines after financial liberalisation. However, in the case of Thailand, the unconditional variance is increased, which suggests that the average level of volatility has gone up after financial liberalisation.

Table 5.14: Unconditional Variance of the GARCH(1,1) Model without Sudden Changes of Variance

Country	Full Sample	Cut off Point: Official Liberalisation Date			Cut off Point: Structural Break Date		
		Pre-Lib	Post-Lib	% change	Pre-Lib	Post-Lib	% change
Korea	0.354	0.378	0.303	-19.84	0.443	0.233	-47.40
Taiwan	1.000	1.600	0.555	-65.31	1.615	0.524	-67.55
Malaysia	0.354	0.467	0.238	-49.03	0.562	0.221	-60.67
Thailand	0.250	0.033	0.400	1112.12	0.034	0.333	879.41
Philippines	0.533	0.846	0.360	-57.44	0.843	0.350	-58.48

This empirical result of this study is similar with Bekaert and Harvey (1997), Huang and Yang (2000), Kim and Singal (2000) and Kassimatis (2002) who do not find support for the claim that market liberalisation increases stock price volatility. This finding suggests that the impact of financial liberalisation on stock market volatility varies from country to country. Having opened up their stock markets to the outside world, the East Asian emerging markets are buffeted by first by large inflows of foreign funds and leading to integration of financial markets, regionally and globally. The entry of foreign funds into East Asia region contributed greatly to the rise in stock market prices. After liberalisation, the stock market volatility in these markets becomes lower as a result of increased foreign participation and the deepening of markets, which allows more investors to share a given amount of risk.

5.5 Conclusions

After financial reforms and opening the markets, the East Asian emerging markets have encouraged their financial deepening where they predated the reforms. There was dramatic growth in capitalization and volume in these markets due to the rapid capital flows liberalisation. The interesting issue arises here is that has the stock market grown more volatile after liberalisation. The stock market volatility is important to be addressed because rapid and large swings in stock prices threaten the security of collateral and the value of capital bases, regardless of the causes of volatility. With respect to the theoretical view, the Keynesian view predicts that stock market volatility will increase when it opens its stock market to foreign investors. This study examines whether the data in East Asian emerging markets are consistent with the theoretical prediction.

The Exponential GARCH (EGARCH) model combined with sudden changes of variance methodology is employed in the analysis. The EGARCH model allows financial time series to respond asymmetrically to 'bad news', a negative shock, and 'good news', a positive shock, even though the shocks are of the same magnitude. The sudden changes of unconditional variance detected by using ICSS algorithm procedure are incorporated into the EGARCH model in order to capture all the variance effects. The estimated results indicate that by incorporating dummies to capture these instabilities, a more accurate and reliable

estimate of the volatility can be computed. Besides, there is significant evidence for asymmetry in stock returns, and a greater impact on volatility of negative, rather than positive, return shocks in the East Asian emerging stock markets. This is consistent with many empirical studies, which have shown that a negative price shock leads to considerably higher volatility in stock returns. That is, investors react more sensitively to bad news than to good news, so there is higher volatility in response to bad news.

Only a few break positions of sudden changes of variance are identified for the stock return series, and the break positions are corresponded closely to dates of official financial liberalisation dates. The endogenous dates are detected later than official dates (except for Malaysia) and this indicates that financial liberalisation in terms of opening up stock market to foreign investors in East Asian emerging markets does cause sudden shift in stock return. The empirical results based on different sub-sample periods indicate that after liberalisation, the stock market volatility exhibited diminishing volatility in East Asian emerging markets except for the case of Thailand, which witnessed increased volatility. The finding of this study is robust to alternative estimation method and sample period. On the other hand, the stock market volatility of East Asian emerging economies demonstrates high volatility during the 1997-98 East Asian financial crisis period.

Appendix 5.I: Iterated Cumulative Sums of Squares (ICSS) Algorithm

Let say the notation $a[t_1 : t_2]$ represents the series $a_{t_1}, a_{t_1+1}, \ldots, a_{t_2}, t_1 < t_2$ and use the notation $D_k(a[t_1 : t_2])$ to indicate the range over which the cumulative sums are obtained.

Step 0: Let $t_1 = 1$

Step 1. Calculate $D_k(a[t_1 : T])$. Let $k^*(a[t_1 : T])$ be the point at which $\max_k |D_k(a[t_1 : T])|$ is obtained, and let

$$M(t_1 : T) = \max_{t_1 \le k \le T} \sqrt{(T - t_1 + 1)/2} |D_k(a[t_1 : T])|$$

If $M(t_1 : T) > D^*$, consider that there is a change point at $k^*(a[t_1 : T])$ and proceed to Step 2a. If $M(t_1 : T) < D^*$, there is no evidence of variance changes in the series. The algorithm stops.

Step 2a. Let $t_2 = k^*(a[t_1 : t_2])$; that is, the centered cumulative sum of squares applied only to the beginning of the series up to t_2. If $M(t_1 : t_2) > D^*$, then we have a new point of change and should repeat Step 2a until $M(t_1 : t_2) < D^*$. When this occurs, we can say that there is no evidence of variance change in $t = t_1, \ldots\ldots, t_2$ and, therefore, the first point of change is $k_{\text{first}} = t_2$.

Step 2b. Now do a similar search starting from the first change point found in Step 1, toward the end of the series. Define a new value for t_1: let $t_1 = k^*(a[t_1 : T] + 1$. Evaluate $D_k(a[t_1 : T])$, and repeat Step 2b until $M(t_1 : t_2) < D^*$. Let $k_{\text{last}} = t_1 - 1$.

Step 2c. If $k_{\text{frist}} = k_{\text{last}}$, there is just one change point. The algorithm stops there. If $k_{\text{frist}} < k_{\text{last}}$, keep both values as possible change points and repeat Step 1 and Step 2 on the middle part of the series; that is, $t_1 = k_{\text{first}} + 1$ and $T = k_{\text{last}}$. Each time that Steps 2a and 2b are repeated, the result can be one or two more points. Call N_T the number of change points found so far.

Step 3. If there are two or more possible change points, make sure they are in increasing order. Let cp be the vector of all the possible change points found so far. Define the two extreme values $cp_0 = 0$ and $cp_{N_T+1} = T$. Check each possible change point by calculating $D_k(a[cp_{j-1}+1:cp_{j+1}]), j = 1,.....,N_T$. If $M(cp_{j-1}+1:cp_{j+1}) > D^*$, then keep the point; otherwise, eliminate it. Repeat Step 3 until the number of change points does not change and the points found in each new pass are 'close' to those on the previous pass. In our implementation of this algorithm, we consider that if each change point is within two observations of where it was on the previous iteration, then the algorithm has converged. This convergence is achieved in few iterations of Step 3. Note that during each iteration, the newly found points must be kept apart to make an entire pass through the series based on a single set of points.

Appendix 5.II: Discussion of the choices for official liberalisation dates[76]

Korea: January 1992. In September 1991, there is an announcement that stock market will open to investors in January of 1992. The announced regulations are that a foreign investor cannot own more than 3% of a company's shares and foreigners cannot own collectively more than 10% of a company. The government later raised the limit to 25% for 45 companies that already had more than 10% ownership by foreigners. Also IFC liberalisation date. Important coincident events include, Korea being admitted into the United Nations in September 1991 and Republic of Korea and Democratic People's Republic of Korea concluded an agreement covering political reconciliation, military nonagression and economic aggression in December 1991.

Taiwan: January 1991. Implementation date of the second phase of the liberalisation plan. Eligible foreign institutional investors may now invest directly in Taiwan securities if they have applied for and received SEC approval as a qualified foreign institutional investor (QFII). Outward remittance is not allowed until three months after initial investment. Each foreign institution is limited to holding a maximum of 5% of any listed stock and total foreign holdings in any listed companies may not exceed 10%. Also International Finance Corporation (IFC) liberalisation date.

Malaysia: December 1988. In the budget introduced in October 1988, plans are detailed for the liberalisation of foreign ownership policies to attract more foreign investors. Also International Finance Corporation (IFC) liberalisation date.

Thailand: September 1987. Inauguration of the Stock Exchange of Thailand's Alien Board. The Alien Board allows foreigners to trade stocks of those companies that have reached their foreign investment limits. Thais continue to trade stocks on the Main Board. The IFC liberalisation date is December 1988, which is not associated with any particular regulatory changes.

Philippines: June 1991. A Foreign Investment Act is signed into law. The Act removes, over a period of three years, all restrictions on foreign investments. Under the provisions, foreign investors are required only to register with the Securities and Exchange Commission, and most sectors of the economy are opened to 100% foreign ownership.

[76] A more detailed chronology is presented in Bekaert and Harvey (2000).

Appendix 5.III: Tests for Asymmetries in Volatility: Sign and Size Bias Tests

Engle and Ng (1993) propose a set of test statistics, which are useful in deciding whether asymmetry is present. Their tests are designed to detect: (i) sign bias; (ii) negative size bias and (iii) positive size bias. These tests can either be conducted on the raw data, that is without imposing a particular volatility model, or on the residuals from a particular volatility model. The optimal forms of the regressions for conducting the sign bias test, the negative size bias test, and the positive size bias test are respectively,

$$v_t^2 = a + bS_{t-1}^- + \beta' z_t^* + e_t \quad \text{(A.5.1)}$$

$$v_t^2 = a + bS_{t-1}^- \varepsilon_{t-1} + \beta' z_t^* + e_t \quad \text{(A.5.2)}$$

$$v_t^2 = a + bS_{t-1}^+ \varepsilon_{t-1} + \beta' z_t^* + e_t \quad \text{(A.5.3)}$$

where v_t is the normalized residual corresponding to observation t under the volatility model hypothesized, that is, $v_t = \frac{\varepsilon_t}{\sqrt{h_t}}$, S_{t-1}^- as an indicator dummy that takes the value one if ε_{t-1} < 0 and zero otherwise and S_{t-1}^+ = 1 - S_{t-1}^- (S_{t-1}^+ picks out the observations with positive innovations), $z_t^* = \frac{\tilde{h}(\theta)}{h_t^*}$, where $\tilde{h}(\theta) = \frac{\partial h_t}{\partial \theta}$ evaluated at the values of maximum likelihood estimates of parameter θ and h_t^* is the estimated conditional variance by a model considered, a and b are constant parameters, β' is a constant parameter vector, and e_t is the residual.

The sign bias test statistic is defined as the t-ratio for the coefficient b in regression Equation (A.5.1). If positive and negative shocks to ε_{t-1} impact differently upon the conditional variance, then b will be statistically significant. It could also be the case that the magnitude or size of the shock will affect whether the response of volatility to shocks is symmetric or not. In this case, a negative sign bias test would be conducted, based on a regression where S_{t-1}^- is now used as a slope dummy variable. Negative sign bias is argued

to be present if b is statistically significant in the regression (A.5.2), whereas the positive sign bias test statistic is defined as the t-ratio of the coefficient b in regression (A.5.3).

Engle and Ng (1993) propose a joint test for sign and size bias based on the regression

$$v_t^2 = a + b_1 S_{t-1}^- + b_2 S_{t-1}^- \varepsilon_{t-1} + b_3 S_{t-1}^+ \varepsilon_{t-1} + \beta' z_t^* + e_t \qquad \text{(A.5.4)}$$

where a, b_1, b_2 and b_3 are constant parameters, β' is a vector of constant coefficients, and e_t is the residual. The t-ratios for b_1, b_2 and b_3 are the sign bias, the negative size bias, and the positive size bias test statistics, respectively. A joint test statistic is formulated in the standard fashion by calculating TR^2 from regression (A.5.4), which will asymptotically follow a χ^2 distribution with 3 degrees of freedom under the null hypothesis of no asymmetric effects.

CHAPTER SIX

CONCLUSIONS

6.1 Introduction

This final chapter summarises the major findings and policy implications derivable from the empirical results. It is organised as follows. We begin by providing a general review and finding of the study. Next we point to the policy implications, which emerge from the analysis. Lastly, we suggest areas for further work.

6.2 General Review and Finding of the Study

The fundamental questions examined by this dissertation concern financial development, economic growth and stock market volatility. More specifically, this dissertation examines three issues: (i) the effect of financial development on economic growth with taking into consideration of the role of institutions; (ii) the determinants of financial development from trade openness and capital inflows perspectives and (iii) the impact of financial liberalisation on stock market volatility. We have formulated empirical models and tested the above issues by using large panel data that cover different sample countries, as well as the high frequency time series data sets.

The novel analysis is primarily reported in Chapters three to five of the dissertation. Nevertheless, before conducting the empirical studies to investigate the above issues, we surveyed both theoretical and empirical developments in the finance, growth and stock market volatility literature in Chapter two. The studies of the literature were briefly reviewed under three sub-sections: (i) finance, institutions and growth; (ii) the determinants of financial development, and (ii) financial liberalisation and stock market volatility.

In general, the empirical studies indicate that finance and economic growth nexus is positive and significant, and the relationship is not driven by simultaneity bias. More recently, the empirical findings also demonstrate that the role of finance in promoting growth may reflect different stages of economic development, where finance is most effective in

promoting growth in middle-income economies. At different strand of literature discusses the role of institutions in determining economic growth. With the new data set of institutions, many empirical studies have emerged and the empirical results indicate that good institutional quality is an important determinant of long-run growth. This study attempts to examine the presence of institutional quality that could alter the significance of the finance-growth relationship. With respect to the determinants of financial development, there are few theoretical views that emerged to explain what are the factors that determine country's level of financial depth, namely the law and finance view, the endowment theory of institutions and the interest group theory. Finally, the stock market volatility issue has also received much attention in empirical studies especially after the financial liberalisation programmes in late 1980s and early 1990s, and also the rapid developments in world financial markets and the occurrence of several financial crises in 1990s. Stock market volatility, in particular, could harm the economy through a number of channels and it may impair the smooth functioning of the financial markets and systems. Even though much research has been conducted to examine the impact of financial liberalisation on stock market volatility, the empirical evidence is still mixed.

Chapter Three is embedded in the large literature examining the role of finance and institutions in promoting economic growth, using cross-country and panel data analysis over the period 1978 – 2001. The Solow growth model is estimated using a cross-country and panel data techniques. Numerous financial development indicators are employed in the analysis, which include banking sector development and capital market development. In this chapter, the analysis deviates from the previous work in two important respects. First, this study tests the hypothesis that the interaction between financial development and institutions – that is to say, a financial market that is embedded in good institutions – has a separate positive impact on economic growth under the augmented Solow growth model typically employed in the applied literature. Second, besides using cross-country analysis, the panel data estimations namely mean group (MG), pooled mean group (PMG) and static fixed effect model are employed in the empirical analysis at four different income groups. The cross-country empirical results indicate that institutions and financial development play a pivotal role in influencing economic growth. However, the effect of financial development is more

powerful compared to institutions. The coefficient on the interaction term between financial development and institutions is statistically significant and larger than financial development and institutions individually. This finding reveals that financial development has larger effect on growth when the financial system is embedded within a sound good institutional framework.

The panel data estimations are carried out for 4 groups of countries, depending on the level of economic development. Financial development and institutions are found to be more potent in delivering extra economic growth in middle-income economies. The effects of financial development and institutions in high-income OECD countries are smaller than in middle-income economies, where the effect of both variables are diminishing. Various interpretations have been offered for the weaker link between finance-growth in the OECD sample, such as close international linkages across OECD financial markets make it difficult to identify the influence of domestic financial development on a country's growth rate. In addition, OECD countries are at a more advanced stage of development, where financial systems may have a different (and more difficult to measure) impact on growth than in earlier stages of development. On the other hand, institutional quality has stronger impact on growth than financial development in low-income countries. Low-income economies tend to have less developed financial intermediaries and capital markets. These economies would hardly benefit from financial development probably because they have not implemented the appropriate financial infrastructures that could promote economic growth.

Evidence from Chapter Three suggests that financial development is an important determinant of economic growth. This led to further investigation to find out the determinants of financial development. This issue from the historical perspectives have been examined in the literature such as from law and finance and endowment theory of institutions. The law and finance view predicts that historically determined differences in legal origin can explain cross-country differences in financial development observed today. Specifically, this view predicts that economies that inherited the British Common law tradition obtained a legal tradition tends to both emphasise private property rights and support financial development than economies that obtained the French Civil law tradition. On the other hand, the endowment theory of institutions, predicts that the initial environment encountered by

European colonisers shaped the types of lost-lasting institutions has an impact on financial development today. Hospitable endowments favoured the construction of settler colonies, where Europeans established secure property rights tend to encourage financial development, compared to extractive colonies where Europeans established institutions that facilitated state control rather than individual property rights.

More recently, another point of view that explains the determinants of financial development is interest group theory proposed by Rajan and Zingales (2003). Even though this theory emphasises that financial development is influenced by political choices, it discusses the determinants of financial development from an openness perspective. According to this view, incumbents oppose financial development because it produces fewer benefits for them than for potential competitors. Nevertheless, when a country is open to trade and capital flows, and then it will deliver benefit to financial development because it breeds competition and thus threatens the rents of incumbents. In order to examine this possibility, the determinants of financial development from trade openness and capital inflows are examined in Chapter Four. The sample countries are based on a group of developing countries, using the econometric tools that applied in Chapter Three, namely cross-country and dynamic panel data techniques. The econometric results based on different measures of capital inflows and trade openness indicate that capital inflows lead to greater financial development in developing economies. The cross-country results reveal that the positive impact of capital inflows on financial development is apparent during the 1990s, the period of a major upsurge of international capital flows. Institutions also matter for financial development and this is consistent with the growing evidence that institutional differences have an impact on financial systems. The evidence presented using cross-country and panel data analysis provides qualified support to the Rajan and Zingales (2003) hypothesis – capital inflows and trade openness simultaneously would promote financial development. One important qualification is that the interaction term between both variables enters positively into cross-section and panel estimations, after controlling for real GDP per capita, institutions and the real interest rate. The empirical evidence is robust to alternative measures of financial development and openness, as well as estimation method and sample period.

Chapter Five concentrates on studying the effect of financial liberalisation in terms of opening up domestic stock markets to foreign investors on stock market volatility. Volatility, which represents the risk, may distort the role of financial markets and systems in channelling funds from surplus to deficits units. In the mid 1980s and early 1990s, many emerging economies have liberalised their stock markets by allowing foreign investors to invest in their domestic stock markets. The increased liberalisation and openness have motivated high rate of increases in cross-border capital and direct investment flows. Both inflows and outflows of private capital have been sharply increasing since the early 1980s in the emerging economies. Also, against the background of increased liberalisation of particularly the financial sector, there have been remarkable financial integration and financial development. During this period, the emerging markets financial depth has been rapidly increased, as measured by stock market capitalisation and the share of value traded. Thus, this event has created an ideal laboratory for investigating the impact of financial development as a result of financial liberalisation in emerging economies stock market volatility.

The empirical analysis is carried out using data from five fast growing East Asian emerging markets, namely South Korea, Taiwan, Malaysia, Thailand and the Philippines using EGARCH (1,1) model with sudden changes in variance. The sudden changes of unconditional variance are detected by employing the Iterated Cumulative Sum of Squares (ICSS) procedure developed by Inclan and Tiao (1994). The sample period is divided into three sub-sample periods, namely pre-liberalisation, post-liberalisation before Asian financial crisis and post-financial crisis eras. The endogenous break dates of stock market volatility or sudden changes of variance corresponded closely to dates of official financial liberalisation reforms. The stock market volatility in South Korea, Taiwan, Malaysia and the Philippines has declined after liberalisation, but not for the case of Thailand. The GARCH(1,1) estimations also suggest similar findings. Nevertheless, the stock market volatility in these economies is high especially during the crisis period.

6.3 Policy Implications

Formulation of an economic policy package that is conducive to growth has always been the major concern of policy makers especially in developing countries. Policy makers can select an appropriate policy or policies among alternative policy options based on empirical evidence. In this study, the empirical analyses are carried out using cross-country and panel datasets. We are aware of the fact that these datasets cannot be used in policy formulation at the country specific level, thus the policies implications to be drawn from these findings ought to be treated with caution. In order to obtain country specific finding, then it ought to be dealt with case by case using time series analysis.

A clear conclusion from the analysis is that financial development and institutions are important determinants of economic growth. The effectiveness of a financial system to generate economic growth is dependent on the institutional structure in which the system is embedded. Financial development has larger effects on economic growth when the financial system is embedded within a good institutional framework. This realisation implies that 'quality-adjusted finance' is important to promote economic growth. We found this to be particularly true for poor countries, where more finance may well fail to deliver more growth, if institutional quality is low. For poor countries, improvements in institutions are likely to deliver much larger direct effects on growth than financial development itself. And to economists who worry that some low-income economies may find it difficult to rely on external financing, steps to improve institutional quality should make it easier to overcome this obstacle.

In short, the policies that promote financial development and institutional reforms can have a positive influence on economic growth. Efforts should be concentrated to promote well-developed financial systems as well as good quality of institutions. Several aspects of improving institutional quality, for example, enhancing rule of law, securing property rights, cracking down on corruption and reducing uncertainty, by enhancing investor confidence, play a key role in the functioning of financial systems, and hence, may to hold the key for both financial development and economic growth.

In terms of capital inflows and trade openness in promoting financial development, this study found that openness to both trade and capital are the relevant variables in fostering financial development in the sample of developing countries. Thus, simultaneously stimulating foreign capital inflows and trade openness will encourage financial development. This policy would run contrary to the sequencing literature, which advocates that trade liberalisation should precede financial liberalisation and that capital account opening should be the last stage in the liberalisation process. Openness in terms of trade and capital flows creates competition from outsiders, and hence promotes the development of financial markets by becoming more efficient. The expansion in markets also led to an expansion in the need for financing as well as in the supply of financing.

While capital account openness provides significant benefits to investors and economies, it can be risky for undeveloped economies. This is because it could make the economies susceptible to financial vulnerability such as sudden reversal of capital inflows. Thus, the appropriate policy for the large developing economy is to gradually liberalise their trade and capital accounts until the sound good institutions and macroeconomic policies for a market economy are in place. So one of the main challenges for the developing countries is how to create a commitment to increase the level of competition while allowing time for market institutions to be built. Indeed, the level of openness is highly conditional on a country's pre-existing circumstances. Some characteristics, such as macroeconomic stability, credibility in government's policies, reliable legal institutions, etc should be fulfilled first before removing all trade and capital barriers, in order to make liberalisation as little costly, socially and economically, as possible.

The empirical results presented in this study suggest that stock market volatility has decreased after financial liberalisation in East Asia emerging markets except for the case of Thailand. This finding suggests that the impact of financial liberalisation on stock market volatility varies from country to country as well as the magnitude of the volatility. Having opened up their stock markets to the outside world, the East Asian emerging markets are buffeted by first by large inflows of foreign funds and leading to integration of financial markets, regionally and globally. The entry of foreign funds into East Asia region contributed greatly to the rise in stock market prices. After liberalisation, the stock market volatility in

these markets becomes lower as a result of increased foreign participation and the deepening of markets, which allows more investors to share a given amount of risk.

Even though financial liberalisation can bring benefits to emerging markets in terms of risk sharing, better allocation of resources and more efficient management, the external liberalisation also may induce extreme financial fragility in emerging developing countries. For example, the bulk of capital flows to East Asian economies had been in the form of short-term portfolio investment in tradable bonds and equity shares rather than longer-term foreign direct investment. Short-term flows tended to be speculative and unstable, and are susceptible to herd behaviour. As a result they had been associated with an increase in stock market volatility, which in turn disrupted financial markets, rather than supporting domestic capital formation. This experience was clearly illustrated during the 1997-98 Asian financial crisis, which was accompanied by high volatility of the East Asian emerging markets especially in Thailand, Korea and Malaysia.

Policy makers need to concentrate their efforts to attain stability in economic fundamentals in order to reduce volatility and minimise investor uncertainty. This is because the countries with stable economic fundamentals are more able to sterilise against the destabilising effects of external shocks than those with weaker fundamentals. In addition, policy markers in emerging markets need to consider how to design economic policies that secure the most benefits from capital inflows while reducing their vulnerability to sudden reversals. They should strengthen their domestic financial systems to improve the intermediation of sudden capital inflows or to cope with sudden capital outflows. In a number of cases, countries have restricted capital inflows or outflows. For example, in Malaysia, the 1997-98 East Asian financial crisis created a wave of uncertainty and volatility in the foreign exchange and stock markets. Panic-stricken investors started to pull out short-term capital on a large scale causing a steep depreciation of the currency and higher interest rates. In response to the crisis, the Malaysian government had implemented various actions to strengthen domestic economic fundamentals and deal with inherent weaknesses in the financial system. To ensure that the recovery measures managed to run smoothly, selective

capital control measures[77] were introduced in September 1998 to give Malaysia breathing space for its reforms to work. The Malaysian economy responded relatively well to these recovery measures. The GDP growth rate has been healthy and unemployment has been brought down to its pre-crisis level, while inflation has remained under control beginning to the new millennium.

6.4 Recommendations for Further Study

The analysis of this dissertation is carried out using aggregate level data. However, the disaggregate level and firm level data will be very valuable to understand the contributions of financial development and the quality of institutions to growth, as well as the nature of the links established between financial development and openness.

The institutional quality measurement in this study was based on the perception of the overall institutional environment. Even though the institutional quality indicators demonstrate high correlation results, further research and policy analysis are needed to identify the role of rule of law, bureaucratic, corruption, risk of expropriation and government repudiation of contract separately, such as to identify the channels through which institutions affect the magnitude of growth. This might help policy makers focus their efforts on improving the right set of institutions. The analysis also left out an exploration of the determinants of institutional quality since good institutions are important to promote financial development and economic growth.

The structural break of stock market volatility detected by using Inclan and Tiao (1994) test is robust to identify the break points. Nevertheless, recent advances in the theory of change-point estimation, using various new CUSUM type change-point estimators and tests for multiple breaks in the context of volatility models also worth to investigate, such as proposed by Kokoszka and Leipus (2000), Lavielle and Moulines (2000) and Sanso *et al.* (2003). It has been suggested that capital inflows such as portfolio investment flow to emerging markets are usually not based on the domestic macroeconomic fundamentals and

[77] The control covered the convertability of the Ringgit abroad, a moratorium on the outflow of capital and profits for 12 months and restrictions on exporting Malaysian currency. The Ringgit was pegged at RM3.80 to the US dollar. Though, initially, the selective capital controls seemed restrictive, from time to time, they were relaxed sequentially to serve their purpose better.

so highly speculative and volatile. Future research could investigate the volatility effects of this stream of capital flows on the stock market of emerging markets.

Finally, future research could also focus on the implications that the global process of financial integration (the ratio of financial trade flows to GDP) has on financial volatility, financial development and economic growth. In this context, the role of legal systems and institutional quality in promoting financial integration and growth may be also an interesting issue to look at.

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APPENDIX A: Pooled Mean Group Estimation of Dynamic Panel Data Models

Suppose that given data on time periods, t = 1,2,...T, and groups, i = 1,2,...N. We wish to estimate an ARDL(p,$\underbrace{q,q,\ldots,q}_{k\text{-times}}$) model as below:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij}' x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{1}$$

where x_{it} (k x 1) is the vector of explanatory variables (regressors) for group i; μ_i represent the fixed effects; the coefficients of the lagged dependent variables, λ_{ij}, are scalars; δ_{ij} are k x 1 coefficients vectors. T must be large enough such that we can estimate the model for each group separately. T need not be the same for each group, though for notational convenience we shall use a common T. The model could also contain fixed regressors such as intercepts, seasonal dummies, or time trends. However, in order to keep the notations simple, we do not allow for such effects.

It is convenient to work with the following re-parameterisation of the ARDL model of (1) as an error correction model:

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i' x_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*'} \Delta x_{i,t-j} + \varepsilon_{it} \tag{2}$$

$$i = 1, 2, \ldots..N, \text{ and } t = 1, 2, \ldots, T$$

$$\text{where } \phi_i = -(1 - \sum_{j=1}^{p} \lambda_{ij}), \ \beta_i = \sum_{j=0}^{q} \delta_{ij} \tag{3}$$

If we stack the time series observations for each group, Equation (2) can be written as

$$\Delta y_{it} = \phi_i y_{i,-1} + X_i \beta_i + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,-j} + \sum_{j=0}^{q-1} \Delta X_{i,-j} \delta_{ij}^{*} + \varepsilon_i \tag{4}$$

I = 1, 2, ..., N, where y_i = (y_{i1}, y_{i2}, ...y_{iT})' is a (T x 1) vector of the observations on the dependent variable of the i-th group, X_i = (x_{i1}, x_{i2}, ..., x_{iT})' a (T x k) matrix of observations on the regressors, $y_{i,-j}$ and $X_{i,-j}$ are period lagged values of y_i and X_i, $\Delta y_i = y_i - y_{i,-1}$, $\Delta X_i = X_i - X_{i,-1}$, $\Delta y_{i,-j}$ and $\Delta X_{i,-j}$ are j period lagged values of Δy_i and ΔX_i, and $\varepsilon_i = (\varepsilon_{i1}, \varepsilon_{i2}, \ldots., \varepsilon_{iT})'$.

Following Pesaran, Shin and Smith (1999), we make the following assumptions:

Assumption 1: The disturbances ε_{it}, i = 1,2,...., N; t = 1,2, ..., T, in the ARDL model (Equation 1) are independently distributed across i and t, with zero means, variance σ_i^2, and finite fourth-order moments. They are also distributed independently of the regressors x_{it}.

Assumption 2: The ARDL(p,q,q,...q) model is stable in the sense that the roots of

$$1-\sum_{j=1}^{p}\lambda_{ij}z^j=0 \tag{5}$$

I = 1, 2, .., N, fall outside the unit circle. This assumption in particular ensures that $\phi_i < 0$, and that there exists a long-run relationship between y_{it} and x_{it} defined by

$$y_{it}=-(\beta_i/\phi_i)x_{it}+\eta_{it} \tag{6}$$

for each I = 1,2,.... N, where η_{it} is I(0).

Assumption 3: The long-run coefficients on X_i, defined by $\theta_i = \frac{-\beta_i}{\phi_i}$, are the same across the groups, namely

$$\theta_i=\theta, \quad i=1,\ldots,N \tag{7}$$

As we have discussed, Pesaran, Shin and Smith (2001) have developed a general framework for testing Assumption 2 in time series, irrespective of whether the underlying variables are I(0) or I(1). The extension of this test to panel data models requires a separate paper and will not be attempted here. Under Assumption 2 and 3, the error correction model can be written more compactly as

$$\Delta y_i=\phi_i\xi_i(\theta)+W_i\kappa_i+\varepsilon_i \tag{8}$$

where

$$W_i=(\Delta y_{i,-1},\Delta y_{i,-2},\ldots,\Delta y_{i,-p+1},\Delta X_i,\Delta X_{i,-1},\ldots,\Delta X_{i,-q+1}) \tag{9}$$

$$\xi_i(\theta)=y_{i,-1}-X_i\theta \tag{10}$$

$\xi_i(\theta)$ is the error correction component, and

$$\kappa_i=(\lambda_{i1}^*,\lambda_{i2}^*,\ldots,\lambda_{i,p-1}^*;\delta_{i0}^{**},\delta_{i1}^{**},\ldots,\delta_{i,q-1}^{**})' \tag{11}$$

There are three issues to be noted in estimating (8)

1. The regression equations for each group are nonlinear in ϕ_i and θ.

2. There are cross-equation parameter restrictions by the virtue of the long-run homogeneity assumption.
3. The error variances differ across groups.

Concentrated Log-Likelihood Function

$$\gamma_T(\varphi) = -\frac{T}{2}\sum_{i=1}^{N} \ln 2\pi\sigma_i^2 - \frac{1}{2}\sum_{i=1}^{N} \sigma_i^{-2} Q_i \tag{12}$$

where

$$Q_i = [\Delta y_i - \phi_i \xi_i(\theta)]' H_i [\Delta y_i - \phi_i \xi_i(\theta)] \tag{13}$$

$$H_i = I_T - W_i (W_i' W_i)^{-1} W_i' \tag{14}$$

I_T is an identity matrix of order T, and as before $\varphi = (\theta', \phi', \sigma')'$.

In the case where the x_{it}'s are I(0), the pooled observation matrix on the regressors

$$\frac{1}{NT}\sum_{i=1}^{N} \frac{\phi_i^2}{\sigma_i^2} X_i' H_i X_i \tag{15}$$

must converge in probability to a fixed positive definite matrix. In case where the x_{it}'s are I(1),

$$\frac{1}{NT^2}\sum_{i=1}^{N} \frac{\phi_i^2}{\sigma_i^2} X_i' H_i X_i \tag{16}$$

must converge to a random positive definite matrix with probability 1. These conditions should hold for all feasible values of ϕ_i and σ_i^2 as $T \to \infty$ either for a fixed N, or for $N \to \infty$ as $T \to \infty$.

The Pooled Mean Group Estimator

The (quasi-) maximum likelihood estimates of the long-run coefficients, θ, and the group-specific error-correction coefficients, ϕ_i, can be computed by maximizing (12) with respect to φ. These (quasi-) maximum likelihood estimators will be referred to as the 'Pooled Mean Group' (PMG) estimators in order to highlight the pooling effect of the homogeneity restrictions on the estimates of the long-run coefficients, and the fact that averages across

groups are used to obtained group-wide mean estimates of the error-correction coefficients and the other short-run parameters of the model.

Pesaran, Shin and Smith (1999) propose two different likelihood-based algorithms for the computation of the PMG estimators which are computationally less demanding than estimating the pooled regression. The first is a 'back-substitution' algorithm that only makes use of the first derivatives of the log-likelihood function:

$$\hat{\theta} = -\left[\sum_{i=1}^{N} \frac{\hat{\phi}_i^2}{\hat{\sigma}_i^2} X_i' H_i X_i\right]^{-1} \left[\sum_{i=1}^{N} \frac{\hat{\phi}_i}{\hat{\sigma}_i^2} X_i' H_i (\Delta y_i - \hat{\phi}_i y_{i,-1}\right] \tag{17}$$

$$\hat{\phi}_i = \left(\hat{\xi}_i' H_i \hat{\xi}_i\right)^{-1} \hat{\xi}_i' H_i \Delta y_i \tag{18}$$

$$\hat{\sigma}_i^2 = T^{-1} (\Delta y_i - \hat{\phi}_i \hat{\xi}_i)' H_i (\Delta y_i - \hat{\phi}_i \hat{\xi}_i) \tag{19}$$

where $\hat{\xi}_i = y_{i,-1} - X_i \hat{\theta}$. Starting with an initial estimate of θ, say $\hat{\theta}^{(0)}$, estimates of ϕ_i and σ_i^2 can be computed using (18) and (19), which can then be substituted in (17) to obtain a new estimate of θ, say $\hat{\theta}^{(1)}$, and so on until convergence is achieved.

Alternatively, the PMG estimators can be computed using (a variation of) the Gauss-Newton method which makes use of both the first and the second derivatives.

Extension to the Case where a Subset of Long-Run Coefficients is the Same Across Groups

It may be of interest of constrain only a subset of the long-run parameters to be the same across groups. Accordingly, partition the T x k matrix of explanatory variables X_i as

$$\underset{(T \times k_1)\ (T \times k_2)}{X_i = (X_{1i}, X_{2i})} \tag{20}$$

$k = k_1 + k_2$, and conformably

$$\beta_i = \begin{bmatrix} \beta_{1i} \\ \beta_{2i} \end{bmatrix}, \begin{bmatrix} \theta_{1i} \\ \theta_{2i} \end{bmatrix} = \begin{bmatrix} -\beta_{1i} / \phi_i \\ -\beta_{2i} / \phi_i \end{bmatrix} \tag{21}$$

we now replace Assumption 3 by

Assumption 3a: Only the long-run coefficients associated with X_{1i} are the same across the groups;

$$\theta_{1i} = \theta_1, \qquad I = 1, 2, \ldots, N. \tag{22}$$

Hypothesis Testing

Likelihood Ratio Tests of Parameter Homogeneity

Tests of the homogeneity of the error variances and/or the equality of (some of) the short or long-run slope coefficients across countries can be readily carried out using Likelihood ratio or other classical statistical procedures, sine the PMG and fixed effects estimators are obtained using restricted versions of the set of individual country equations.

$$LR = L(\hat{\theta}_{MG},....) - L(\hat{\theta}_{PMG},....)$$

where $\hat{\theta}_{MG}$ and $\hat{\theta}_{PMG}$ are the Mean Group (MG) and the PMG estimators, respectively. Then for sufficiently large T the log-likelihood ratio statistic LR, is distributed as a χ^2 variate with kN degrees of freedom, where k is the dimension of θ and N is the number of groups, assumed to be finite.

A Hausman Type Test of Parameter Homogeneity

An alternative testing procedure would be to compare the MG and the PMG estimators directly using Hausman test (Hausman, 1978). Consistent estimates of the mean of the long-run coefficients can easily be obtained from the MG estimator. These, however, will be inefficient if slope homogeneity holds. Under slope homogeneity, the pooled estimator is consistent and efficient. Therefore, the effect of heterogeneity on the means of the parameters can be determined by a Hausman-type test between the MG and fixed effects, or PMG estimates. The test statistic is given by

$$h = \left(\hat{\theta}_{MG} - \hat{\theta}_{PMG}\right)\hat{\Psi}^{-1}(\hat{\theta}_{MG} - \hat{\theta}_{PMG}) \tag{23}$$

where

$$\hat{\Psi} = \hat{V}(\hat{\theta}_{MG}) - \hat{V}(\hat{\theta}_{PMG}) \tag{24}$$

and $\hat{V}(\hat{\theta}_{MG})$ and $\hat{V}(\hat{\theta}_{PMG})$ are consistent estimators of the variances of the MG and the PMG estimators. Under the long-run slope homogeneity hypothesis the Hausman statistic is asymptotically distributed as a χ^2 variate with k degrees of freedom, the dimension of θ. However, note that there is no guarantee that $\hat{\Psi}$ will be positive definite, and in some cases the test may not be applicable.

APPENDIX B: Political Risk Services (PRS)

The PRS groups is an affiliate of Investment Business with Knowledge (IBC), a United States-based corporate providing up-to-date country information for international business. PRS was founded in 1980 and is headquartered in Syracuse, New York. As of April 2001, can be reach at http://www.prsgroup.com.

Since 1982, PRS produces the International Country Risk Guide (ICRG), which provides assessments of political, economic and financial risks in a large number of developed and developing countries. These assessments are based on an analysis of a worldwide network of experts, and are subject to a peer review process at subject and regional levels to ensure the coherence and comparability across nations.

The ICRG assesses three major categories of risk: political (with 12 components), financial (5 components) and economic (6 components). Knack and Keefer (1995) compiled a database of governance and security of property rights indicators from this data, for the Center for Institutional Reform and the Informal Sector (IRIS) at the University of Maryland. A brief description of the variables included in the database is provided below:

1. Corruption in Government

   Lower scores indicate 'high government officials are likely to demand special payments' and that 'illegal payments are generally expected throughout lower levels of government' in the form of 'bribes connected with import and export licenses, exchange controls, tax assessment, police protection, or loan,.

2. Rule of Law

   This variable 'reflects the degree to which the citizens of a country are willing to accept the established institutions to make and implement laws and adjudicate disputes'. Higher scores indicate: 'sound political institutions, a strong court system, and provisions for an orderly succession of power'. Lower scores indicate: 'a tradition of depending on physical force or illegal means to settle claims'. Upon changes in government new leaders 'may be less likely to accept the obligations of the previous regime'.

3. Quality of Bureaucracy

   High scores indicate 'an established mechanism for recruitment and training', 'autonomy from political pressure', and 'strength and expertise to govern without drastic changes in policy or interruptions in government services' when governments change.

4. Risk of Repudiation of Contracts by Government

   This indicator addresses the possibility that businesses, contractors, and consultants face the risk of a modification in a contract taking the form of a repudiation, postponement, or scaling down' due to 'an income drop, budget cutbacks, indigenisation pressure, a change in government, or a change in government economic and social priorities'. Lower scores signify 'a greater likelihood that a country will modify or repudiate a contract with a business'.

5. Risk of Expropriation of Private Investment

   This variables evaluates the risk 'outright confiscation and forced nationalisation' of property. Lower ratings 'are given to countries where expropriation of private investment is a likely event'.