

Economic Development with Finance: Studies of Emerging Economies

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A Thesis Submitted to
the University of Birmingham for
the degree of
Doctor of Philosophy

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University of Birmingham,
June 2009

Abstract

This thesis is composed of four original working chapters in terms of four researching purposes to show the macroeconomic development with finance, as well as to consider the comparative proxies of investment and trading sectors in emerging economies. These four original working chapters can be briefly presented as: Theoretical Models, Structural Breaks for NICs of Asia, Causations in Steady State and Dynamic Process in NICs of Asia, and Studies with Countries' Sizes in BICS¹. For different groups of countries in the developing world, it is necessary to mention a fact for empirical studies: that the methodology for estimations should be different, due to many realistic situations and some important ideas from development economists. In the theoretical section, some mathematical models are developed to look at the relationship and effects of finance and development, each of which highlights one special aspect of the interconnections in terms of taxonomy idea. The first empirical part of this thesis investigates the different types of emerging economies of New Industrialized Countries (NICs) in Asia, typically Singapore, Korea, Malaysia and Thailand, and various stages they pass through in terms of their economic development and financial growth 1960s to 2007. Another different empirical study concentrates on the size effects on the impacts of financial systems to economic development, which involves specific estimations of four specific large emerging economies of Brazil, China, India and South Africa (BICS) with quarterly data from 1995 to 2007. Specially, the study of BICS means the comparison of interrelationship of real sectors and financial sectors on development in terms of specifications of size effects on financial systems. The roles of financial system to economic development are suggested to be investigated in terms of specifications of different emerging economies based on either theoretical or empirical studies of this thesis.

¹ BICS: Brazil, India China and South Africa as a typical group of large emerging economies.

Acknowledgements

First of all, I should thank my main and first supervisor Professor Somnath Sen for his lots of patient help, continuous encouragement, invaluable comments and precious instructions. All of these are always the most important to support my postgraduate study since I was his student in September of 2005. Without his supports, I would not be here and this thesis would not have been completed. Professor Sen not only helped me correct, edit and improve my thesis technically, but he also spent lots of time helping me read the thesis carefully. In the meanwhile, I am really thankful to my second supervisor, Professor James L. Ford, for his much assistance in providing the comments of econometric parts of my thesis. I really appreciate what both professors helped me in the period of my PhD study.

Special thanks to my families, including my parents, parents-in-law, my wife Xian (Jessie) Zhang, and my lovely son Yutong (Jeffrey) Sun for their understanding, patience and everlasting supports throughout the years. I should extend my warmest thanks to all my friends for their encouragement and assistance at various times, and these friends are from Singapore, United Kingdom and China.

I would also like to thank all staff in the Department of Economics, University of Birmingham. I appreciate all financial supports from Department of Economics for my postgraduate study.

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Economic Development with Finance: Studies of Emerging Economies²

Chapter One

Introduction: Interrelationships between Economic Development and Financial Systems

1.1 General Ideas and Structure of Thesis

A number of recent studies have used various growth theories and empirical estimations to investigate the complex links between economic development and financial growth. The notion of economic development by itself is complicated enough; it has been claimed by the literature that development should include a broader discussion of structural problems of developing countries, such as development policies, state institutions, historical legacy and cultural transformation. In the same vein, financial growth could be encompassing too - taking account of systems and institutions, as well as the legal framework. However, theoretical and empirical models sometimes have to take a narrower and more focused point of view. We follow Lucas in concentrating on the core aspect of economic development and focusing on per capita income: “By the problem of economic development I mean

² Emerging Economies: NICs and BICSSs in this thesis; The NICs mean Newly Industrialized Countries of Singapore, Korea, Malaysia and Thailand; the BICSSs means Large Emerging Economies of Brazil, India, China, South Africa.

simply the problem of accounting for the observed pattern, across countries and across time, in levels and rates of growth of per capita income. This may seem too narrow a definition, and perhaps it is, but thinking about income patterns will necessarily involve us in thinking about many other aspects of societies too -----” (Lucas (1988). In the same way, financial growth will be defined as several important indicators of monetisation and financial depth used in empirical estimations to measure the development of a financial system. The central aim and purpose of this thesis is to evaluate the interrelationships between economic development and the growth of financial systems, which involves both conceptual models and empirical studies, with respect to emerging economies.

There are three fundamental issues that this thesis tries to deal with. First, is whether there is a positive (or negative) relationship between financial systems and economic development. In other words, the structural transformation of the financial system affects the aggregate macroeconomy and we wish to analyse whether this impact is significant and positive (or negative). We are also concerned with the temporal dimensions of the problem, so the short-run and long-run relationships are carefully delineated. Second, we need to investigate whether the causality runs from finance to development or vice versa. As we shall discuss in more detail later, this is the long running controversy in the development literature as to whether financial development actually *causes* economic growth or whether the very process of development forces a well functioning financial system to evolve at a later stage. The discussion is exemplified by the work of Joan Robinson and Joseph Schumpeter,

which we later term as the Robinson *versus* Schumpeter debate. Third, emerging economies have special circumstances and these may cause the core bi-variate relationship to move in specific ways. We investigate whether, in the era of globalisation, as to whether these co-related issues such as investment in physical capital, openness to trade and international finance, as well as size of economies and the cost of providing public goods, are determinant factors in influencing the interrelationship between finance and development.

The three issues mentioned above can be re-formulated into a series of questions, answers to which are provided in the rest of the thesis. Is there a short run (VAR-based) relationship between economic development as expressed by per capita income and financial development, as represented by various indices of financial depth and monetisation? Correspondingly, is there also a long run co-integrating relationship between these two indicators of structural change within the aggregate economy and the financial system? Does the causality run in the short run from finance to growth or vice versa? Do the stages of development have any impact on this causality? Can we create taxonomy for development which can make us understand this causality better? Do emerging economies have special features (such as size, openness, investment, public goods) which allow us to investigate this complex bi-variate relationship better? Does 'size' in terms of population, land area and aggregate GDP, have a particularly special impact effect in the short run, particularly in the face of exogenous shocks, which require estimation methods to be separated out?

This thesis first develops three different theoretical models to justify the

positive and significant interrelationships between economic development and financial growth in terms of conceptual ideas. It also provides some ideas regarding a taxonomy or taxonomic scheme by which the finance-growth nexus is related to stages of development. We claim that the causality between these two variables, in the context of the Robinson *versus* Schumpeter debate, is actually linked to the stages of economic development or where the country is within a hierarchical scheme of development. The empirical estimations with case studies of emerging economies are shown in the following chapters. These chapters for empirical studies of emerging economies refer to two very different groups of countries, which are normally acknowledged to be the most important powers in the developing world: first are the Newly Industrialized Countries of Asia, denoted as NICs in this thesis; second are the four large emerging economies, denoted as BICS. The first group, in this thesis, consists of Singapore, Korea, Malaysia and Thailand. This group of NICs is normally acknowledged to be in the advanced and middle-level stages of economic development and are expected to benefit the most from developing financial structures and systems. These Asian NICs show a strong and sharp upward trend in many aspects of their macroeconomic performance, in particular in the three important aspects of investment, trade, and financial growth. The second group is the BICS, which means the large developing countries: Brazil, India, China and South Africa. These four countries' economic development became a new popular idea for developing economies, and one of the main arguments for their development is in terms of the relationships between economic development and a country's size. In fact,

the different investigations of economic development with financial growth in these two different groups of countries should suggest some implications for economic policies in other developing countries which also has the potential advantage of size.

For studies of economic development with financial growth, the first group of NICs has been proved by many studies to show the close links and important roles of financial systems in economic development, in particular during the take-off periods, approximately during the 1970s and 1980s. But in recent decades, several serious economic recessions in this region are mainly due to significant shortcomings of the financial systems, the most significant being the 1997 Asian Financial Crisis. The question regarding the whether finance is good or bad for economic growth and development takes on an important dimension in these countries because they have both benefited and suffered from financial development. Another group of new powers in the developing world can be explained by the growing-up of several very large developing countries, as the countries of Brazil, India, China, Russia and South Africa. In these countries, the traditional real sectors (such as agriculture, manufacture and export) still exert major and important roles in macroeconomic development, and these influences from real sectors are more likely to be irreplaceable. Thus finance may play a different set of roles in these countries compared to small developing countries such as the NICs.

In this thesis, the normal method of panel study of much of the recent literature has not been conducted. Since inter-country variation in terms of data availability, structural factors and historical differences are quite large, pooling them into a panel

study would not be appropriate. We want to study each individual country separately in terms of the econometric relationship. However, the core issues of a comparative study is brought out by explicitly comparing the countries with each other within the afore-mentioned taxonomic framework. Time-series methodologies were used to consider both long-run relationships and short-run dynamics for the NICs. For BICS the relatively short developing periods suggest that it is much more efficient to conduct another time-series methodology of structural vector autoregressive model known as SVAR, which is broadly employed by researchers to investigate dynamic shocks and analysis. Since the BICS came into prominence, and showed dramatically high rates of growth, during the recent epoch of globalisation,

In summary, this thesis is composed of four original research chapters in terms of four research themes to show the macroeconomic interconnections between development and finance, as well as to consider the comparative impact of real investment and trading sectors in emerging economies. These four original chapters can be briefly described as: Theoretical Models; Structural Breaks for four NICs of Asia; Causations in Steady State and Dynamic Processes in these NICs; and, Studies for large Countries with Size Effects in BICS. We claim that for different groups of countries in the developing world, differentiated by size (small and large) it is necessary to emphasise the following issue for empirical studies: that the methodology for estimations would be different, due to different fundamental structural characteristics and some important ideas from development economics.

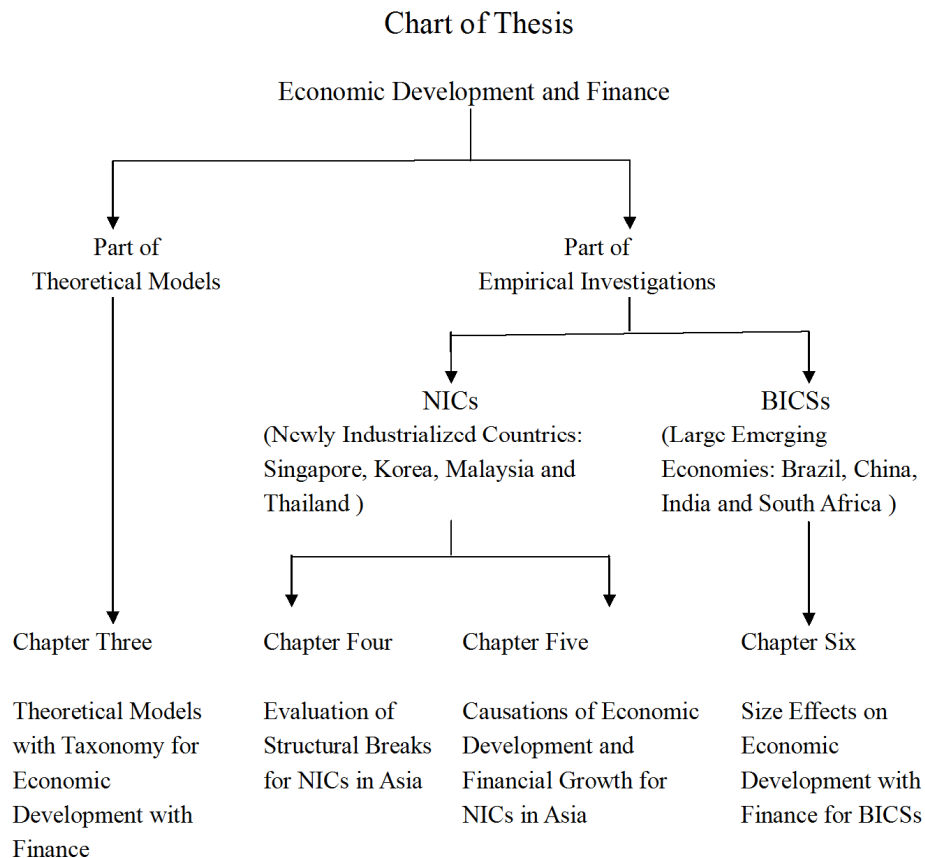
In the following chapter, we firstly provide the theoretical and empirical

surveys about economic development with financial growth in terms of various schools of thought in different periods. Chapter 3 develops three different growth models to theoretically establish the significant interconnections between the two conceptual issues, growth and finance; two of these models are based on endogenous growth framework and the third one based on growth being exogenously determined. The important roles of investment and trade are specified in the theoretical models, which provide theoretical support for the involvement of investment ratio in the empirical estimations. Chapter 4 begins the empirical estimations to support our hypothesis in the theoretical chapters, and this chapter investigates the existence of endogenous structural breaks for both economic development and financial growth in NICs of Asia. This chapter also evaluates the influence of fluctuations of these breaks in the process of economic development with investment, trade and finance. Chapter 5 uses advanced time-series methods to investigate the causations in both steady state and dynamic processes between development and finance for NICs in Asia. It also summarizes the empirical findings and provides a taxonomic analysis to explain the different kinds of causation, based on the VECM framework, for countries at various stages of economic development. Chapter 6 considers the influence of a country's size on economic development with finance, using the dynamic technique of SVAR to investigate the dynamics between finance and development in the group of BICS: Brazil, India, China, and South Africa. It also provides an interesting comparative study among the shocks from financial growth and the shocks from real sectors to economic outputs, based on the SVAR framework. A special characteristic of these

countries refers to the issue of a country's size; the costs and benefits of countries' sizes are also considered in the empirical analysis.

One important implication of our research on the BICS is that we can suggest that the efficient approach of dealing with the recent economic recession of 2008–2009 for these large developing countries is to strengthen real sectors, such as an increase in investment spending and reforms of trade policies, instead of helping financial sectors directly, whereas in the NICs of Asia the more efficient method is to help financial sectors directly due to the strong evidence of significant links between development and finance in these NICs.

Although this thesis is about financial development per se, a long-run phenomenon, it may be instructive to say a few words about financial crises and economic recessions, which are the short-run concepts and often signal the negative aspect of financial systems. Thus, a few significant aspects of both crucial financial crises are mentioned in this thesis: the current 2000s Global Economic Recession and the Asian financial crisis of the late 1990s. Implications for how to deal with financial crises are suggested in this thesis, in the concluding part, in view of different growth patterns and characteristics of economic development.



1.2 Historical Overview of the Literature: Economic Development with Finance

Over the twentieth century, a growing literature has shown that there is a positive and directly causal relationship between financial growth and economic development. Firstly, it is important to review some historical discussions of this view by economists, whose studies represent distinct views about the relationship between the growth of financial systems and steady state economic development. Schumpeter (1911) argues that a financial system plays an important role in economic development, and he mentioned the situation when financial institutions can sharply

motivate technological innovation and improve future economic growth by funding productive investment. Moreover, economic progress can be influenced by banks through their effect on the allocation of savings. In other words, banks have the right to decide and assign which firms may use society savings. Thus, the Schumpeterian view of finance and development highlights the impact of banks on technological innovation, as well as the growth of productivity. Bagehot (1873) argued that the financial system played a crucial role in 18th century England's industrialization through its effect on facilitating capital mobilization.

Robinson (1952) famously wrote, "...where enterprise leads, finance follows..."; her arguments concentrates on the importance of finance in determining the rate of economic growth, not in simply emerging as a necessary sideshow to technologically-driven growth. Furthermore, Robinson's arguments imply that financial development primarily follows economic growth and the engines of growth must be sought elsewhere. In terms of policy, if financial intermediaries exert an economically large requirement for growth, then this raises the degree of urgency attached to legal, regulatory, and policy reforms designed to promote financial development. The standard link between liquidity and economic development arises because some high-return projects require a long-run commitment of capital, but savers do not like to relinquish control of their savings for long-periods. Thus, the demand for financial services, consequent to initial economic growth, create the conditions for the development of financial systems.

According to David Levhari and Srinivasan (1969), high returns have

ambiguous influences on saving rates because of income and substitution effects, while lower level of uncertainty affected saving rates ambiguously. Accordingly, the saving rates may change (rise or fall) with an increase in liquidity caused by monetisation through financial development.

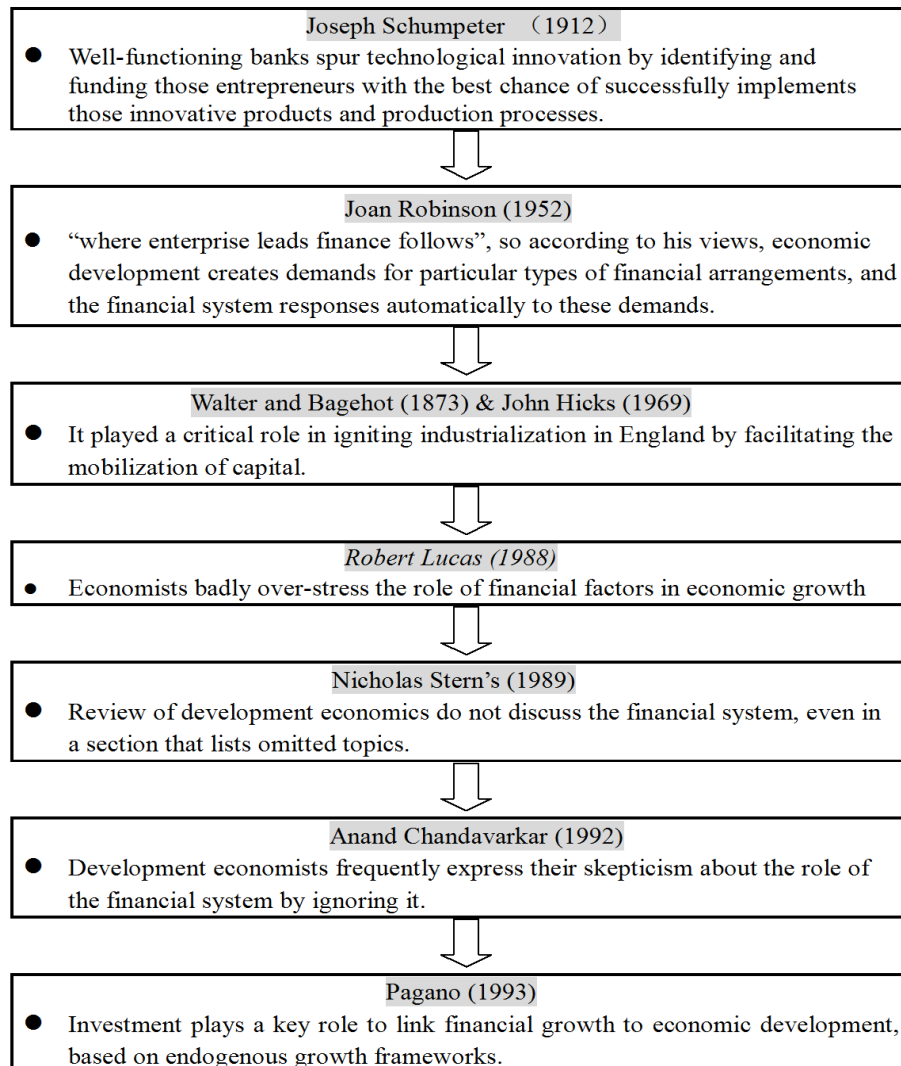
Hicks (1969) argues that the products manufactured during the first decades of the Industrial Revolution had been invented much earlier. So if the financial system does not augment the liquidity of long-term investments, less investment is likely to occur in the high-return projects. Therefore, according to Hicks (1969), the critical factor to promote the England's economy in 18th century relies much on capital liquidity, rather than solely depends on the innovations of technology. Actually, the products are invented too much earlier, but many existing products require a relatively long-term accumulation in capital.

McKinnon (1973) shows that financial development will promote the development of physical capital, raise the level of the saving ratio, and thereby accelerate economic growth. Many empirical studies such as Levine (1993) show also that most financial indicators are positively correlated with economic development. However, some economists hold the opposite view about financial growth and economic development, such as Lucas (1998). Lucas argued that the growth of financial systems was "badly over-stressed" in the process of economic development. Furthermore, One of most important comprehensive literatures is the study by Pagano (1993), King and Levine (2001, 2004), and they confirm a growth correlation with different indicators of financial sectors with cross-section estimation methods. Their

results are generally regarded as a robust finding. However, some problems involving in the empirical estimation still exist, especially on the importance of investment and efficiency (Pagano, 1993). In addition, Saint-Paul (1992) underlines the influence of risks from investment returns to technological choice. Agents in markets have to face the shocks resulting from the unexpected variation in demand, and if without financial markets, these shocks should be diversified through the technological flexibility and thereby less productive technologies. According to Saint-Paul (1992), the possible influences are underlined with reference to the discussion of technological specialization. In order to explain clearly, the following table provides a graphic description of historical studies about association between financial intermediation and resources allocation and mobilization.

Table 1.1

Historical Reviews



1.3 Transmission Channels from Financial Systems to Economic Development

In the theoretical part of this thesis, the financial-development nexus is discussed with reference to some theoretical surveys, in order to show that financial growth is an efficient input into the process of economic growth, changes in technology, and the accumulation of physical capital. Economic theory argues that the

financial system, including financial institution, financial instrument and financial market, can reduce the pernicious influence of transaction and information costs. The functions of financial systems need to be critically discussed also since it is the basis of the inherent connection between economic growth and financial development. Thus, this functional approach can be described as a way of evaluating the causality association between the structure of financial system, the services provided by financial systems, the productivity of financial system and finally its impact on economic development, economic growth and the rise in per capita income.

In the empirical part of the thesis, the core econometrics tests the impact of finance and growth as well as the causality entailed by the relationship. We take two sets of countries: NICS where financial development played a major role and BICS where finance was always secondary. Many developing countries failed to recognize the conditions needed to establish a complete financial system for themselves until the 1970s. In the 1960s, the financial sector was used only as a tool to help finance interventionist policies and those policies were made in the form of credit allocations directly from government. But the crisis from international debt obviously underlined the importance of a well-performing financial system in mobilizing internal resources. Therefore, during the last ten years, many developing countries have created many economic policies to liberalize financial growth. Moreover, most developing countries are involved in the process of structural adjustment, in order to correct the deficiencies resulting from their initial strategies of import substitution. This thesis seeks to evaluate and discuss the empirical experiences of developing countries using

an empirical model, which is based on an endogenous growth model. Actually, in recent decades, many developing countries have made amazing strides in economic development, and at the same time have developed efficient financial systems to provide good quality financial services. Moreover, it is believed that the growth of financial systems may have been the major source of economic development in some NICs, such as South Korea, Singapore, Malaysia and Thailand. In these countries, the financial sectors account for a greater weight in the whole economy, as well as employing more people. Due to the well-performing financial systems, these countries have become the most significant examples for other developing countries, since their financial experiences clearly provide a good guide to dealing with the role of the financial sector in economic development. Furthermore, these countries are trying out more far-reaching reforms of the financial sector in economic development, because most of them suffered under the Asian financial crisis in 1998, which started with Thailand's catastrophe in the financial system. This thesis examines the association between the growth of financial sectors and the roots of economic development in four Asian countries. The thesis will concentrate on the functions of the financial structure, monetary and financial policies, and the level of capital mobility in studying these economies.

The positive impact of financial development on economic growth depends on the core functions of the financial system, the transmission mechanism and the channels through which finance operates. This whole systemic structure can be classified under three broad categories:

- i) Uncertainty reduction and Risk management;
- ii) Reduction of Market Friction, Transaction cost and Information cost – all act similar to technological progress, indirectly increases productivity of the ‘real’ economy through positive externality and spin-off (The current discussion in the United States ‘Wall Street to Main Street’ emphasizes the negative impact of a similar process but in the opposite direction)
- iii) Direct productivity and growth effects via increases in quality and quantity of savings which in turn has a positive impact on domestic and foreign investment (such as FDI, FEI attracted by a developed financial system)

Levine (1998) emphasizes a number of specific functions of the financial system: reducing risk; allocating resources more efficiently; monitoring managers; exerting corporate control; mobilizing savings; facilitating exchange of goods and services through monetisation.

Thirlwall (2005) adds a new dimension by emphasizing the positive effect of a modern financial system in reducing the pernicious influence of the informal (‘curb’) money market charging usurious interest rate and stifling investment. All of these six functions can be categorized into the three broad systemic categories that we discussed earlier. All of these, except for the first, are basically methods by which productivity of physical and human capital can be enhanced either indirectly (see (2) above) or directly (see (3) above).

Our thesis concentrates on the broad categories (2) and (3), assuming in the process that financial development has a positive impact on development via

investment and growth. There is a pre-supposition in the theoretical literature (Dixit and Pindyck (1994) that the level of investment is related to uncertainty more than profitability alone and that financial systems can reduce risk, which may be the key factor in corporate finance, and thereby stimulate investment. However, in developing countries core investment (particularly sunk costs) is inevitably based on profitability of project (short-run and/or long-run), availability of finance (for example from the commercial banking system or development banks or even family finance) and the productivity of capital. In addition, financial development reduces the spread between the lending and the borrowing rate, reduces the impact of the curb or underground financial markets charging usurious rates of interest and limits the negative impact of the informal financial sector.

We now continue with describing a stylized picture of the transmission channels for economic development with important contributions from financial growth. This will explain the core mechanisms to answer the question of why financial systems cause growth.

From a traditional perspective, the most essential role of financial sectors in stimulating economic growth relates to notions of risk and uncertainty (see point (1) above). In terms of the Knightian understanding of uncertainty, the unpredictability of asset prices can be efficiently diminished by sound financial systems, as the probability of investment projects succeeding or failing is not known for households and savers. The costs of variation or deviations in asset price from their expected mean might lessen investments and thus weaken economic growth. A decrease in the

fluctuation of asset prices is likely to be beneficial in boosting the accumulation of assets, and therefore the development of financial systems can spur economic growth through helping to hedge, trade, pool and diversify risk. The main impact of diversifying risk is in short-term fluctuations. Yet, in developing countries these are of smaller order of magnitude. The constraints to investment growth arise from low and inefficient savings, either due to ceiling on interest rates or through public sector crowding out or to incomplete markets. Developing countries need initially to increase the average propensity to save, thus increasing the quality and quantity of savings before being concerned with issues at the margin – such as risk reduction. In parallel studies on exchange rates, decreases in variance of international asset prices increases the number of transactions, but the effects are of the second order. A similar story could be told for financial markets to assess the impact of diminishing variability of asset price. Our theoretical models therefore de-emphasise the role of risk/uncertainty in developing country situations.

As mentioned earlier, a second channel could be summarized as financial systems which help to boost economic growth through elimination of market frictions together with the correction of imperfect markets which create information costs. A well-developed financial institution can reduce those information costs for individual households. Furthermore, the processing of investment projects and fund gathering can be better performed by financial institutions instead of individual households. But it should be noted here that these institutional features vary across countries, which could be related to the structure of corporate governance. Moreover, when the

majority of large enterprises' shareholders are composed of banks, the regulation is normally easier than in cases of non-financial shareholding.

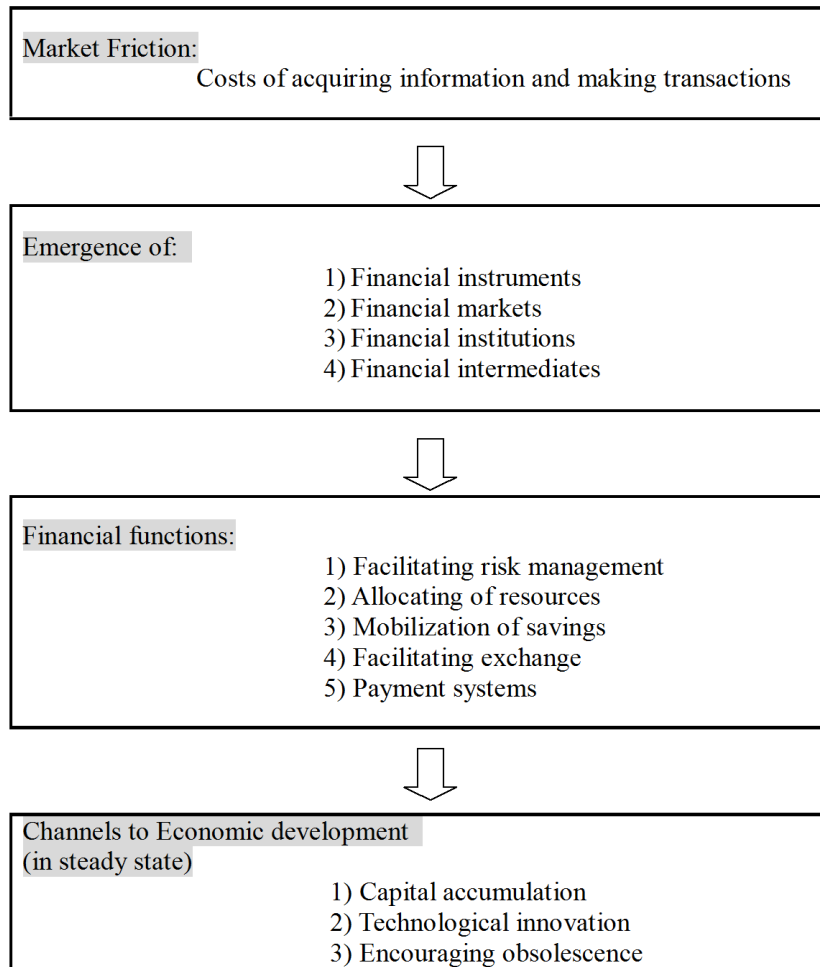
In summary, although financial systems have various implications in fostering economic growth, this thesis concentrates on the most important effects of a reduction in information and transaction costs as well as the implications of the existence of imperfect or incomplete markets. The existence of imperfect markets and frictions in trade and exchange must result in a string of transaction and information costs, and these costs can be diminished by the expansion of financial systems. Hence, decreases in these costs must foster economic growth through enhancing sectoral investments, which can be summarized as having three main implications:

- (i) when the transaction and information costs for investments in riskier assets are reduced, individual households would move toward these riskier assets involving higher returns, and therefore a higher growth level;
- (ii) when the transaction costs of borrowing are reduced, the proportions of liquid assets become much less necessary in financial markets;
- (iii) when transaction costs of trading assets are reduced in financial markets, the individuals, who have surplus funding but cannot invest rapidly, can lend this surplus money to others.

The stylized interpretations of these impact effect and systemic implications are represented in the following table.

Table 1.2

Picture of Transmissions Mechanism



Let us concentrate a bit more on the conceptual explanations of the broad functions of financial systems in relation to economic development, since this is a key element to understand the significant role of financial structures and systems in economic development and provide a theoretical foundation for further studies of empirical estimations in this thesis. At this stage, it is worth re-visiting the classical Arrow-Debreu model (1959). This model presents an interesting conclusion: *even if* information cost and transaction costs do not exist, one might think that it would be less useful for the financial system to promote economic development; yet, their

model argues that the financial system can still use resources in researching projects, facilitating the management of risks and improving the process of transaction and exchange (Debreu 1958) and increase efficiency and output. Thus, many economists believe that most economic theories about the financial system are adding specifics and reality to the canonical and abstract Arrow-Debreu model, therefore the Arrow-Debreu model can be as the theoretical basis for further studies about the financial system's functions. According to this view, the cost of obtaining information and making transaction are even more reason for the development of financial markets and institutions. Moreover, different types of information costs and transaction costs simply add to the efficacy of financial instruments, markets and institutions. On the basis of considering transaction and information costs, financial systems provide one of the most important functions in facilitating the allocation of resources over times and across countries (Bodie 1995).

Furthermore, there are a number of channels —the accumulation in capital and the innovation in technology—which can be related to the third category discussed earlier i.e. that causing direct productivity effects through savings mobilisation and the process by which the growth of financial systems may affect economic development. On the channel of capital accumulation, financial systems influence the long-term economic development through their affects on the accumulation rate in capital (Romer 1986; Rebelo 1992). And also a financial system can affect capital accumulation by reallocating available savings. The channel of technological innovation is concentrated on the new productive innovations and advances (Romer,

Howitt 1993), and then the functions of financial system influence the steady-state economic development by affecting the rate of technological innovation.

We now see that these three broad categories are quite general and we need to narrow them down and focus on specific functions. In order to explore the mechanisms of financial systems, this thesis separates the function into a number of individual parts: management of risks, allocation of resources, mobilization of savings, establishment of payment systems, and facilitating of exchange. These are systematically discussed in the next sections.

1.4 Discussions of Financial Functions on Economic Development

1.4.1 Functions of Facilitating Risk Management

It is generally believed that an important role of a financial system is to reduce the risk in trading and in pooling. This section is discussing about the financial systems approach for risk management. Here, there are two distinct types of risks: liquid and illiquid risks. For example, the liquidity of real estate is less than equities and therefore real estate has high liquidity risk. Liquidity risk arises due to the uncertainties in the process of converting assets into a medium of exchange. Liquidity risk could rise because of asymmetries of transaction and information costs, and financial markets and institutions will arise accordingly. Thus, we can define liquid markets as the markets which involve less uncertainty in settling the trading.

During the recent decades, the establishment of financial systems in response to liquidity risk has been always debated by economists, and the association of financial

systems and economic development has been evaluated in various ways. The first way is introduced by Diamond and Philip that is named as the *Seminal Model of Liquidity*. According to that model, savers in markets have the possibility of receiving shocks after choosing between liquid project (High return) and illiquid project (low return), and that risk can encourage more investment in the liquid (low return) projects. Supposed that it is expensive to receive a shock in this model, so that the insurance contracts need to be ruled out and financial markets will exist, where individuals can trade securities with higher confident level. Stock markets reduce liquidity risk by facilitating the trade and thus more projects will be invested with the high return. On the basis of above discussion, information costs, with which agents can verify whether other investors receive shocks, are the main cause for the emergence of the stock market. Moreover, it is noticed that trading costs are also able to highlight the significance of liquidity. But if this economic activity is expensive, production technologies will be less attractive due to its longer period. Therefore, liquidity affects the production decisions, which can be measured in trading costs in secondary financial market and thus greater liquidity will result in transferring to longer period and higher return technologies.

After the parts about liquidity risk, it in turn seeks to explore the association between financial intermediaries and the economic development. The definition of financial intermediaries is generally concluded as the combination of agents to provide financial services, and thus financial intermediaries can be used to strengthen liquidity, and also to reduce risk from liquidity. On the basis of the discussion in the

previous part, the Diamond-Dybvig Model assumes that it is not possible to make insurance contracts in the market, and thus savers can get liquid deposits from banks. Furthermore, the liquid risk can be reduced by a completed insurance provided by the bank, while the long-term investments could be facilitated in high return projects. By reducing liquidity risk, investment can be increased in the high-return projects, which normally is described as the liquidity asset; and then the economic growth will be promoted. But all of those studies about the functions of banks are based on the assumption of lack of state-contingent insurance contracts (Diamond-Dybvig Model). But this assumption simultaneously brings a problem about describing how a bank reduces liquidity risk. In other words, if there is a market of equity, agents in the market prefer to using equities and then nobody has incentive to use financial institutions.

After considering the main role of reducing the risk of liquidity, other risks associated with individual industries could also be reduced by an efficient financial system. Indeed, one primary role of financial markets is to provide services for diversifying and trading various risks. The ability of financial system to offer the service of risk diversifications can influence the process of economic development by changing allocation of resources and by arranging the saving rates. Therefore, financial markets tend to make portfolio investment shift to the higher-returns projects (Paul; Obstfeld).

The risk diversification not only has an effect on capital accumulation, but also makes changes of the technological innovative advances. Agents in the market are

trying to make technological advances to get profits for the innovators, and thereby successful innovation can improve the process of technological advances. The ability of holding a portfolio of innovation projects is able to reduce risk, and also investments are promoted in enhanced innovative activities. In conclusion, financial systems play an important role in facilitating technological advances and promoting economic development through their effects on improving risk diversification effectively.

1.4.2 Functions of Financial Systems and Allocation of Resources

In order to promote economic development, it is crucially important to allocate and mobilize sufficient resources for various investments and the quality of the allocation to different investments play a critically significant role on economic development.

Economists have identified various mechanisms to explain the positive influence of financial intermediation on the capital productivity. Actually the allocation of resources includes three important critical points that are associated with the establishment of financial institutions—the diversification of risks, the management of liquidity risks, and the evaluation of managers' skills in enterprises. But since the management of risks has been discussed in the previous subsection, this subsection will only concentrate on two parts. On the basis of these three factors, different economists present various arguments about the possible influence to the economic development. For example, Greenwood and Jovanovic contends that the influence on the growth is due to an increase in the resources invested in productive capital and an

improvement in productive efficiency. Here, there are two points needed to be known:

a) the returns on investment are associated not only with some risks in the productive process, but also with other risks associated with future product demand; b) all intermediation activities can be carried out either by banks or financial markets.

Therefore, the development of financial markets helps agents reduce those risks with the efficient diversification of their investments, and simultaneously choosing more productive technological advances. On the basis of this view, because of the higher level of opportunity costs involved in flexible technology, the development of financial markets becomes much more attractive for investors. The dualism way of technology is able to be described as an important method of diversification of technological risk, while productive risks can not be diversified in the modern sector effectively due to less-developed financial markers and intermediaries, including stock markets and banks.

The assessments will take place in the process of monitoring the various kinds of investments, and the costs of these assessments include fixed costs basically. Supposed those fixed costs are enough high, individual investors would be encouraged from conducting that research. Furthermore, this will result in an increase in the investment in bad risk projects and a decrease in the productive efficiency of investment, and thereby has negative influences on economy development. The emergence of those fixed costs can be described as an important incentive to found specialized financial institutions which is used to integrate the information on investments. If such information can be collected for an enough amount of investors,

financial intermediaries will spread the fixed cost among the whole participated investors. Therefore, investment projects are more productive and this has a positively critical influence on economic development accordingly.

There is another kind of view about the monitoring effect on financial intermediaries. Agents in markets have their own choices between two types of investment projects: the investment with high productivity but low risk; the investment with low productivity but high risk; the risky investment is constrained to the technological shock. Unless individual agents are able to spend more money in monitoring others, private investors can not normally observe the shock affecting their investment projects. On the basis of this view, the financial intermediation can also be described as a systematic network, which works to connect various individual investors and facilitate the diffusion of information on the return of individual investments, so that financial intermediaries are able to obtain information about the shocks to affect investments. In conclusion, there are two summarization points needed to understood in this subsection: a) Due to more informed breakdown of shocks, financial intermediaries can make investment go towards the invested projects with more yields and profits; b) agents can reduce the risks in private projects better due to monitoring the systematical shock and there will be an increase in resources allocation invested risky but productive investments. The results both accelerate economic growth, as well as promote the development of entire economies.

1.4.3 Functions of Mobilizations of Savings

Another important function of financial intermediaries and markets is concentrating how to mobilize available savings efficiently in an economy. Indeed, the emergence of financial systems and intermediaries provides an efficient way of mobilization and pooling of available savings, which can integrate existing financial resources from individuals to group investments. Actually more advanced technological innovations can be used in the process of production, which initially required a certainly higher level of investments. The mobilization includes some instruments, with which investors are able to keep diversified portfolios, then to spend more investments in efficient firms and to raise the degree of liquidity of financial assets. Therefore, mobilization has a definitely positive influence on the allocation of resources, by improving the diversification of risks and the size of firms. This means the financial intermediaries can offer investors the relatively higher expected returns in the process of resource integrations, which in turn results in an increase in capital productivity and also individual household can obtain the more profitable yields.

However, for every individual investor it must be very expensive to mobilize and pool the savings by himself due to much high cost involved in the process of the integration of resources. Among various costs, there are two most important costs to be studied here: a) costs of transaction, which come from pooling savings from every investor; b) costs of informational asymmetries, which make investors feel better to give up the control of their long-period savings. In facts, around the mid-1880s some bankers have already used some connections in Europe to increase capital overseas

for investments in the America, while other banks also attempted to find the connections with banks and entrepreneurs in the USA to start the steps of capital mobilization. At the same time, other banks also wanted to sell securities to individual households through some other methods—such as advertisement. Furthermore, financial intermediaries are generally required to have a good reputation, and then savers will feel comfortable about consigning their savings in the banks , since agents of conducting the mobilization have to tell the investors with the rationalization of investments. Although many transaction and information costs have to be suffered under the process of the saving mobilization, there are various financial policies to solve these frictions and to improve the ability of pooling. For example, numerous multiple contracts are made in the mobilization, and these contracts take place between productive units and agents with surplus resources. The joint stock company shows us an example of multiple mobilization, with which a new legal entity—the firm—can be invested by many individuals. Also pooling might take place here with intermediaries, and here many investors consign their money in intermediaries which invest in firms .

The efficient mobilization and pooling of savings not only have effects on the accumulation in capital, but also have positive influences on improving the allocation of resources, as well as creating the innovation of technological advances. When financial systems are more effective at pooling the savings from individuals, they can deeply influence economic development. In addition, the development of financial intermediation can lead to releasing the constraint of liquidity, which agents in the

economy have to face when planning their consumption through the life. Consequently, when liquidity constraints could be released, the savings rate will fall down. This positive relationship between the liquidity constraints and the saving rate has been empirically evaluated by Jappelli and Pagano with a case study of OECD member countries. But here we have to underline an important assumption, since any discussions of the liquidity constraint on the economic development are based on that consumption: productivity gains are only connected to externalities in the accumulation of physical capital. However, if the liquidity constraint leads to the encouragement of savings, the negative effects will exist on economic growth. This situation occurs if growth arises from the accumulation in human capital instead of only in physical capital, since the probability of individual borrowing in the time of schooling would be reduced. Therefore, through the affects of externalities, the emergence of liquidity constraints, based on the less-developed financial system, can make the choice of a low equilibrium with weak growth, and thereby a trap of poverty correspondingly.

1.4.4 Functions of Being Payments System

Another significant distribution of financial systems to economic development comes from the establishment of an efficient and adaptable payment system. That means the influence from a financial system to the economic development can be discussed with reference to a well-performing payment system in the financial markets. Empirically, a creditable means of exchange is a necessary condition to promote the economic

development. If the payment system is now assumed not to exist, the transaction costs may offset some gains in productivity, which is linked to the division and the beginning of partial economic growth. And payment systems can interactively adapt with the process of economic development. Here, the definition of economic development does not only imply the sustained productivity gain, but it also mean a maintained opening up of new markets and an efficient diversification of products. All of these economic activities lead to the more exchanges, which will make an economy more complicated. Then, there will be a growing demand of monetization, which should be necessary for sustaining the economic growth. Finally, there will be long-term trend towards a reduction in the money velocity and this conclusion been confirmed by many experiences from most developing countries.

Furthermore, it is necessary to mention the need to reduce the opportunity cost of keeping money, which brings a stable movement trend of payment systems towards credit connections supervised by financial intermediaries, and this trend might be strengthened by the process of technological advances. But these technological advances can not only reduce the information costs that are linked to credits, but also they are easily able to make modernistic financial assets substitutable for conventional financial assets. That is initially shown by a long-term increase in the ratio of financial activities to entire GDP, and also working population in financial sectors is increasing sharply correspondingly, and thereby that will have a critically positive influence on the economic development. However, this fall seems to be confirmed by the wide money aggregates and the notion of wide money aggregates includes more

complex kinds of financial assets, whose high cost implies that they only become accessible beyond a certain level of economic development. Actually, the positive relationship between real GDP and the ratio of the financial assets to GDP (traditional expression of monetization) was discussed and highlighted in initial studies on financial growth and economic development.

1.4.5 Conclusion

The above discussions have illustrated a functioning approach of the main functions of a financial system associated with economic development. But it seems to be too narrow a focus to evaluate the influence on economic development from every separate function, so that many economists encourage various functions into an integrated understanding of the functions of a financial system to help economic development. Actually it is better way to study the financial system functions with the integration of the different individual functions. In fact, by identifying the individual functions performed by the financial system, the functional approach can motivate a more complete understanding of relationship between financial growth and economic development. There were some good studies provided by earlier economists to evaluate the associations between finance and development. For example, Schumpeter (1912) explores a board explanation of the roles of a financial system on economic development. It looks like Smith (1776) uses the key factor to explain the importance of the process of specialization. Schumpeter uses the ties between firms and banks to explore the significance of the financial system on adopting the technological advance

and innovation. McKinnon underlined the significance about facilitating the use of the efficient agricultural techniques. Consequently, all economists believe that it is necessary to integrate all individual roles into a simple way about how the financial system affects economic development as a whole. Moreover, all of individual functions of financial system on economic growth must be interactively discussed and most economic activities should include the interaction of individual roles, rather than considering only one function solely.

Table 1.3

Economic Development and Financial Institutions

Possible Influences on the rate of Growth		Increase in resources invested in productive capital	Technological specialization	Elimination of Premature Liquidation of Capital	Increase in Productive efficiency
Factors Leading to the setting up of financial institutions	Diversification of Risks (productivity or demand shocks)	Levine (1991) Levine (1992a) Obstfeld (1994) Greenwood and Jovanovic (1990)	Saint-Paul (1992)		
	Management of Liquidity risk	Bencivenga and Smith (1991) Levine (1991) Levine (1992a)		Levine (1991)	
	Evaluation of Projects and entrepreneurs				King and Levine(1993a) Greenwood and Jovanovic (1990) Levine (1992a)

Chapter Two

Economic Development with Finance: A Literature Review for Theoretical and Empirical Studies

2.1 Introduction

The roles of financial sectors in economic development have been debated for nearly a century. Schumpeter (1911) is generally recognized to be the first economist to discuss the arguments. He was followed by Gerschenkron (1962), Patrick (1966), and Goldsmith (1966), as they expressed the significant role of financial sectors through either theoretical or empirical routes. The following literature, in the early 1970s, concentrated on the repression of financial systems, whereas most theories are based on the studies of Keynes (1936) and Tobin (1965).

McKinnon (1973) and Shaw (1973) disputed some policies of financial repression. Both of them stressed the significant effects of financial systems in the process of economic development through increasing savings and then creating incentives. According to the McKinnon–Shaw’s theories, if governments wanted more investment and savings, the ceilings for interest rates must be abolished and governments were therefore advised to take more inflationary monetary policies. Actually, many developing countries who implemented McKinnon–Shaw’s financial policies achieved remarkable growth rates of economic development; but these coincided with shortcomings, particularly in the volatile real value of interest rates in some excessive growth nations.

As many rapidly growing countries encountered economic recessions in the early 1980s, the McKinnon–Shaw models were criticized by some advanced economists, such as neo-structuralists. They believed that financial liberalization could decelerate the growth rate of economic development. Joseph (1989) argued that financial liberalization led to failures of financial markets.

In recent years, the endogenous growth models are generally acknowledged to analyse the causations between financial sectors and economic development, which are regarded as a completely different route for theories of financial development. The endogenous growth theories hold an obviously different idea from the neo-structuralists in the 1980s, as the positive causations are detected and certified with endogenous growth theories. The theories are extended and augmented by economists from the 1990s to explain the financial–economic growth nexus; the workings by King and Levine (1993, 1997) and Pagano (1993, 1998) are mentioned in this thesis. The details of endogenous growth theories for economic development with financial growth will be the focus for study in this thesis.

2.2 The Forerunners for Growth and Finance: Schumpeter to Tobin

The pioneers in the relationships between economic development and finance are academically acknowledged as Keynesianism economists. These Keynesianists' arguments in favour of financial repression have dominated the academic debate for many years. In fact, the theories before the 1960s, approximately from the 1930s to the end of World War II, indicated that the development of financial systems followed

from economic growth, but not vice versa. Gerschenkron's theories linked the functions of the financial sectors, mainly represented by banking sectors, to the context of "economic backwardness". His view was that the growth degree of the banking system in an economy relied on its economic development in the initial stages of industrialization. For example, at the start of industrialization in England, an active banking sector was not necessary, as investment was too small to need much capital. But for Germany, the financial sectors provided a sufficient amount of capital to support industrialization, as technology was in such a high level of industrialization that investment had to be on a large scale.

Following the ideas proposed by Gerschenkron, Patrick studied the relatively specialized question of the causality between economic development and financial growth. The most important contribution to development with finance he identified as having two patterns: the "supply-leading pattern" and the "demand-following pattern", also relating them to their specific economic development stages. The first supply-leading pattern mainly exists in the early stages of economic development, or in the less-developed countries; and the second demand-leading pattern exists at more advanced stages of economic development. Thus, the causality runs from finance to economic growth initially, and the following pattern is expected to run from growth to finance.

In the supply-leading pattern, financial sectors induce growth through channelling savings from dispersed savers into relatively large investors, and then financial intermediation could transfer resources from traditional sectors to modern

ones in order to promote industrialized production. In the demand-following pattern, the need for financial services is created because of economic development. The demands for external funds are increased as a rapid growth of macroeconomic aggregates. As the economic growth leads to too much variance across the sectors, more financial services are demanded to transfer savings from savers to the lenders. Patrick (1996) proved his idea with empirically testable investigations.

The argument for both growth-inducing and growth-induced financial systems, mainly represented as banks, was initially announced by Rondo Cameron, while his studies show the significant function of the quality of financial services, as well their efficiency. In terms of Cameron's ideas, financial sectors can transfer dispersed and small money from savers to investors that have entrepreneurial skills, so that the availability of funds for investors can be efficiently increased through financial intermediation.

In the meantime, the incentives for investors can be enhanced by financial systems. The dispersion ranges of interest rates can be reduced by expanding financial sectors and enhancing financial services. Cameron also argued that the technological process can be promoted through the growth of financial systems. Technical innovations can be introduced through the establishment of firms to access the financial systems. Based on above ideas, Cameron also provided the empirical investigations to study interactions of economic development and finance in the successful industrialized countries in the 19th century, such as Japan, England, France, Germany and Russia.

The positive impacts from the development of financial sectors on economic growth were pronounced by Goldsmith. The argument concentrated on the dual approach of increasing amounts of investment and raising efficiency levels. Goldsmith is acknowledged to be the first academic to reveal the significant empirical evidence regarding the interrelationship between economic growth and finance with a cross-countries study.

In summary, the studies by Gerschenkron, Patrick, Cameron and Goldsmith represent the academic pioneer debates about interactions between economic development and finance for either developing or developed countries before the emergences of arguments based on the MacKinnon–Shaw school in the 1970s. The main criticism of their ideas is that they are relatively unsophisticated and the empirical evidences are too rough, but they created interest in the field of economic development with financial growth.

2.3 The McKinnon–Shaw School for Growth and Finance: the 1970s

The code ideas for studies of growth and finance in the McKinnon–Shaw school refer to the financial liberalization and financial repression in the 1970s. At this time either Ronald McKinnon or Edward Shaw announced the dominant arguments to explain the interrelationships between economic development and financial growth; this became known as the McKinnon–Shaw school. Contradicting the ideas of Tobin and Keynes, the arguments of the McKinnon–Shaw school were for the approval of liberalization of interest rates and the abolition of other indicators for financial repression policies.

The basic theoretical framework for the McKinnon–Shaw school involves three important agents: financial intermediation, risk-reverse savers and risk-preferred investors, and their models are normally money-inside models, as credits to private sectors are backed through the internal debt from private sectors. According to the McKinnon–Shaw school, the functions for investments are negatively linked with real term interest rates and positively linked with the functions of savings with real interest rates. The amounts of investments can be decreased as inflation rates increase. In fact, there is another idea about effects of inflation: when land ownership can hedge the inflation rate, the demand for land can be stimulated by a decrease in the real term interest rate as deposits are less attractive for individuals, and then more individuals are willing to shift deposits from banks into land ownership. These shifts will drive up land prices faster than the normal level, which could result in an increase in consumption and thus a decrease in investment.

In fact, financial repression emerges because of a nominal term of interest rate below the market clearing value and, accordingly, there could be two possible situations in an economy. If there is only a fixed saving rate, a large gap is highly likely to exist between deposit and loan rates. But for developing countries, the more realistic situation is the simultaneous existence of both fixed lending and deposit rates. The allocation of credits should rely on various criteria, such as quality of collateral, transaction costs, loan size and reputation. The efficiency of the investment can be reduced as lower-return investments normally become profitable after setting the lending rates at a low enough level. The credit allocation could be subject to

randomness as another important distortion factor. The policies suggested by the McKinnon–Shaw school are therefore to abolish institutional restrictions in nominal terms for interest rates and thereby, to reduce inflation rates.

Although the arguments from McKinnon and Shaw come to many common conclusions in the field of economics, which led to it being named the McKinnon–Shaw school, there are still some important differences between the ideas from McKinnon’s and Shaw’s models. The McKinnon model concentrates on the assumptions that an economy is constrained to self-finance, and investments involve many important indivisibilities. So the differences between individual savers and investors are relatively less, and may even be ignored. For an investor, the capital-accumulation stages are necessary for further investments, for example accumulating savings and other financial assets. Therefore, the investor is the individual saver at the same time. Thus, in McKinnon’s model, there exists an intertemporal complementarity of deposits and physical capital. The McKinnon model is classed as an outside-money approach to a growth–finance model, whereas Shaw’s model is an inside-money approach. The Shaw model doesn’t involve the proportions of McKinnon’s model, and thus there is no need for complementarity, as investors are not required to be self-financed.

The main functions of financial intermediation, in Shaw’s model, are to sustain the level of deposit accumulation through increasing real-term returns to individual savers and, accordingly, to expand their lending ranges. Moreover, financial intermediations could reduce real costs to investors by various methods, like

economies of scale in lending, improved efficiency, lowering information costs and risk diversification.

The complementary view by McKinnon and the debt-intermediation hypothesis by Shaw do not contradict each other, as investment should be financed by both internal and external factors simultaneously. The model by Shaw is more suitable for advanced or industrialized economies, whereas the McKinnon studies refer more to developing or emerging economies, as Shaw's model contains relatively complex financial systems.

A number of studies following the McKinnon–Shaw arguments extended various specific approaches. The formal macroeconomic models were developed by Kapur, Galbis and Fry, where financial repression is utilized by governments and its authorities to restrict the deposit rate below its market clearing value. The demand for real money can be reduced through an increase in the inflation rate, and therefore the demand for money rests on the fixed nominal interest rate and then inflation.

According to the model by Mathieson and Kapur regarding financial repression, if the restricted ceilings for interest rates are relaxed, the same effect can be achieved by reserve requirements. Supporting the existence of zero-inflation, a ceiling for the deposit rates must be set by a fixed reserve ratio. The gaps between lending and deposit rates will be larger as inflation increases. In the views of these models, the economic policy means reduced reserve requirements at a given inflation rate which increases the lending abilities of the financial systems. Galbis introduced a two-sector model based on the Harrod–Domar model: financial repression results in the joint

existence of a traditional sector involving a low constant rate of returns to capital and a modern sector with higher returns. The relatively lower rate for deposits causes a high proportion of self-financed investments in the traditional sector. An increase in the deposit rate results in more demand for money and therefore a higher amount of investment is allowed in this model, mainly financed by bank loans. This important change in the composition of investment enhances the efficiency of investment.

The dynamic models were developed by Kapur, Mathieson and Fry to allow the capability of illustrating the impact of liberalization of interest rates as an approach for macroeconomic stabilization policies. According to their studies, we can conclude that liberalization of the interest rate involves a double advantage: (i) exerting a positive influence on long-run economic growth; (ii) reducing the contractionary effects from stabilization programmes of monetary policies.

2.4 The Critical School of Financial Liberalization: the 1980s

The first important school about growth and finance after McKinnon–Shaw school is the Neo-structuralist School, which concentrates on the critiques of financial deregulation in terms of macroeconomic stabilizations. Taylor (1983) combined the studies of the Neo-structuralist School into two main arguments, and in particular developed one specific model for emerging economics. Firstly, according to Taylor's model, unorganized financial markets have some important impacts in determining whether financial liberalization is able to boost economic growth or not. As an increase in the real term of interest rates for deposits results in a transfer of financial

assets from the credit market, the requirements for financial intermediations will be declined due to the existence of reserve requirements, and in the unorganized money market these requirements for reserve do not exist. Furthermore, the extent of the contractionary impacts on the supply of credits relies on the degree to which financial assets are substituted out of the curb market or out of inflation hedges. The other argument concluded by Taylor talks about cost-push inflation resulting from higher interest rates, leading to a collapse of effective demand. In fact, this argument is always valid, even if financial systems do not shrink, since the propensity to save can be increased to weaken effective demand. There are several important assumptions to support the Neo-structuralist School's arguments: the first is that unorganized money markets are in the status of perfect competition; the second is that the aggregate amount of investment is considered instead of investment efficiency.

Another issue for the critical school of financial liberalization is the microeconomic underpinnings of macroeconomic policies. The studies by Weiss and Stiglitz (1981) indicate that the disequilibria in the credit market might have causes instead of interventions by governments. According to their arguments, the nature of the transaction might be affected by the price of credit, and would result in a no-clearing market. The interest rate in a highly clearing market might be very attractive for bad borrowers, and could result in encouragement for more investors to prefer relatively higher risk investment projects, and hence there is a greater possibility that borrowers will default. The level of interest rate is less likely to be increased by banking sectors to its market clearing level. Consequently, credit

rationing takes place only if a large amount of lending is allocated. In view of the microeconomic level, these adverse results are because of the shortcomings of a free credit market.

Mankiw (1986) presents a model about financial collapse, where some small changes in interest rate could alter the riskiness of groups of lenders. If the lending applicants are too risky to provide financial intermediations for their expected returns, a free credit market is more likely to collapse. An extreme outcome would be a serious financial crisis.

Stiglitz (1985) and Shleifer (1986) investigated the principal-agent problems, in which they proposed that it may not pay any of them to monitor the management of a corporation with a small number of investors. Another group of the studies referred to market failure, presenting the issues of asymmetric information involved in credit markets, which may result in banks emerging due to this asymmetric information between savers and lenders. According to ideas of costly verification by Diamond (1984), banking sectors can examine the success or failure of investment projects only with a relatively lower cost for monitoring. Information asymmetries cause problems of capital misallocation and monitoring costs, which could lead to equilibrium credit rationing, even without the emergence of other market failures. Referring to insurance markets, moral hazard is an important issue for economic development and financial intermediations. According to Pyle's studies (1991), implementing more stringent capital requirements with deposit insurance might cause an increase in asset risk.

2.5 Endogenous Growth and Finance: the late 1980s and 1990s

Studies about economic development with financial growth have become a more realistic, comprehensive and scientific, following the pioneering work in the 1970s, the McKinnon–Shaw school in 1970s, and the Critical-School of Financial Liberalization in 1980s. The core ideas of theoretical studies after the late 1980s, in particular in 1990s, are mainly about investigating the relationships between long-run economic development and financial growth in terms of endogenous growth frameworks, and this school can be presented as the endogenous growth and finance school.

The principle question is whether financial development can support sustained economic growth, denoted mainly as per capita outputs or incomes, and moreover the core idea is that finance has external effects on the efficiency of the total investments in an economy. According to the endogenous growth and finance school, the decrease of marginal product of capital (MPK), due to diminishing returns to scale (DRS), can be offset by the development of financial sectors. For some studies about industrialized countries, the stock market is considered exclusively, whereas there are fewer studies about stock markets for developing economies.

Most of these studies with endogenous growth models are basically from the AK type models, which are discussed in more detail in the following theoretical chapter in this thesis. The first published argument for endogenous growth and finance school is normally acknowledged to be the model by Bencivenga and Smith (1991), in which

existing savings can be invested in more productive projects when investors can be allowed to shift their assets to more liquid and growth-enhancing products. Investors therefore meet their future liquidity requirements due to uncertainty, which implies that individual investors can have two types of assets: liquid assets and illiquid assets. The liquid assets are safe but less productive, whereas illiquid assets are more productive but also riskier. The emergence of financial agents, such as financial intermediaries, adjusts the investments towards more risky and highly productive assets, thus boosting economic growth. As individual investors have future liquidity requirements, financial intermediaries such as banks face the predictable demands of liquid from their savers due to the regulations of large amounts. Hence banks are able to allocate investment funds efficiently, and then individuals are no longer required to face liquid investment projects due to the existence of financial intermediaries. In a similar vein to the above arguments, Starr and Smith (1995) say that the liquid risk can be reduced by financial institutions reducing the number of distinctive investment projects in long run.

Another group of studies with endogenous growth models refers to the possibility of reciprocal relationships between economic development and finance, involving some discussions of multiple equilibrium points and poverty traps. According to endogenous models created by Greenwood and Jovanovic (1990), a positive bi-direction is presented between economic development and financial growth: (a) one of the most important functions of financial intermediaries is to collect and analyse information in order to explore some investments with highest

returns and profits. Existing funds can be channelled by financial intermediaries into more productive projects, and hence raise the efficiency of investments and then boost economic growth; (b) economic development provides the implements to develop costly financial structures.

Saint-Paul (1992) developed a model which involved the effects of financial growth on technological choices and labour markets. There is a choice of two technologies for each individual in this model: the first technology involves low productivity but allows for diversification; the second is more productive and specialized. In the case without financial markets, risk-averse agents prefer technological flexibility rather than high productivity. The financial institutions allow agents to have a diversified portfolio to ensure that individuals are protected against the negative shocks of demand. This will result in a greater division of labour markets.

The possible existence of multiple equilibrium points is one of the most important characteristics in endogenous growth theories. This is considered jointly with financial development in the Saint-Paul model (1992). At low equilibrium points, financial institutions are less developed and hence individuals choose to be less productive but less rigid, while there are fewer incentives to develop financial institutions. This economy is more likely to be trapped in a less developed state. At higher equilibrium points, financial institutions are relatively highly developed, technology is riskier, being specialized and so less flexible. As a result, the more advanced financial markets are required to boost growth. Moreover, some similar

studies refer to multiple growth paths, as well as conditional convergence across different countries. It should be noted that notions of convergence are another important characteristic for endogenous growth frameworks.

Another type of endogenous growth–finance model is presented by Berthélemy and Varoudakis (1996) through the means of learning-by-doing, in which the positive effects of financial systems increase capital efficiency, and accordingly enhance economic development through volume savings. This model focuses on explanations of two-ways causality between economic development and finance. Firstly the savings can be channelled into more productive projects through collecting and studying the information on financial systems. On the other hand, the development of real sectors, like manufacturing and agriculture, helps to increase the volume of savings. The expansion of financial sectors results in higher technical efficiency through learning-by-doing in the financial markets (Varoudakis, 1996). Furthermore, it is highly possible that poverty traps will emerge because of insufficient development of financial systems.

A Schumpeterian school for growth and finance is argued by King and Levine (1993a, 1993b) through the means of technological process, which are similar with studies by Romer (1990), and Grossman and Helpman (1991). Some specific entrepreneurs are encouraged to foster more innovative activities by financial intermediaries and markets, with which the growth can be enhanced through productivity enhancements. These encouragements work through several main functions of financial systems, such as diversifying risks, pooling resources and so on.

It is not difficult to believe that advanced financial systems are more likely to increase the possibility of successful innovative activities. The functions of financial systems in this thesis mainly refer to the studies by Levine (1993, 1997), which are presented in another section in this thesis. Transmission channels between economic development and finance are discussed and presented in another section in this thesis.

Government interventions are considered in the growth–finance models by Roubini and Sala-i-Martin (1992) through the credit market or failure of markets, and these government interventions are regarded as a new idea in endogenous growth theories (Roubini, 1992). For example, financial repressions are evaluated with the absence of diminishing returns of scale in the endogenous growth theories. In this model, governments could opt for economic policies of financial repression as they generate easy inflationary revenues. Financial repression can cause individuals to conduct a large supply of nominal money which is important for inflation tax. With the presence of high income tax, governments can repress financial systems to increase inflation levels and then growth could be decreased in terms of the negative influences of financial repression on the productivity of capital and amount of savings.

A different model announced by Mattesini (1996) shows that the credit market is enabled to be characterized due to asymmetric information based on an overlapping generation theoretical framework. The ability to monitoring costs of financial intermediaries is regarded as one dominated factor for boosting economic growth, and actually the monitoring of costs by financial institutions is acknowledged as a good

indicator of the efficiency of financial systems. The indicator of monitoring costs is approximated through the gap between borrowing and lending rates for the following empirical studies. Economic growth would be reduced by high monitoring costs, which means there is a negative relationship between this gap and economic development. The models by Bencivenga and Smith (1993) are worth discussing here, as this model involves credit rationing that jointly determines the economic growth but adversely influences economic development.

The last points from the development-finance school in the 1990s are about the existence of stock markets in the growth theories. These studies are normally efficient in industrialized countries, and less important in developing economies. The main reason to separate discussing these studies with stock markets is that the stock markets normally yield different results from classical discussions about economic development with financial intermediaries or institutions. Atje and Jovanovic (1993) present a model which applies the endogenous models to stock markets. The main function of stock markets is to insure investors against bad externalities of idiosyncratic risks, as well as to help investors gain more information about investment projects and so reduce the risk. Levine (1991) also develops a simple model, based on his previous studies of endogenous growth theories, where a stock market can boost economic growth through two means: liquid risk is reduced as well as productivity risk. The support in the case without stock markets is that risk-averse investors may be prohibited from investing in a firm due to productivity fluctuations. Investors can efficiently use stock markets to reduce the risks by allowing them to

hold more diversified investment portfolios. On the other hand, liquid fluctuations may require individuals to sell their assets with a low returns. As ownership can be transferred more easily, the stock markets can reduce the risks. This decrease in liquidation risks allow firms to make more investments and hence to accelerate economic growth. This study also indicates that high tax for financial markets has significant negative impacts on long-run economic development.

The most important feature of studies on endogenous growth models is that an increase in the growth rate of economic development can be sustained, which implies that the rate of technological progress can be endogenously determined within the estimated models, whereas McKinnon–Shaw’s school is only thinking of short-term growth of economic development, depending only on physical capital accumulations. Based on much literature about endogenous growth theories, the main functions of financial systems to cultivate capital accumulation and promote productive growth can be summarized as following points: (a) financial systems are able to facilitate the diversifying, hedging, pooling of risks, and trading; (b) financial systems can help society allocate resources efficiently; (c) financial systems can monitor managers and controls independently; (d) savings can be mobilized efficiently by financial intermediation and agents; (e) the exchange of goods and services can be facilitated by financial systems (Levine, 1993, 1997 & 2004).

2.6 Empirical Studies of Causality between Growth and Finance

Empirical results to evaluate the finance–growth nexus are always ambiguous, but most literature in recent decades, especially for studies with developing nations, exhibits a positive relationship between economic growth and some indicators of financial sector development. The first literature to present this positive correlation was from Goldsmith (1969), and McKinnon and Shaw (1973). Among these early studies, there are still some empirical estimation problems, such as the causality relationships for them, the roles of the investment and so on.

The empirical studies for economic development with financial growth normally attempt to answer two questions: firstly, what directions of causality can be detected or what is the dominant direction; secondly, what specific types of financial institutions can promote growth in specific countries.

Goldsmith (1969) roughly investigated the interrelationships between economic development and financial sectors in the period 1860 to 1963 with a sample of 35 economies; however Goldsmith's studies were only able to provide some unclear results. The studies by King and Levine (1993a, 1993b, 1997) showed much stronger evidence: a large scope of financial indicators is significantly associated with capital accumulations and the growth of productivity, and therefore economic growth. Their studies indicated that there exists a spread between high-income countries and low-income countries, and this spread can become wide with an increase in the size of the financial intermediaries.

Two of most important comprehensive studies are by King and Levine (1993a), and Renelt and Levine (1991). These confirm a growth correlation with different indicators of financial sectors with a cross-section estimation method. Their results are generally regarded as robust. However, some problems involving the empirical estimation still exist, especially the importance of investment and efficiency (Pagano, 1993). In most literature, only aggregate indicators in the financial sector are employed to present the financial development, such as money stock or domestic bank credits. But those indicators are argued to be more a unilateral position. Levine (1993) attempts to use more comprehensive measurements for financial systems, such as private credits to total credits, or private bank claims to total claims. Jovanovic (1992) researched the correlation between economic growth and financial development with a consideration of trading volume. Jappelli (1992) exposed a significant correlation between economic growth and household lending with the indicator of consumer credit to GDP.

With the use of convergence tests to investigate potential poverty traps, Berthélemy and Varoudakis (1995) concluded that educational attainment is a priority factor in the estimations. However, financial systems might also lead to multiple equilibria. Their studies also indicate that sufficient amount of human capital can sustain economic development. In terms of Ram's study (1999), a positive interrelationship between financial growth and economic development is only investigated in high growth countries.

Benhabib and Spiegel (2000) conducted a study for four Latin American and South East Asian countries over the period of 1965–1985. Their study involved a very

special characteristic: specific indicators of financial growth, linked with specific factors of macroeconomic development. Fattouh (2002) presented a study to show that financial depth is only positively associated with economic development in the group of high-income countries.

2.7 Empirical Studies about Causality and Links with Different Stages

As in our previous analyses, there is a core question in Patrick's theories (1966): what are the directions of impacts for economic development and financial growth, and whether these directions depend on stages of economic development. Many empirical studies have investigated these questions for more than 40 years; even today our empirical studies continue to discuss this interesting question.

Odedokun (1996) used a sample of 71 developing countries to span the 1960s to 1980s so as to study the information of causality. His results strongly supported the hypothesis of impacts of direction from financial growth to economic development. Based on the methodology of time-series, Odedokun concluded that financial sectors accelerated economic growth for nearly 90 per cent of the population of whole countries. At the same time, financial systems have the same effects: boosting economic growth in other real sectors, like expanding trade, increasing capital ratio and developing labour markets. Finally, Odedokun's study found growth-boosting impacts of financial systems in developing countries with low income.

An important study about developing countries was presented by Demetriades

and Hussein (1996), which used causality tests to detect the possible causations with 16 developing economies. There is little evidence to support the hypothesis that financial systems play a remarkable role in economic development, but more support for the opposite direction of impacts, i.e. from economic development to financial growth. The second important implication in their study is that causality directions vary across different nations, which means a requirement for empirical studies and more detailed time-series study. Khan's study (1999) involved the vector autoregressive models with ten developing countries, which suggested strong evidence for bi-directional causality for all countries.

A study involving five industrialized countries was presented by Rousseau and Wachtel (1998), which suggested that from 1870 to 1929 the UK, the USA, Canada, Sweden and Norway experienced a rapid-growth stage of industrialization that was mainly driven by the development of financial systems. In their studies, the advanced time-series methods of vector error correction models are used to detect a leading role of indicators for financial growth on real sector economic activities in the absence of important feedback influences. The study with US data across the period 1965 to 1995 by Sussman, Harrison and Zeira (1999) suggested that there was evidence to show the feedback impacts of financial growth and economic development in developed countries. They mean that economic growth can reduce the costs of financial intermediations through attracting new entrants to financial markets and decreasing costs of monitoring, as well as enhancing specialization, and then investment and growth are promoted finally.

2.8 Contemporary Time-series Studies

The empirical studies for the finance–growth nexus are mainly composed of several approaches: time-series studies, panel studies, comparative studies, micro firm-level studies and so on. There are always some debates about the advantages and shortcomings for these distinctive methods, as well as which methods are more efficiently used to support various theories. Since the endogenous growth theories are more acknowledged as being the theoretical frameworks, time-series studies have been broadly employed to investigate the relationships between economic development and financial growth since the late 1980s. Another important reason to use time-series studies broadly is the relatively complete time-series data provided by World Bank and IMF. On top of that, time-series technology has been developed and time-series models therefore become more realistic, efficient and acceptable.

The time-series literature frequently employed Granger-type causality tests and normal vector autoregressive (VAR) models before the 1980s, but their results are always criticized by econometricians due to the relatively simple methodology and limitations of data, in particularly for time-series studies in developing countries before the late 1980s. In recent years, the technologies of cointegrations and vector error correction (VEC) models were broadly employed to explore the advanced relationship between economic development and financial growth. In the last five years, there have been some of the most advanced time-series approaches, one of which is broadly employed by central banks in newly industrialized countries in order

to investigate the associations more efficiently. Research has progressed by employing better variables for the development of financial systems, using more efficient econometric techniques and through evaluating individual countries in rather greater depth.

The initial work with the time-series technique is to focus on the importance of measuring the development of financial systems accurately, which suggests that estimations with better measurements for financial development tend to reveal a growth-improving impact of financial development. Demetriades and Hussein (1996) and June (1986) used the ratio of money to output as an important measure of financial systems. Their studies showed that bi-directional causality runs in both directions, particularly in developing countries. But Kugler (1998) measured financial growth by the added value provided by the financial sectors, rather than using simple indicators for the size of financial sectors. They showed that economic growth is fostered by finance. Similarly, Wachtel and Rousseau (1998) presented a time-series analysis of financial growth and economic development for five different countries over the period of the past century, which measured the financial systems with the assets of both banks and non-banks. Their study indicated that there was a dominant direction of causality running from finance to economic development. Demetriades, Arestis, and Luintel (2000) conducted time-series estimations with measurements for the development of both stock markets and banking sectors. An additional support is documented in their study to strengthen their hypothesis that financial growth fosters economic growth, but simultaneously showed some problems about the size of their

relationships. The quarterly data was analysed for five developed countries, and the effect of banking sector growth was larger than that of the stock markets, while both markets boosted economic growth. But the problems of sample sizes for estimation were criticized as being too limited, and thus it is not enough to describe clearly whether the quarterly data and vector error correction models abstracted from high frequency factors would affect the stock markets, banking sectors and growth to economic development in the long-run steady state.

Christopoulos and Tsionas (2004) criticized the results which used time-series data as being unrealistic due to the limited data resources. Accordingly, panel unit roots and panel cointegrations techniques were conducted to evaluate the links between financial development and economic growth for 10 developing nations, which resulted in causality inferences with a panel context. In contrast to results by Demetriades and Hussein (1996), their study showed strong evidence for long-run causality running from financial development to growth, but much weaker evidence for bi-directional causality. More specifically, their empirical results showed a unique cointegrating vector based on vector autoregressive models between growth and finance, which implied efficient long-run relationships.

With a consideration of the specifications in different economies, a move away from studying a varied group of countries towards individual countries has been presented by much of the literature. These individual countries studies allow the involvement of country-specific variables to measure financial developments. An assessment for the US economic growth with finance was launched by Rousseau and

Sylla (1998, 1999) to involve the development of stock markets. A series of multivariate time-series models was conducted to relate indicators for banking sectors and equity market activities for investment, imports and other factors over the period 1790 to 1850. In the US, there is strong evidence to support the view that financial growth was the result. Rousseau (1999) conducted another investigation into a developed country: a study of the Meiji period in Japan from 1868 to 1884. A set of vector autoregressive models were involved in the Japanese study and then financial sectors in Japan were instrumental in accelerating Japan's explosive growth before World War I. The impacts of financial innovation were examined by Rousseau (1998) with the US data over the period 1872 to 1929. Innovation was measured by reductions in the spread of loan-deposit rates. The influence on the size of the financial sectors was evaluated with unobservable approaches. Their study showed that a permanent decrease of 1% in the spread of New York banks was linked with an increase in financial depth ranging from 1.7% to almost 4%. Their results indicated some direct impacts running from financial innovation to an increase in financial depth, which are actually linked with economic development in other literature.

It is not difficult to notice that most time-series studies use annual observations and quarterly data to maximize the information involved in their studies. Bekeart, Harvey and Lundblad (2004) conducted estimation, averaged over a period of five years, to emphasize growth instead of higher frequency relationships. However, overlapping data was employed in order to avoid the lack of information from non-overlapping data. Furthermore, standard errors were adjusted and an array of

sensitivity checks was conducted, although the procedure could not formally solve the problems of simultaneity bias. To support the views of Levine and Zervos (1998), the study by Bekeart, Harvey and Lundblad (2004) indicated that economic growth can be fostered by financial liberalization through improving the allocation of resources and enhancing the efficiency of investment.

Appendix 2.1: A Survey of Theoretical Models

A Survey of Theoretical Models			
Year	Schools	Principal Exponents	Main Remarks
1960s and before	Pioneer hypotheses	Keynes(1936)	Keynesianism arguments in favour of financial repression: financial development followed from growth and not vice versa Their theoretical framework was still relatively unsophisticated and empirical evidence for a significant relationship between finance and growth remained rough.
		Gerashchenko (1962)*	
		Patrick (1966)*	
		Cameron (1967)*	
		Goldsmith (1969)*	
1970s	The McKinnon-Shaw school	Ronald McKinnon (1973)*	They come to the conclusion that, starting from a situation of financial repression, interest rate liberalization has a double advantage. Apart from exerting a positive effect on long-run growth, financial liberalization reduces the contraction effects of monetary stabilization programmes.
		Edward Shaw (1973)	
		Kapur (1976)	
		Galbis (1977)	
		Mathieson (1980)	
		Fry (1980)*	
		Stiglitz and Weiss (1981)	
		Wijnbergen (1982, 1983)	
		Taylor (1983)	
		Diamond (1984)	
1980s	Critiques of financial liberalization	Shleifer and Vishny (1986)	As a result of mixed experiences with financial liberalization policies the Neo-structuralisms School emerged, which criticized financial deregulation from a macroeconomic point of view. Another group of authors focussed their attention on microeconomic underpinnings of macroeconomic policies.
		Williamson (1987 a)	
		Geinotte and Pyle (1991)	
		Romer (1986, 1990)	
		Greenwood and Jovanovic (1990)	
1990s	Endogenous growth and finance	Bencivenga and Smith (1991)	In the 1990s research on the relationship between financial development and long-run growth received new impulses from the literature on endogenous growth. A branch of this stream started to focus on the question whether financial conditions could explain sustained growth in per capita GDP.
		Grossman and Helpman (1991)	
		Aje and Jovanovic (1993)	
		Saint-Paul (1992)*	
		King and Levine (1991, 1993 b) *	
		Pagano (1993) *	
Notes:			
** means the major discussion ideas in this thesis			

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Appendix 2.2: Empirical Surveys of Economic Development with Finance

Empirical Surveys on Economic Development with Finance					
Author	Year	Empirical Countries	Testing Period	Main variables in estimations	Estimation Results
Fry	1978	Asian Developing countries	1962 – 1972	Domestic saving rates; Real terms of interest rates	Real term of interest rates have a significantly positive impact on domestic savings
Giovannini	1983	Asian developing countries	1964 – 1980	Domestic savings; Real terms of interest rates	no positive interest elasticity of savings
Tybout	1983	Micro firm-level data in Colombia	1973 – 1976	Investments by enterprises; Ability to access credit markets	a) Large size of enterprises are easily access to credit markets b) Financial liberalization may have significantly improve the efficiency of allocations of credits and then efficiency of investments
Fritz	1984	Philippines	1969-1981	financial development index with 10 weighted sub-indicators economic indicators	a) early stages of economic development: finance causes growth b) more advanced stages of economic development: growth causes finance
Jung	1986	37 developed countries and 19 Less developed countries	1950-1980	M2 over GDP M1 over GDP Real per capita GDP	a) finance causes growth: more frequently found for LDCs; b) growth causes finance: more frequently found for industrialized countries c) both high and low growth LDCs finance causes growth pattern prevails, but different financial indicators are crucial

King/ Levine	1993	Chile, Korea, Philippines, Argentina, Indonesia	1960-1989	real per capita GDP growth; capital stock; investment share	M3/GDP or M2/GDP if M3 not avail ; deposit money bank domestic credit ; private credits;	case studies: financial sector reforms lead to higher level of financial development
De Gregorio and Guidotti	1995	12 Latin American countries	1950s-1985	real per capita GDP	Domestic credits	Latin American: credit significantly negatively related with growth because of liberalization in poor regulatory environment
Demetriades and Hussein	1996	16 less developed countries	27 Annual data (at least)	real per capita GDP	bank deposit liabilities to GDP; bank claims to GDP	finance causes growth: little growth causes finance: and much bi-directionality; and very much patterns vary strongly across countries
				With ECM and VAR analysis		
Mattesini	1996	40 high income and low income	1978-1992	real per capita GDP	lending-deposit spread	negative association between growth and spreads whole sample very significant high income countries very significant; low income countries not significant
Demetriades and Luintel	1996	India	1961-1991	bank deposit liabilities over GDP	real per capita GDP	banking sector controls inhibited financial deepening bi-directional causality between finance and economic activity in India

Lamin Leigh	1996	Singapore	1975-1991	Real physical capital (K); human capital (H); $M2/gdp$ (F)	Real Income	Significant coefficient for long run relationship between financial and economic growth, but human capital role is not as big as expected results
Robert Dekle and Mahmood Pradhan	1997	Indonesia, Malaysia, Singapore Thailand	1975-1995	Real narrow money; real broad money	Real GDP	Rapid growth and ongoing changes in financial markets suggest that policy needs to be guided by a wider set of monetary and real indicators
Benhabib and Spiegel	2000	Argentina, Chile, Korea, Indonesia	1965-1985	real GDP growth; investment share; total factor productivity growth;	Financial depth: with same as Ross Levine in 1993	financial development are significantly positively associated with growth, different financial variables are associated with different components of growth
Chen-min Hsu and Wan-Chun Liu	2002	Korea, Taiwan, Singapore	1981-2001	M2 to GDP; Private credits; Turnover ratio	Growth rate of GDP	Significant role of financial development and structure, monetary and financial policies in the economic growth processes, with the a consideration of endogenous growth model
James B. Ang and Warwick J. McKibbin	2005	Malaysia	1960-2001	Domestic Savings; Investment shares; M2 over GDP; M3 over GDP; domestic credits over GDP	Real GDP per capita	Benefits from financial liberalization can be realized since a well-functioning financial system can play an important role in the process of economic development in Malaysia
				With Causality, VAR and Cointegration		

Chapter Three

Theoretical Models with Taxonomy for Economic Development with Finance

3.1 Introduction of Theoretical Issues

The dynamic structure of financial and economic development is best analysed through growth models, both exogenous and endogenous. However, the complexity of modelling the multi-faceted contribution of the financial sector (from direct productivity effects to signalling the strength of the economy to intermediation and risk management) is difficult to incorporate theoretically into any single encompassing model. Although some economists have developed various growth models involving the crucial factors of measuring financial growth, none of them can be broadly acknowledged to be a comprehensive model that fully covers both growth ideas and financial factors simultaneously.

In summary, there are several key problems in the process of setting forth theoretical growth models with finance. Firstly, there are still some arguments about the basic theoretical frameworks among economists as to whether we need an exogenous growth model or endogenous growth model. In fact, two different approaches of the frameworks argue whether the financial factors can be regarded as one of endogenously dominated factors within our theoretical frameworks. But in recent decades, the endogenous models are relatively acknowledged to be better at explaining the interrelationships between growth and finance. Secondly, there is the question

regarding the differences between real sectors in an economy and financial factors arising in the theoretical studies. There should be some differences between real sectors, (like manufacture, agriculture, investment and trade), and financial factors in an economy, but the question is whether these differences are significant in studies of growth models with financial factors. In other words, the key argument is whether the financial sectors can play the same roles in economic development as the real sectors. Thirdly, the measurements of financial growth in theoretical models are always controversial. In empirical studies, the indicators for financial growth are very diverse, but the measurements are able to rely on the local economic situations or other practical conditions. The problem of choosing a correct indicator to measure financial growth becomes more significant in the theoretical models which should be independent of real economic variables. In order to provide a better explanation for interrelationships between economic development and financial systems, this thesis does not use a single model in the chapter on theoretical models, and three models will be presented in this chapter.

We therefore construct three separate growth models to look at the interrelationship and impact effect of finance and development, in order to provide a better understanding of the connections between economic growth and finance in terms of the theoretical views. In addition, an explanation about the differences between exogenous and endogenous growth frameworks is presented in this chapter as well, but with a consideration of limitations of words, these discussions emphasis the core of the literature.

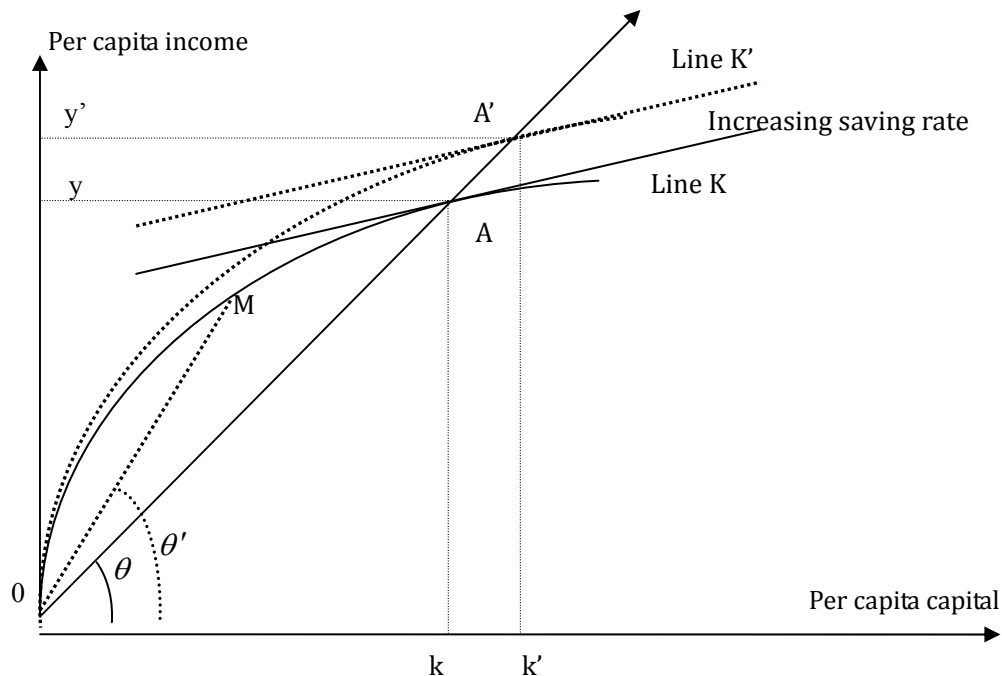
3.2 Discussion about Endogenous and Exogenous Growth

In order to exploit the financial-economic nexus systemically, it is necessary to study some basic theoretical discussions, which should provide theoretical support for the critical role of financial sectors in economic development. Referring to growth frameworks with financial factors, there are different theoretical approaches to interpret their interrelationships, and in the light of development economics, there are two distinctive approaches to analyse the impact of economic behaviour on long-run economic growth: the exogenous approach and the endogenous approach. This section concentrates on some general introductions of exogenous and endogenous growth frameworks from basic theoretical ideas.

3.2.1 Exogenous Growth Theory

The exogenous growth approach indicates that economic growth in the long run relies on exogenously determined variables, such as technical progress. The endogenous growth model, however, argues that the long-run growth rate can be affected by some endogenous variables, such as human capital formulation. The key factor in exogenous growth theories is the existence of decreasing returns to capital (DRK), which leads to the exogenously determined growth rate in the steady state equilibrium. In other words, the exogenous growth theories indicates that there are only level effects in a steady state equilibrium, but no growth effects for long-run economic growth. In order to understand the exogenous growth models better, the simple version of Solow model is illustrated here to explain the constant economic growth rate in the steady state

equilibrium. In exogenous models, economic behaviour has a level effect in the long run. However, in contrast to endogenous models, there is *not* any impact on growth levels of economic growth in the steady state.



The Solow model is illustrated here to show the crucial characteristics of exogenous growth frameworks and mechanisms. In Solow model, the production process involves two kinds of input: labour (L_t) and capital (K_t), thus the production function can be shown as:

$$K_{t+1} = (1 - \delta)K_t + S_t, \text{ where } S_t = s * Y_t, K_t = \theta * Y_t$$

The productivity here is defined as $(1/\theta)$, as $\theta = (K_t/Y_t)$. One of the most important characteristics for exogenous growth models is the endogeneity of capital–output ratio within the theoretical framework, which leads to another crucial notion—diminishing return. The relaxation of DRK in growth frameworks results in another important growth framework, endogenous growth theories, and thus the endogenous growth models imply that growth rate of capital might not decrease as per capita income

growth, which could be caused by some buffers by human capital growth and other factors. Furthermore, endogenous growth models are likely to involve the increasing returns to scale (IRS) or constant returns to scale (CRS), whereas the exogenous growth theories only include DRK.

3.2.2 Endogenous Growth Theory

In general, the notion of economic growth is attributed to three factors: growth in labour, growth in capital, and growth in technical progress. In the light of the exogenous growth theories, the economic growth in the long run is dominated by exogenously significant variables, such as exogenous technical progress. Thus some economic behaviour, such as human capital, technological factors, savings and investments, cannot influence the steady state growth rate, whereas the endogenous growth theories suggest the policies can affect the growth rate in long run steady state. The simple version of Harrod–Domar theory is introduced here to describe the general characteristics of endogenous growth theories. Harrod–Domar model is a typical and simple endogenous growth model, as its growth rate in steady state can be affected by policies.

In the Harrod–Domar model, some policies play an important role in economic growth, whereas it is strongly opposite to the exogenous growth model such as the classical Solow model. In practice, central planning economies were deeply influenced by Harrod–Domar style model, such as India and China before the 1980s and the previous Soviet Union. The mathematical expression of the Harrod–Domar model is

presented as follows:

$$K_{t+1} = (1 - \delta)K_t + S_t, \text{ as production function}$$

Suppose there is an assumption here:

$$S_t = s * Y_t \text{ and } K_t = \theta * Y_t, \text{ where } s = \frac{S_t}{Y_t} \text{ and } \theta = \frac{K_t}{Y_t}$$

The term $\frac{1}{\theta}$ is defined as productivity. The growth rate of outputs can be denoted as

$$g = \frac{Y_{t+1} - Y_t}{Y_t}. \text{ The production function can be restructured as following:}$$

$$\theta * Y_{t+1} = (1 - \delta) * \theta * Y_t + s * Y_t$$

$$\Rightarrow \frac{\theta * Y_{t+1}}{L_t} = (1 - \delta) * \theta * \frac{Y_t}{L_t} + s * \frac{Y_t}{L_t}$$

$$\Rightarrow \theta * y_{t+1} * (1 + n) = (1 - \delta) * \theta * y_t + s * y_t \text{ where } y_t = \frac{Y_t}{L_t} \text{ and } 1 + n = \frac{L_{t+1}}{L_t}$$

$$\Rightarrow (1 + n)(1 + g) = \frac{s}{\theta} + (1 - \delta)$$

After ignoring the value of ng , the growth rate of output can be represented as:

$$g = \frac{s}{\theta} - \delta - n$$

Here the term of θ is the capital-output ratio which is assumed constant over the changes of K, so it is regarded as an exogenous factor. Then it implies an important characteristic for endogenous growth models: lack of DRK. As the productivity is denoted as $\frac{1}{\theta}$, and saving policy is expressed by the saving ratio s , the higher saving ratio must result in a higher growth rate. Therefore, it implies that the growth rate in the long-run steady state can be affected by economic policies, whereas the exogenous growth model argues that the growth rate in the long-run steady state cannot be affected by any policies.

In other words, the exogenous growth theories argue that there are only level effects on domestic outputs or inputs in long-run steady state, but nothing of growth effects; the endogenous growth model says there would be both growth effects and level effects on domestic outputs in long-run steady state. The main reason for this elementary difference is the existence or lack of DRK in two models respectively. The existence of DRK must imply that marginal productivity of capital will decrease over the increases of capital; however, the scope of capital here normally involves only physical capitals, like machinery for manufacture. If the capital is composed of both physical capital and human capital, the marginal productivity of capital is highly likely to increase over the increase of capital, or to remain the constant level. The growth rate in long run steady state can be affected by policies in terms of endogenous growth theories. In practical situations, the fundamental factors to be affected in the theoretical models are saving ratio and capital-output ratio. The government can make some changes to make an increase in saving ratio in terms of endogenous growth theories, and then the growth rate in long run steady state can be influenced by these economic policies.

This section of discussions of exogenous and endogenous growth theories shows that the different approaches of theoretical bases would result in different methodologies to analyse economic development. The following models in this thesis for economic development with finance are composed of both approaches: the exogenous growth model and the endogenous growth models

Table 3.1
Comparisons between exogenous and endogenous growth models

Approaches	Models	Growth Rate (Steady State)	Explanation	DRS
Exogenous Model	Solow Model	$g^* = n + \Pi + \delta$	Growth rate in Steady State can not be affected by policies, such as saving rate.	Existence of Diminishing Return to Scale
	Harrod-Domar Model	$g = \frac{s}{\theta} - \delta - n$	Growth rate in Steady State	
	Human Capital Model	$g = s^{\alpha} q^{1-\alpha}$	relies on the impacts of policies, such as saving rate	Lack of Diminishing Return to Scale
Endogenous Model	AK Model	$g = sA + \frac{\dot{A}}{A}$	(s).	

- Notes:
- 1. The term of g means the growth rate in long run steady state.
 - 2. The term of s means the typical economic policy-saving policy
 - 3. The term of A means the technology; the term of Π means the growth rate of technology; the term of δ is the depreciation of capitals; the term of n means the population growth rate

3.3 Theoretical Foundations for Growth and Finance

3.3.1 Introduction

The causality relationship between financial intermediation and economic growth has been studied over nearly three decades by many scholars, such as Goldsmith (1969), Shaw (1973) and McKinnon (1973). Although some evidence has been produced to indicate a correlation between financial and economic development, their work seems to be less analytical, especially for foundations. According to traditional growth theories, the economic growth rate in the steady state cannot be influenced by any economic behaviour, such as education or financial activities; however, the respective level could be affected by economic behaviour. Thus, the theoretical growth model was regarded as an exogenous growth model. But there is one additional point about the exogenous growth model: in the transitional stage, the growth rate could be affected by economic behaviour, and this is only for the transitional stage.

But recent literature in the financial-economic nexus comes mainly from technical ideas of other growth models, which are named as the Endogenous Growth Models. The Endogenous Growth Models have indicated that the steady-state economic growth could be affected by some economic behaviour, so that the growth rate can be self-sustaining. Therefore, economic behaviour, for example financial intermediation, has not only level effects, but also growth effects in the endogenous growth models, whereas the exogenous growth models only show the significant level effect, rather than growth effect for long-run steady-state economic growth.

Endogenous growth models provide insight knowledge, leading to a good understanding to capture the potential associations between financial sector growth and economic development. In the field of development economics, there are many good examples of endogenous growth models, such as Harrod–Domar model, the augmented Solow model (with human capital) and the AD model, which all provide excellent explanations about the impact of some economic behaviour on long-run economic growth. However, the simplest endogenous growth model, the AK model, is considered here to capture some influences on economic growth from financial development.

3.3.2 Comprehensive Reviews of Finance and Economic development

3.3.2.1 Theoretical Explanation based on AK model

The AK model represents aggregate output as a linear function of the aggregate capital stock: $Y_t = AK_t$ (1). The AK endogenous growth model could be theoretically regarded as a combination of two underlying frameworks, by Romer (1989) and Lucas (1988). The former assumes that productivity is positively related to aggregate capital stock K , whereas an individual firm in the model faces a technology with constant returns to scale. In this case, the B is supposed to be a parameter for each firm, but B is actually related to average capital stock: $B = AK_t^{1-\alpha}$. By adding every individual firm, the aggregate output is represented as $Y_t = AK_t$ in accordance with $Y_t = Ny_t$. Another framework, by Lucas (1988), provides another way to explain the AK model derivation, which supposes that K_t is the combination of two kinds of

capital—human capital and physical capital—rather than only one capital, and both are reproducible with identical technologies.

Suppose that the population growth is constant and also that there is only a single good in the economy. The single good can be either invested or consumed, and then the gross investment can be expressed: $I_t = K_{t+1} - (1 - \delta)K_t$. Under the consumption of a closed economy without governments, the equilibrium of a capital market requires that: Gross Savings=Gross Investment. However, it is more reasonable and convenient to consider a part of savings to be lost in the process of financial intermediation, so that the left savings equal to investments. $\phi S_t = I_t$. The growth rate can be given as:

$g_{t+1} = Y_{t+1} / Y_t - 1 = K_{t+1} / K_t - 1$ and then deviation is as follows:

$$g_{t+1} = Y_{t+1} / Y_t - 1 = K_{t+1} / K_t - 1$$

$$g_{t+1} = (K_{t+1} - K_t) / K_t = (I_t - \delta K_t) / K_t = I_t / K_t - \delta$$

Due to $Y_t = AK_t$

$$g_{t+1} = A * \frac{I_t}{Y_t} - \delta$$

Finally, the steady-state growth rate can be derived as:

$$g_{t+1} = A * \frac{I_t}{Y_t} - \delta = A\phi s - \delta \text{ where } s = \frac{S_t}{Y_t}, \phi = \frac{I_t}{Y_t}, \delta = \text{Depreciation rate}$$

Actually, this regression reveals how the financial sectors have impacts on economic growth in steady state equilibrium: (a) the growth of financial sectors can increase ϕ , which indicates that the proportion of savings is funnelled into investment; (b) it can raise A, which means there would be an increase in the social marginal productivity of

capital; (c) it may affect s , which shows a higher level of private saving rate. All of these routes are explained in subsequent discussion.

i) Funnelling saving into firms (affect ϕ , increase saving s to investment I)

Firstly, the financial intermediation can increase the proportion ϕ of saving funnelled into investment, which in turn has a long-run impact on economic growth. In fact, a dollar saved by a household generates less than one dollar in value of investment, since the left fraction $1-\phi$ goes to dealers as commission fees, to banks as the spread between lending and borrowing rates, and to securities brokers and such like. The activity of the financial sector, and the absorption of resources, is often burdened by restrictive regulations and by taxation (normally in the form of high reserve requirements, transaction taxes, etc). While the financial development can reduce the leakage of resources, i.e. an increase in ϕ , the steady state growth rate g can be increased thereafter.

ii) Improving allocation of capital (affect A , higher marginal productivity)

Another important function of financial intermediation is to increase the allocation of funds to those investments, where the marginal product of capital is relatively higher. This function can be represented as an increase in the value of A in the above endogenous framework, thereby the steady-state economic growth rate could be promoted; this fraction will normally follow the two ways: (i) induce individuals to share risk in some riskier but more productive investments; (ii) play the informational role to evaluate alternative investment projects.

Financial intermediaries can play a role of sharing risks in some investments,

which should affect individuals' investment choices, as well as their saving behaviour. In fact, this role is conducted not only by insurance markets but also by banks and securities markets, which allow investors to share the uninsurable risk of idiosyncratic shocks, such as unobservable taste or liquidity shocks. Suppose that the bank is absent, individuals can be against idiosyncratic liquidity shocks only by investing in productive assets which can be promptly liquidated, thereby frequently forgoing investments that are more productive but also more liquid. The significant role of the bank is to reduce this inefficiency, and banks can pool the liquidity risk of depositors and invest most of their funds in more illiquid and more productive projects. In addition, the amount of liquid assets need not exceed the expected withdrawals by households hit by liquidity shocks.

The financial intermediaries have another informational role, which has been related to productivity growth³. The capital may be invested in a less-risk and low-yield project or a risky, high-yield one. The returns to the risky investment have two random terms: an aggregate and a project-specific shock. Financial intermediaries can perfectly unscramble the aggregate productivity shock due to their large portfolio, and thereby choose the projects that are most appropriate for the current realizations of the shock. Therefore, the savings through financial intermediaries are allocated more efficiently, while the higher productivity of capital leads to higher economic growth.

iii) Increasing saving ratio (affect s , a higher level of private saving rate)

The growth of financial sectors can affect the economic growth rate through the

³ This is firstly mentioned by Greenwood and Jovanovic (1990).

saving parameter s in the AK function; however, the conclusion is ambiguous. The development of financial intermediation also narrows the gaps between the interest rate obtained by households and that paid by firms. While capital markets develop, individuals can get better insurance against endowment shocks and better diversification of risks, and consumer credit becomes more cheaply available. Either of these economic behaviours can affect saving parameters, but it is noticed that in each case the effect is ambiguous.

Financial markets can transfer funds among households, channelling from the households who prefer to save to the households who do not save, and normally this process will be in the form of consumer mortgage and credit loans. If the supply of loan is lower than the demand, some households become liquidity-constrained: their consumption relied on by available resources, rather than permanent income.

With an overlapping generations model⁴ (three-period-lived household), the saving rate can be increased by bidding liquidity constraints, since it is normally believed that young persons are not able to save as much as they want. This will lead to an increase in the aggregate saving rate via saving parameter s , which in turn results in a higher level of growth rate. It is necessary to consider a significant qualifier about understanding ambiguous effects. Households borrow not only to finance current consumption, but also to finance accumulation of human capital. The effects of liquidity constraints become ambiguous, because the productivity of investment will decline while the saving rate increases. Actually, this qualifier relies on the extent to

⁴ Pagano (1992)

which human capital is self-financed by households. Some countries subsidize this qualifier through governmental activities, such as grants for students, free-interest loans, and public training, which are broadly recognized to be as important as general schoolings.

After considering the aspects of borrowing by individuals in above section, the following section discusses another risk-sharing role of financial markets. With this role of risk-sharing of financial markets, households are able to share either endowment risks or market return risk. Suppose that there is a simple version of markets in an economy, and savings from consumers would be less when their utility function involves a derivative, which actually means a satisfied condition with constant risk aversion: the need for some savings to be reduced by introducing the insurance market. Hence, this decrease in saving ratio results in a fall in the economic growth rate, which indicates that the development of financial institutions might have diverse impacts on economic growth. On the other hand, the impacts from return risks on savings are still ambiguous. The positive impacts are based on a necessary condition of positive risk aversion for consumers' utility function; otherwise, there might be negative impacts on saving ratio.

3.3.2.2 Some Empirical Evidences and Problems

The empirical results to evaluate the finance-growth nexus are always ambiguous, but most of the literature in recent decades, especially for studies with developing nations, exhibits a positive relationship between economic growth and some indicators of

financial sector development. The first literature to present this positive correlation was Goldsmith (1969) and McKinnon and Shaw (1973). Among these early studies, there are still some empirical estimation problems, such as the causality relationships for them, the roles of the investment and so on.

Among the most important comprehensive contributions are the studies by King and Levine (1993a), and Renelt and Levine (1991). They confirm a growth correlation with different indicators of financial sectors with a cross-section estimation method. Their results are generally regarded as robust. However, some problems involving the empirical estimation still exist, especially the importance of investment and efficiency (Pagano, 1993). In most literature, only aggregate indicators in the financial sector are employed to present the financial development, such as money stock or domestic bank credits. But those indicators are argued to be a more unilateral position. Levine (1993) attempts to use more comprehensive measurements for financial systems, such as private credits to total credits, or private bank claims to total claims. Jovanovic (1992) researched the correlation between the economic growth and financial development with a consideration of trading volume. Jappelli (1992) exposed a significant correlation between the economic growth and household lending with the indicator of consumer credit to GDP.

Although more comprehensive variables are employed in the empirical working, the data limitation for developing countries is still a crucial impediment to conducting an efficient estimation (Levine 2000). Most recent studies on developing countries' financial systems still use some general indicator to capture the essential points. As

most developing countries' financial systems are still at an under-developed stage, compared with more mature systems in European countries, the estimation of more comprehensive variables cannot be conducted with efficient estimation methodology and sufficient data. Therefore, in most studies about the growth-finance nexus in developing worlds still follow some successful experiences with developed countries, and in the meantime, the explored pace never stops in the cases of developing countries.

3.3.3 Endogenous Growth models with Financial Factors

3.3.3.1 Introduction

The academic literature on finance and economic development has been developed from the first generation to the second generation. The second generation literature about the growth-finance nexus shows more comprehensive discussions, as they have generally combined both notions from endogenous financial institutions and financial growth. Among earlier literature providing theoretical basics, the representative contributions which need to be considered are Philip and Diamond (1983), Douglas (1984), John and Edward (1986), Lucas (1988) and Romer (1986, 1990). In this first-generation literature, the financial institutions are typically estimated explicitly instead of treating them in simple deterministic terms. The notions of quality ladders and externalities are normally employed to explain endogenous growth model. But according to this earlier literature, it is possible to use non-endogenous growth models with alternative financial models, since this literature does not believe that the precise cause of endogenous models affects the function of finance.

Among financial growth models in recent years, some are worth considering here: Bencivenga and Smith (1992, 1993), King and Levin (1993a 1993b), Greenwood and Smith (1993) and Pagano (1993). These second generation financial growth models correct critical shortcomings of first generation models and these models begin to analyse the interactions of the growth-finance nexus with endogenous growth models, however, most of the second generation literature ignores the analysis of dynamic processes of financial stabilization. In other words, almost none of these models attempt to combine the short-run stabilization with long-run growth. This section provides a discussion of economic growth in the views of endogenous growth theories, which regard financial influences as a kind of important endogenous factor inside the growth model.

3.3.3.2 Information Uncertainty in Financial Markets

To begin understanding the financial growth models, it is necessary to explain why financial markets are different from ordinary commercial markets, such as apples, machines and motors. The general answer needs to be considered from the extraordinary nature of financial markets: they involve a special delivery in the future and the future is uncertainty for everybody in the current period. In principle, there are plenty of insurance policies for financial markets, and accordingly there should be a series of insurance prices to cover all types of possible uncertainty in financial markets, especially for the future state of the world. With enough insurance policies, everybody might be able to borrow an infinite amount of money from the financial markets at a

certain level of market interest rate, and the market rate could result in an efficient allocation of income among investment, saving, and consumption.

Essentially, it is better to begin understanding the above explanation from an example in the ordinary commercial market. Suppose that a farmer would like to borrow money to purchase seeds, if he can obtain costless information about all future weather conditions, the farmer and lender could agree a contract to specify the profits with all possible future states. With the full conditions of competitive markets for that farmer, the marginal expected return from extra investment might be equivalent to the marginal cost of the borrowing; in the meantime, the lender could get an expected payoff equal to the risk-free market interest rate. Consequently, the expected marginal return to the original investment for the farmer must be equal to the risk-free market interest rate. For all potential investors, therefore, all investments should provide the same rate of marginal expected return. Then, more higher-return investments would be exploited under this condition. While re-allocation of invisible money among potential investment projects cannot increase the investor's total profit, there would be an efficient allocation or optimal allocation of available money, which is called as Pareto efficient allocation. Another important feature here is that the types of contracts or agreements in financial markets and the sources of available money for investment are both irrelevant, also the transaction procedures are assumed to be costless in financial markets.

For all of the above reasons, it is assumed that the information for future states is freely and costlessly available in any state of the world and monitoring should be

costless. However, as this never happens in this world, financial markets cannot provide sufficient insurance to cover all possible states of the world. Since plenty of risks cannot be always guaranteed, it is impossible for everybody to borrow an infinite amount of expected borrowing funds. Hence, some high-profits investment projects might be unexploited as the information is highly costly for investors. One of the most crucial problems involving the expense of obtaining information is the monitoring cost. The lender has to monitor all the actual and potential activities of the borrower in order to guarantee that all conditions of financial contracts will be observed. With the previous of the farmer, when the return rate on outputs becomes lower, the farmer always blames the worse situation on the bad weather, since the farmer is highly likely to use less resources than expected and agreed with the lender.

Hence, the lender has to monitor the borrower to ensure that all conditions involving the contracts are always monitored. When the monitoring costs might be very high for both the farmer and the lender, they normally cannot get a favourable agreement. Therefore, the marginal rate of expected return payoffs to the original investment should not be equivalent with real situations in the world. Actually, the financial institutions become relevant for financial markets with a consideration of some real-world situations, such as transaction costs, positive information and monitoring costs, instead of our previous assumptions in the financial markets. The lender would reduce the risk through the borrower's potential balance sheet and use of collateral or taking hostage, providing less available funds than expected by the borrower, even restricting the repayment period of the loan.

3.3.3.3 Finance Growth inside Endogenous Models

According to Ross Levine (1993a, 1993b), explaining the endogenous growth model, the human capital of every worker would be increased “independently of the individual’s own investment of resources” as more resources can be kept in enterprises during the two-period production procedure. Essentially, the accumulation process of every person’s human capital in an enterprise relies on several crucial points: (i) the amount of resources invested by that person; (ii) interactions with other persons in that enterprise; (iii) the invested and remaining resources in the two periods.

The externality indicates that the accumulation rate of human capital would be reduced by the liquidation of the investment project by the member of an enterprise after the first period, and then the growth rate of technological progress might successively decline, as well as economic growth. Under the condition of a full competitive market, the invested resources are always less than the expected amount. In terms of studies by Bencivenga and Smith (1991), enterprises normally believe that it is costly to recognize externalities and to mobilize investible resources, but these activities are still beneficial for the financial institutions, such as investment banks. These institutions are still useful in promoting economic growth through prompting enterprises to make more investments. In terms of studies by Diamond–Dybvig, a simple framework involving a two-stage production process is developed. In our simple story, the investors have free access to technical information about current designs, and thus new techniques or inventions can be exploited in the first stage. This

process is labelled as externalities or external effects. With legal patents, the designers are freely able to sell the exclusive rights of their new techniques to anybody in the world. The engineering tools and facilities, such as machines, should be rented or bought by new producers buying the new techniques. Economic growth would take place through the increasing use of engineering tools and facilities.

In terms of the previous discussion, the endogenous growth model involves a positive relationship between investment ratio and economic growth, as the investment capital cannot suffer from a diminishing returns rate. Based on the studies by Pagano (1993), there is a closed economy with production function of $y = Ak$ where y is per capita output, k is per capita capital and A represents technology. The steady state economic growth rate can be addressed as $g = s * A - \delta$, where s means the saving ratio and g is steady state economic growth rate, and hence it is obvious that g has a positive relationship with s . The previous Diamond–Dybvig model has assumed the absence of costly financial intermediations, which is obviously unrealistic in the world. Now this unrealistic assumption can be relaxed with studies by Pagano through integrating financial development into the endogenous growth model. The saving ratio can be defined in two parts: s and $1-u$, where the term $1-u$ implies some parts of lost savings in the procedures of financial intermediation. Then, the steady state growth rate can be represented as $g = (s) * (1-u) * (A) - \delta$, which expresses that finance can influence economic output via the terms of A, s, u . These are the general ideas of Pagano (1993), and following are involving some reviews and discussion by King and Levine (1993a, 1993b) and Levine (2000).

Ross Levine develops another way to consider financial issues with endogenous growth theory, and this alternative method was presented by King and Levine in 1993 and extended again by Levine on 2000. According to Levine's consideration, an economy should be separated into three parts: enterprises, households and financial institutions. In this model, enterprises need a certain level of capability to monitor and manage the investment project, and this project is supported to promote productivity growth with a probability of α . All enterprises are separated into capable and incapable firms, and the level of their capability can be examined for a fixed cost of f . This fixed cost of f needs to be invested through financial institutions to ensure that the expected return profits with the efficient financial strategy should be more than the expected return profits with blind financial investment.

Under these conditions, those capable entrepreneurs can use financial institutions to spend x hours of labour in the invested projects, and x hours is actually the labour requirement. But it needs to be noticed that nobody can guarantee that all invested projects are successful and, even for capable firms, the projects would be successful with a probability of ϖ . Only after spending x hours of labour on the projects, can the final results for success and failure be known for both enterprises and financial institutions. According to Levine (1993b), there are two main reasons to explain why these activities must be managed by financial institutions instead of any individuals: (i) the risk of failure can be widely diversified; (ii) .

Therefore, sufficient financial institutions are advantageous for innovative enterprises, as they are able to provide some certain payoffs for firms. The

representative forms for financial institutions in this model are normally investment banks and venture fund-investment enterprise. The main roles of these financial institutions are to provide more effective and less costly management, monitoring and evaluation services for investment projects. In summary, financial institutions help enterprises to reduce the operation costs and then improve the productivity and promote economic development.

Now it is time to consider the literature of Gross and Helpman (1991) about productivity, which involves studies of finance in endogenous growth by King and Levine. According to Gross and Helpman's model, while the production costs can be reduced by innovations, which are also able to move up the ladder for production technology. The enterprises would get a certain level of profits, such as monopoly rents, from some successful innovations, but these innovations cause some loss for previous industrial conductors. The current market conductors set the price of each commodity to be same as its rival's cost per unit. Actually, the probability of successful innovation for an industry Π in current market is closely linked with the number of enterprises attempting to improve this industry. Suppose there are e numbers of these enterprises, $\Pi = \varpi * e$ where ϖ is the probability of successful projects.

The growth rate of productivity relies on innovation, therefore, the productivity function involves the close relationship with the number of enterprises, because the probability of an innovation can be improved by an increase in the number of enterprises. These relationships are expressed by many studies, and one of the typical functions is presented by Martin and Roubini (1992): $Y_t = \phi(F)K_t$ where Y_t means

the economic output, K_t measures capital involving both human capital and fixed capital, and F demonstrates the financial development. In summary, the economic growth can be affected by finance through term F .

3.4 Three Different Models for Causations between Growth and Finance

3.4.1 Core Ideas of Growth-Finance Model

The dynamic structure of financial and economic development is best analysed through growth models, both exogenous and endogenous. However, as we described in the previous sections of this chapter, the complexity of modelling the multi-faceted contribution of the financial sector seems to be difficult to incorporate into one large and complex encompassing model. Thus three separate growth models are constructed by us, as an original contribution, in this chapter to look at the interrelationship and impact effect of finance and development, each model highlighting one special aspect of the interconnections. This section is showing the mathematical details and explanations for these three models. What we do here is theoretically modelled by the growth literature and we can draw lessons from analytical models of the relationship and nexus between financial development and economic development before confronting our hypotheses with the data.

We consider three models in turn, each demonstrating how the two conceptual issues are related to each other. The first is based on an exogenous growth model, where the rate of growth is given exogenously by the rate of growth of efficiency labour

(which includes the sum of labour force growth and rate of change of labour augmenting technical progress) and broader technological process (TP). This model is suitable for early developers including newly industrializing countries where growth is driven by technical progress. A special feature of these countries, especially in East Asia, is that technical progress comes via trade (imports embody new world technology and exports are driven by labour efficiency) so that openness is an important determinant in the nexus.

As we explained in previous section of this chapter, the AK^5 model represents that aggregate output is a linear function of the aggregate capital stock: $Y_t = AK_t$. As an important Core model, it is worth to review some general ideas of this AK models. The AK endogenous growth model could be regarded as the combination of two underlying frameworks, assuming that productivity is the positively related to aggregate capital stock K , whereas individual firm in the model faces a technology with constant returns to scale. In this case, the B is supposed to be a parameter by each firm but B is actually related to average capital stock as following equations: $B = \frac{K}{L}$. With adding every individual firm, the aggregate output is represented as $Y = A * K$ in accordance with $y = Ak^\alpha (B * l)^{1-\alpha}$.

Another framework, by Lucas⁶ (1988), provides another way to explain the AK model derivation, which supposes that K_t is the combination of two kinds of capital—human capital and physical capital, rather than only one capital, and both are reproducible with identical technologies. Following the previous deviations of AK

^{5 2} This is the same as previous section equation, and we just review them here to support the following models.

model mathematically, the steady-state growth rate can be derived as:

$$g_{t+1} = A * \frac{I_t}{Y_t} - \delta = A\phi s - \delta \text{ where } s = \frac{S_t}{Y_t}, \phi = \frac{I_t}{Y_t}, \delta = \text{Depreciation rate}^7$$

Actually, this regression reveals how the financial sectors have impacts on economic growth in steady state equilibrium: i) The growth of financial sectors can increase ϕ , which indicates that the proportion of savings is funnelled to investment; ii) It can raise A , which means there would increase the social marginal productivity of capital; iii) It may affect s , which shows a higher level of private saving rate. All of these routes are explained in subsequent discussion of our growth models.

3.4.2 Theoretical model I: Exogenous Growth-Finance Model

Initially we take the standard neoclassical production function approach but distinguishing between the financial sector (F) and the rest of the economy (Y) sometimes called the “real” economy. In the exotic language of the financial press, we can think of F and Y as “Wall Street” and “Main Street”. Note that our measure of Y is defined by GDP minus the value of F. Although there are only two fundamental inputs in the production function as Capital (K) and Labor (L), the additional factor of F can be explained as additional important resources involved in the production, represented by financial services. These financial services are closely linked with two fundamental factors of capital (K) and labour (L). The financial services could create more effective routes to accumulate capital and savings in order to boost the economic

growth in the following periods, in particularly for reducing the frictions, reducing the transaction costs and re-allocating the resources. In the meanwhile, the financial services could affect the labour factors, while the numbers of skilled workers as important labour factors could be involved into the productions who are working in the financial services. In summary, the financial services could affect the two important fundamental factors in Cobb-Douglas Function significantly, and then financial services could go into this model as exogenous factors. Its productivity has the same neo-classical properties as capital stock in the Solow growth framework, i.e. both the average product and the marginal product of F—denoting its productivity, efficiency and contribution to the real economy—is diminishing if more of it is used as an input into the production process.

Consider a macroeconomy with an aggregate production function:

$$(3.4.1) Y = K^{\alpha} F^{\beta} L^{1-\alpha-\beta}$$

According to the Cobb–Douglas formulation, all factors of production are initially crucial for output. Here, Y implies output, K expresses capital, L presents efficient labour and F shows the broad measure of financial growth.

There are two more important notes about this model:

- (a) Y implies the output of the rest of the economy—aggregate GDP minus the financial sector;
- (b) The main reason to separate variables Y and F is to clarify the nature of causality and the influence of finance on development. Then, the growth rate for output could be obtained from (3.4.1) as follows:

$$(3.4.2) \quad g_Y = \alpha g_K + \beta g_F + (1 - \alpha - \beta) g_L \quad \text{where} \quad g_Y = (dY / dt) / Y$$

Secondly, consider a proportional saving function:

$$(3.4.3) \quad g_K = (dK / dt) / K = s_1 Y / K$$

$$(3.4.4) \quad g_F = (dF / dt) / F = s_2 Y / F$$

Where s_1 implies the proportion of GDP invested for just physical capital formation (K) and s_2 expresses the proportion invested in the financial sector (F). According to the functions above, it is clear from the nature of the above production function that, as K increases without bound, Y/K tends towards zero, and thereby g_K tends towards zero; as F increases over time, Y/F becomes smaller and tends towards zero, so that g_F tends to zero also.

In this model, the growth rate “n” (sum of population growth, labour augmenting TP, or even output augmenting TP) comes from outside the financial sector (or even independent of physical capital formation). In the case of East Asia this could be imported technology, embodied technology through foreign direct investment (FDI), through a large international market where exports need to compete, or via learning by doing, especially in the vertical integrated process among sectors linked to FDI. All of these give a special importance to openness (exports plus imports as share of GDP) and the empirical part of the paper gives special importance to openness (as the conduit of technology transfer affecting the rate of growth). According to above equations, we observe that an increase in the growth rate ‘n’, increases the efficiency of the financial sector (by raising the Y/F ratio) thereby allowing it to expand. In this case the causation

lies from economic development to financial development. An increase in growth rate allows the financial sectors to become more productive in the long-run steady state. In the Solow type growth model an increase in 'n' allows the output capital ratio to rise. In our model, in a similar fashion, an increase in 'n' creates the possibility of a rise in the output to financial capital ratio. In this model, economic development causes financial sector to expand (just as Robinson predicted, 1952)

3.4.3 Theoretical model II: Two-sector Endogenous Model

Consider now a second type of model, this time we explicitly analyse the growth rate through an endogenous growth model. In this endogenous growth model, economic behaviour such as human capital formation can actually affect the rate of growth in steady state equilibrium when all variables grow at the same rate. The analysis concentrates on financial capital formation, that is, the growth of the financial sector.

A two-sector model of an economy is now introduced. In this model, the first sector produces output Y as defined above; the second sector produces financial capital goods F, which represents the size of the financial sector or is measured as an index of financial development. Sector F also has a production function, however, it does not use physical capital or labour as input, and the only input required to produce new financial capital is some stock of existing F. Let there be a constant return to scale production which associates inputs of F to the output of flows of new financial capital goods or financial capital investment. Thus the function can be obtained as follows:

$$(3.4.5) \quad (dF / dt) = \lambda F_f$$

Where F_f is the amount of F required to produce incremental value added or investment in financial capital. Here stock of F is divided into two parts: one is used as input into the production of Y and the other as input into the production of financial investment goods. Thus:

$$(3.4.6) \quad F = F_y + F_f$$

Supposed there is a constant proportion of each element that

$$(3.4.7) \quad F_f = \phi F$$

$$(3.4.8) \quad F_y = (1 - \phi)F$$

The production function for Y is described as:

$$(3.4.9) \quad Y = K^\alpha F_y^\beta L^{1-\alpha-\beta}$$

Our concentration is on the impact of F (financial sectors growth) on Y (economic development). It is assumed that K and L are constant. Therefore, K and L can have no impact on long-term growth of economic development. The question is whether resource allocation towards the financial sector can create growth in the rest of the economy. We can have the following equation:

$$(3.4.10) \quad g_y = (dY / dt)Y = \beta(dF_y / dt) / F_y$$

Considering the combination of above equations together:

$$(3.4.11) \quad g_y = \beta(dF / dt) / F$$

and, then

$$(3.4.12) g_y = \beta \lambda F_f / F \text{ or } g_y = \beta \lambda \phi$$

Therefore, in such an endogenous growth framework, the growth of output in the rest of the economy (outside the financial sector) can be made to depend on the three parameters β, ϕ, λ relevant to the financial sector. The resources allocated to the financial system to produce new investment goods from such a sector is critical in enhancing growth, as is the “technology” associated with the sector given by the productivity coefficient. An increase in β (productivity of financial sector in the aggregate production functions), in λ (productivity of the financial import into re-generating itself and causing an expansion of F by itself) and in ϕ (proportion of financial resources allocated to the financial systems), will also raise growth rate of next output, denoted as y . For this model, financial development causes economic growth (as Schumpeter would have predicted)

3.4.4 Theoretical model III: Endogenous Model with Banks

We now turn to a third model which assumes that the financial sector does not directly enter the production function, nor does it have a direct productivity effect independent of capital formation. However, by reducing the cost of intermediation, lowering the risks involved in capital formation, allowing the price of capital to be a signalling device to ration capital to the most productive enterprises or to reduce wastage of capital, the financial sector raises the amount that households are willing to save and then transforms more of the net savings into productive capital. This again is an endogenous growth model where the rate of growth can change, but the financial sector

affects the growth rate through efficient intermediation. In this model, financial development affects growth positively, so that the causation moves from finance to growth (as Schumpeter would have predicted)

Consider a macroeconomy where households supply a fixed supply of labour, so that the population is constant. Households here claim a financial asset, e.g. bonds B , whose yields (return) is a real variable, r . Then the real rate of interest on the financial asset is r . Current utility is a standard isoelastic utility function. Let households maximize an intertemporal utility function, subject to a flow budget constraint:

$$(3.4.13) \text{Max } u = \int_0^{\infty} \frac{c^{1-\sigma}}{1-\sigma} e^{-\rho t} dt$$

$$(3.4.14) \text{Subject to } \dot{B} = rB + w - C$$

Where $\dot{B} = \frac{dB}{dt}$ and “.” represent derivatives.

It is assumed that there exists a financial sector which intermediates between savings by the household (supply of loanable funds or demand for new bonds \dot{B}). The real wage rate is the same in the financial sector and the real economy through competition. We assume that population of that labour working in the two sectors are two exogenous factors as vL and $(1-v)L$ being the labour force in the real and financial sectors. In the intertemporal optimal problem, the solution is given by the Keynes–Ramsey conditions, which gives the growth rate of household consumptions as:

$$(3.4.15) \frac{\dot{C}}{C} = \frac{1}{\sigma} (r - \rho)$$

Here r is defined as the real rate of return to financial assets and ρ is the rate of time

preference.

In the long-run steady state equilibrium, all variables, C , B and Y (outputs of the real or non-financial sector), must grow at the same rate. Hence the long-run rate of growth (assumed to be given as g) is equal to:

$$(3.4.16) \quad g = \frac{1}{\sigma} (r - \rho)$$

Where σ means the parameter from the utility function (assumed to be constant absolute risk aversion CARA form), ρ is the rate of time preference and r is the real rate of interest.

Consider now the aggregate firm in the real sector producing Y and using K of physical capital stock, and vL of labour work in the real sector. This production function is Cobb–Douglas so that:

$$(3.4.17) \quad Y = AK^{\alpha} (EvL)^{1-\alpha}$$

Here, E is a unit of efficiency so that the number of workers vL is multiplied by the efficiency factor E . However, the efficiency of labour is enhanced by working with a greater amount of capital stock per head. This is an externality of capital stock. It increases productivity directly via K and indirectly via E factor, enhancing the supply of labour vL , and therefore:

$$(3.4.18) \quad E = \Omega * \left(\frac{K}{vL}\right)$$

and Ω is assumed to be one.

After combining the above equations, we get:

$$(3.4.19) \quad Y = AK^\alpha K^{1-\alpha} = AK$$

This is the AK model of Rebelo (1991).

Combining equations fully we have:

$$(3.4.20) \quad Y = AK^\alpha \left(\frac{K}{vL} \right)^{1-\alpha}$$

Therefore the marginal product of physical capital K is given by

$$(3.4.21) \quad MPK = A[\alpha K^{\alpha-1} K^{1-\alpha} + (1-\alpha)] = A$$

Here in the proportion the MPK distributed away with the two factors of production K and L . This must be the population of α and $1-\alpha$ since there are the two elasticities in the production function.

The net return to capital R is therefore:

$$(3.4.22) \quad R = \alpha A$$

while the wage per efficiency unit of labour is:

$$(3.4.23) \quad \frac{w}{E} = (1-\alpha)A$$

$$\text{or } (3.4.24) \quad w = (1-\alpha)A \frac{K}{vL}$$

Although R is a return to capital, savers who contribute to capital formation must do this through the financial sector. The margin of financial intermediation is denoted as i , while the return those households receive for their savings (\dot{B}) is r . Hence, the financial sector earns a return of ri as the price of intermediation i.e. converting saving of the household to capital formation for the firm. Therefore:

$$(3.4.25) R = r + ri = r(1 + i) = \alpha A$$

What then are the impacts of financial intermediation and the existence of a well-balanced financial sector? This will mean lower costs of intermediation, lowering i . Hence from equation, r will rise since $r(1+i)$ is a constant, i.e. αA . An increase in r increases the growth rate of g . Hence financial development increases the endogenous rate of growth in an economy.

On the other hand, economic growth and development (for example, via technological progress or importing foreign technology) will cause A to increase, since $r(1 + i) = \alpha A$, an increase in A will cause r to increase. This allows the financial sector to expand since it will attract more savings and can distribute more investment (thus earning more profits even if the cost of intermediation I is constant).

Therefore, the third model shows that finance can affect growth (development) and development can affect growth. There is bi-variate and bi-directional causality (so Robinson and Schumpeter are both right)

Table 3.2 Conclusions of Three Theoretical Models			
Model	Model Characteristics	Causations based on theories	Direction based on theories
Model I	Exogenous growth	Significant and positive effects from economy to finance	Economic Growth \Rightarrow Financial Development
Model II	Endogenous growth	Significant and positive effects from finance to economy	Economic Growth \Leftarrow Financial Development
Model III		Significant and positive bi-directional causations between finance and economy	Economic Growth \Leftrightarrow Financial Development

3.5 Conclusion

This chapter provides a theoretical view to study economic development with a consideration of financial growth. The first section shows a simple summary of two different Core approaches for economic development: exogenous and endogenous growth frameworks. There follow surveys about theoretical models nearly based on the two different approaches, while there is more concentration on the endogenous growth theories involving financial factors.

The original models in this thesis are presented in the last section of this chapter, and one of them is exogenous and other two are endogenous models. The first one provides us an acceptable reason to link the importance of trade in economic development with finance; the second model shows us an important conclusion that financial growth plays the same important role in economic development as real sectors

of investment, through an approach of the two-sectors model; a third model uses financial bonds as an important indicator to present the importance of financial growth in the process of economic development.

These three models present different causation directions between economic development and financial growth, but in the theoretical views all of these models provide a Core theoretical idea to verify the positive relationships between economic development and financial growth, based on solid mathematical methodology. Therefore, this chapter is the theoretical base for our following empirical estimations, which works like a cornerstone in this thesis.

Chapter Four⁸

Evaluations of Structural Breaks for Economic Development with Finance for NICs⁹ in Asia

4.1 Introduction

The newly industrialized countries in Asian region increasingly show a strong upward trend in many aspects of their macroeconomic performance, such as the growth of GDP, development of financial sectors, quality of investment and trade expansion. A favorable macroeconomic environment, in the era of globalization, is essential for economic development particularly in the fields of financial sectors, investment and trading sectors. However, exogenous international shocks can displace a developing country from its long-run stationary growth path, particularly in highly open and globally integrated economies such as in the Pacific Asia. It is important to analyse the consequences of such shocks and to investigate whether the underlying growth rates are stable in the face of such shocks. If long run stationarity in trends are maintained in spite of international shocks, then it augurs well for long term development. On the other hand, volatility in trends and structural breaks create problems for the long run.

Much of previous research has considered exogenously determined shocks and structural breaks, such as the financial crisis in Asia during 1997. But these a priori

⁸ This chapter is jointly investigating and analysing NICs with the following chapter together.

⁹ NICs mean the newly industrialized countries; and in this thesis the NICs mean four typical newly industrialized countries in Asia: Singapore, Korea, Malaysia and Thailand.

shocks need to be supported by the internal dynamics of the economies concerned. Structural breaks, particularly under rational expectations, can occur even prior to the ‘crisis’ or ‘shock’ and arbitrary dates have little meaning in understanding long term developments of the economy and how it responds to these changes in exogenous variables. This thesis attempts to investigate the presence of Endogenously Determined Structural Breaks of several indicators of macroeconomic development by employing time series annual data during the period from 1960s to 2000s for typical NICs countries in Asia—Korea¹⁰, Singapore, Thailand, and Malaysia. By considering the impact effect of shocks as data-based and endogenously determined we remove the element of arbitrariness associated with historically specified events. We then consider the issue of stationarity and stability in the face of such endogenously determined and calculated shocks.

The thesis is using a different approach for examining the process of economic development with financial sectors with a consideration of financial growth factors. We derive from the standard mean of investigating the factors determining the macroeconomic development and financial growth through evaluating whether Singapore, Korea, Malaysia and Thailand experienced statistically significant structural breaks in both variables of economic development and proxies of financial growth, and determine the timing of those breaks and their relations with the economic policies in this region. We attempt to investigate whether the endogenous structural breaks could result in some serious influences of fluctuations to affect the

¹⁰ The notion of Korea in this thesis means South Korea, or presented as Republic of Korea in World Bank. In order to make presentation to be more simple, this thesis use Korea to present South Korea only.

economic growth patterns with a consideration of financial growth during the last four decades. To do so, we will concentrate on three different models—Additive Outlier Model, Innovational Outlier I Model and Innovational Outlier II Model to scrutinize the existence of potential structural break points in the trend. A sequential test of structural breaks developed by Perron (1997) and Vogelsang (1997) is employed to endogenously evaluate the timing of such structural breaks if any exists. The section considers specific main indicators for macroeconomic development of economic outputs, investment ratio and trading openness, and financial proxies of aggregate monetization ratio, non-financial borrowings to private sectors, liquid liabilities ratio. This section presents a wide cross section of regional economies with many different characteristics but with the common feature of high growth, trade liberalisation and regional integration.

The purpose of this thesis, therefore, is to prove whether those potential structural break points did affect long-run growth, in terms of the trend of time series, in specific newly industrialized countries in Asian region. According to empirical estimation regressions, most of results demonstrate that there were three possible structural break points in this region: around 1979 (oil crisis), around mid-1980s (economic recession, following from international macroeconomic problems such as stagflation and the debt crisis), and around 1997 (financial crisis). It shows through econometric methods that the long-run stationarity of variables depicting macroeconomic development in most selected countries is not affected by these potential structural break points. Since this is mainly due to the successful adjustment

of economic policies, especially for the trading, investment and financial sectors, the positive adjustments of policies in trading and financial sectors have been able to maintain long-run sustained growth and macroeconomic development in ASEAN-Pacific regions. This in turn has helped trade expansion and industrial development at the microeconomic level. This thesis concludes that the symbiotic relationship between macro and micro economic variables has worked well in the region allowing for sustained growth in spite of exogenous shocks and structural breaks. Reduction in volatility in long run trends, and stability and stationarity of long run variables, has helped these economies to withstand shocks such as the oil price rise or the financial crisis. Effectively, we believe that there has been no hysteresis in Asian economies that we consider. This is true for all the four countries selected in the analysis of empirical estimation: Singapore, Korea, Malaysia, and Thailand

The next section in this thesis describes the economic development, performance and economic problems in the ASEAN-Pacific region. The third section performs the explanation about the econometric methodology for testing structural breaks in this thesis. In terms of that methodology, the fourth section analyses the empirical results in these four selected countries. It is worth noting that the study of this chapter is a important and compulsory basic part for advanced time-series investigations of long run and dynamic relationships in the next chapter of this thesis. This important fundamental study is not only about introductions of background for NICs in Asia, but it also linked with the following chapter technically as all variables in each country will be investigated in this chapter.

4.2 Reviews about Economic Performance and Problems for NICs in Asia

The newly industrialized economies in Asian region recorded a rapid and sustained economic growth during the 1970s, and although some decline in the world economy was reflected in a decrease in growth rates in the mid-1980. These countries were remained one of the fastest growing regions, and some countries, such as Singapore and Korea has reached the standard of some developed countries' economies. The surprising growth rates are partly attributed to the favourable world economic conditions at that time, and the oil and commodity boom around 1972. However, there are several economic shocks, from both abroad and domestic, to strike the economic development in this region. Among these shocks, three of them are most significant for economies in this region, which are around 1979, 1985 and 1997. With the notable increase in oil price around 1970s and 1985-1986, the following external factors triggered off the recession in the mid-1980s: the 1979 oil crisis, the slow-down of the US economy, the appreciation of Japanese currency (Yen), and lower external demand for electronics. At the same time, the economies were influenced largely by some domestic factors: rising costs in investment, a decrease in tourism, lack of confidents in domestic financial system, and other industries aggravated the recession. After the serious economic recession of the mid-1980s and the steady reduces in the price of oil, the governments in ASEAN-Pacific region initiated some important structural adjustments and economic reforms (Leipziger 1997). Controls on trade, finance, tax and investment were gradually declined during the late of the 1980s. For some

economies, such as Korea, deregulation has been an important component of the reform agenda.

During the same period, more efficient macroeconomic policies were made and implemented, such as outward-oriented trade and financial policies to service the economies. The Singapore and Malaysia government is the best one to implement these renewed economic reforms to stimulate and sustain the economic growth, but Philippine and Indonesia experienced political instability and poor economic management in the late 1980s and early 1990s. Government of both Korea and Thailand continue to reform their trade policies and update their financial services, and then become more outward economies, especially the reforms in Korean financial systems to be more openness.

In the second half of the 1980s, economies in ASEAN-Pacific region achieved significantly positive performances in macro-economies, trade, financial and investment growth. The recovery of the US economy in 1987 raised the demand for ASEAN product, such as electronic products from Singapore, Korea and Thailand, agriculture products from Thailand and Indonesia, construction materials from Malaysia, raw industrial materials from Indonesia and Malaysia and so on. According to Park (2001), Tan (2004), Baharumshah and Lau (2003), Indonesia, Malaysia and Thailand became the largest capital imports in the world in the 1990s; Singapore became the biggest offshore financial centre in Asia in the 1990s. Stable economic indicators, such as renewed and stable exchange rates, high saving ratio in GDP, remarkable reduction in fiscal deficits were announced and implemented in most of

countries in AESAN-Pacific region.

The Asian financial and economic crisis of 1997-1998 can be regarded as a collective shock (Haggard 2000) and it is the most serious crisis in this region's post-war economic history. After 1990s, the globalisation was processed in most developing countries, especially in the ASEAN-Pacific region. During this period, the financial markets were becoming too much integrated and some investors abroad targeted higher profit returns by short-term lending, but this result in severe potential financial risks. Compared with the previous two economic crises, the existence of the Asian financial crisis 1997-1998 was highly because of much greater integration with the rest of the world. Measure of trade and financial liberalization without having adequate institutional strength made the region more vulnerable to a speculative attack. For example, the short-term portfolio investment abroad was nearly four times higher than long-term foreign investment in Thailand. A pegged exchange regime, the weak and unstable financial system, highly leveraged borrowers initiated the crisis in Thailand, which in short time spread to Malaysia, Korea, Indonesia, and Singapore. All of economies in the Asian-Pacific region have been more or less influenced by this financial crisis.

After this crisis, economies in this region were restructured with initiating and implementing wide-ranging regulatory and institutional reforms, especially in the financial system. Singapore and Korea's government announced and implemented a series of internal reforms; Thailand and Indonesia conducted considerable institutional and the regulatory reforms; in the Philippines on-going reforms are

continued; in Malaysia some reforms in its banking system were initiated. In 2000, the demand of electronic and computer products reached a peak level, which simulate the economic growth in this region.

According to Poon and Thompson (2000), there is a significant relationship between the expectations of reforms and improvements in ASEAN economic environment. Accordingly, the financial crisis in 1997-1998 did not damage the economies, but stimulated trade flows inside and outside the ASEAN framework and more efficient reforms in domestic financial systems.

4.3 Measurements and Data for Empirical Studies of NICs

4.3.1 Measurements for Economic Outputs, Investment and Trading Sectors

The measure of economic development is represented as the logarithmic form of per capita real GDP in this thesis, which is denoted as LPRGDP for each country. In most development economics studies, the economic development is self-evidently measured in several ways, that is, nominal Gross Domestic Production (GDP), Gross National Production (GNP), and Gross National Income (GNI). There are even some complex and qualitative measures being considered in recent decades, such as the Human Development Index (HDI), income of inequality and so on. The financial structure of the economy has been studied using one of the three quantitative measures: (1) GNP or GDP in real terms; (2) per capita GNP or GDP in real terms; (3) nominal GNP or GDP. Strictly, it is believed that if one measure is used to indicate the

development level of an economy, that variable should be based on a per capita magnitude, which has been validated and certified by development economics.

In part, the usage in empirical estimation should consider the specific economic situations. As the growth rate of the population in most NIC¹¹s countries plays a significant role in economic growth, the empirical experiences indicate that it is more efficient and useful to employ the per capita value, instead of the gross value. It is believed that there are inflation variations in developing countries, so this thesis uses the real GDP value, rather than the nominal GDP value. Accordingly, per capita real GDP can be regarded as an efficient way to measure economic development for most developing countries. In addition, the notion of GNP or GNI is not broadly used in developing countries in East Asia, and compared with industrialized countries; GNP or GNI can not represent the economic development without fully understanding this region. Thus, the notion of GDP is still the main indicator in this region.

Some agree that qualitative measures like HDI might be effective indicators of the growth level of economies. There are three main reasons to explain why the HDI is not used in this studies: (i) most qualitative measures are not available in these countries, or incontinuity series; (ii) some studies have attempted to use various human resources indicators, but they are all not very efficient for development economics, because there is no standard measure of human resources in developing countries. Again, in the early stages of economic growth, the level of per capita real GDP is still the most efficient proxy to measure the economy (Jung 1986).

¹¹ NICs: Newly Industrialised Countries

The notion of trade openness has been used by many in development and international economics literatures, particularly in broadly estimating developing economies, since the impact of international trade on economic growth is becoming sensitive and trade openness can represent this impact. In this thesis, trade openness is applied as one of two control variables, which are the most two important factors in the development level of these economies being considered.

The usage of trade openness in this thesis will be considered at the same time as the local growth situations of the economies of these countries being studies. These can be identified as Newly Industrialized Countries (NICs), where the ratio of exports and imports over the GDP is very high. According to new growth theories, if one economy is more openness to international trade, it needs more imports of goods and services which definitely brings more new technology into this economy. This new technology from other economies could be adopted by domestic manufacturers and then used in local economy. Domestic productivity will therefore be improved with more openness to international trade, and then there is greater productivity in the economy. More research and development (R&D) for production should lead to spillover effects linked to avoiding and duplication of productive R&D costs (MacLaren 2000 and Weinhold 1999). Accordingly, it is believed that an economy involving more openness to international trade should grow faster than a relatively closed economy.

4.3.2 Measurements for Financial Growth in Empirical Studies of NICs

The measurements of financial growth have been discussed in most of the literatures on development economics, and those proxies for measuring financial growth differ due to various factors, especially having different research objectives. In fact, the selection of measurements for financial systems is always dominated by a number of factors, such as the empirical economic background, real situations for financial systems, methodologies for empirical regression, availability of variables and data for empirical regression and so on. In particular, the financial measures are always *argumentative issues*. (Jung, 1986)

The empirical estimation here is attempting to study the interrelationships between different stages of the economic development and growth of financial systems, as well as comparative studies in specific economies of NICs in Asia. Therefore, the selection of measurements for financial growth in different nations relies on real situations of economic and financial developments across different economies, as well as different stages of economic development.

Although some literature argue that East Asian region has partial common situations, the countries in empirical regressions have their specific real situations; therefore, the selection of financial systems differs for each country. Based on the local economic situations in the countries being considered, there are several possible appropriate measures for financial development in the countries: narrow money stock, quasi-money stock, monetary aggregates, monetization ratio, bank claims to the

private sector, and liquid liabilities in financial systems. The measurements for each country's financial system are diverse due to a variety of situations in each country such as different development stages, different institutional environment, and financial structures and so on. In the meantime, these measures are subject to the technical limitation, such as data limitation and our estimation methodology. Here, every possible measure to cover all of the countries will be attempted, but in individual country's time series analysis, the specific measures in each single country are explained again in the following sections.

4.3.2.1 The Proxy of MONRT for Financial Growth

The first proxy of measuring financial growth is named as the monetization ratio or currency ratio given by the ratio of total volume of monetary aggregates over the whole economic output, and it is represented as MONRT in empirical regressions in this thesis. In practice, this proxy has been broadly used in many publications over a period of nearly fifty years, and is especially widely used in most studies of developing economies; some typical examples involve June (1986) King and Levine (1993), Berthélemy and Varoudakis (1995) and Levine (2000). The studies have proved that this proxy of monetization ratio is more appropriate for semi-open financial systems or the lower-middle level of development stages.

Furthermore, this monetization ratio could be more appropriate for some specific nations, where the governments have a relatively high level of power to intervene in financial sectors, as governments can control the money/currency stock

or supply to ward off economic recession due to financial crisis. For example, the Chinese government announced a stimulus package involving an increase in aggregate money/currency supply (M_2) in 2009 to boost economic growth in the face of global economic turmoil from 2008. In summary, this proxy can be acknowledged as one of the important basic financial indicators to measure currency levels in the whole economy, which directly reflects the growth status of financial systems.

Conceptually, as real income and social wealth grows, the economy can be basically acknowledged to involve a relatively high level of accumulated financial assets. During a period of rapid economic growth, the increasing specialization in productive factors should lead, to some extent, to growth of real income, and thus to a rise in the stock level of real financial assets. The monetization ratio is used to measure the real size of the financial sectors for an expansive period of an economy. When the financial system expands faster than the real output sector in an economy, there will be an increase in the monetization indicator, and vice versa.

According to this monetary model of McKinnon, the accumulation of aggregates in real money balances is an essential condition before the emergence of self-financial investment in an economy. Theoretically, an increase in the monetization ratio indicates greater use of currency, rather than the expansion in the volume of bank deposits only.

Although the use of monetary aggregates is argued by some other scholars, such as Shaw (1995), Greenwood (1990), Smith and Bencivenga (1991), Levine and King (1993) and Levine (1997), the monetization ratio is still an important variable in

measuring monetary policy, especially in less-developed or semi-developed countries, and the countries in this thesis are all realistically regarded as falling into these categories.

4.3.2.2 The Proxy of PRVNF for Financial Growth

The second acceptable measure for financial growth in this thesis is designed to concentrate on studying lending by private enterprises by financial intermediaries like banks in these specific countries. This is a proxy of private non-financial borrowing, for the production of output from the financial sector, which is given as the ratio of claims on non-financial private sectors to economic outputs or nominal GDP. This is denoted as PRVNF in this thesis.

In fact, this relevant proxy of PRVNF is specified in some economies involving high proportions of private sectors over the whole economy, in order to assess the development levels of financial systems which concentrate on estimating credits allocated to private enterprise by financial sectors, as defined by Ross Levine in 1993 and 1997. It is not difficult to prove that the development of private enterprise in most South East Asian nations accounts for a large proportion of its influences on overall economic growth, and these are typical of the countries involved in the study for this thesis.

In developing countries, the classical financial development nexus can be summarized as being influenced by the following special factors: financial development relating to the growth and efficiency of the formal sector (such as

commercial banking, development banks, hedge funds, etc.) which is in competition with the informal sector (curb markets, family finance and illegal activities). Hence, financial proxies should reflect this aspect of the problem. In particular, the ability of a government to implement financial sector policies will be dependent of the size and function of the formal financial sector. Therefore, the variable of PRVNF for financial growth should be related to the three factors related above. In South East Asian economies, which are in an intermediate stage of development, it is acceptable to use PRVNF.

4.3.2.3 The Proxy of LQLBR for Financial Growth

The third proxy to measure financial growth concentrates on studies about the development status of liabilities in specific nations of South East Asia. This thesis represents this proxy as the ratio of liquid forms of liabilities over production, or nominal GDP, denoted as LQLBR in the empirical estimations. The definition of the liquid forms of liabilities differs between countries, especially in developed and developing economies. In this thesis, the variation in liquid liabilities includes several vital factors in these developing countries: (i) currency held by all sectors excluding financial institutions; (ii) all forms of deposits of enterprises received by financial sectors; (iii) life insurance reserves held by some financial agents like insurance companies; (iv) debentures given by enterprises and households; (v) savings bonds and treasury bills given by the financial institutions like banks.

Compared with the quantitative proxy of PRIVY, the proxy of LQLBR is one of

the most highly qualitative measurements in empirical estimations, and the usage of liquid liabilities is still a controversial topic (Levine, 2007). This thesis identifies the liquid liabilities as the qualitative sum of currency and deposits in the central bank, plus transferable deposits of domestic and foreign currency and electronic currency, time-saving deposits, certificates of deposits, security repurchase agreements, traveler's cheques, and shares of mutual or market funds. (Asian Development Bank, 2004).

4.3.3 Data for Empirical Estimations of NICs in Asia

The empirical sections of this section use annual data covering the period of 1953-2005 (accept some individual variables which have some shorter observation). All of annual data in all countries come from International Financial Statistics (IMF, 2006) and World Development Indicators (World Bank, 2006). Although most papers use the quarter data or month data, this section are employing the annual data for every country's study; actually, there are two main reasons for employing the annual data, rather than quarterly data or monthly data: Firstly, some financial variables for estimated countries in the past did not move too much, because of the implementation of fixed or pegging exchange rate system, so that it needs some variation of it in our studies.

The annual data is a more efficient way to reveal the higher variation than the quarterly data or monthly data. Secondly, the GDP data revealed annually is more accurate and reliable than quarterly or monthly GDP data, in other words, the GDP

reported in higher frequency is less efficient in most econometric models. Finally, most papers in the subject of development economics prefer to employ per capita GDP for evaluating the economic growth, rather than only nominal gross GDP. Accordingly, this section uses the per capita GDP, which requires using annual data of population. Although variety data are represented as different kind of currency (US currency or local currency), all variables in this section have been transferred to local currency, and most variables' data are quoted as constant local currency with some mathematical transferring method. The data are normally represented as the form of natural logarithms; therefore, the data with natural logarithms can be explained in growth terms after taking the first difference.

4.4 Conceptual Links between Proxies and Financial Functions

A detailed review of how financial functions can affect growth has been presented in a previous chapter. This section explains how the variables in empirical regressions are linked with the functions of financial systems. Actually, this interpretation simultaneously provides a theoretical basis to use these variables in empirical regressions and analyses for these specific countries. The selection of financial proxies is practically based on how a well-developed financial system works in an economy, which actually indicates some significant links of variables in empirical regressions with functions of financial systems in estimated economies.

A well-developed financial system should play a remarkable role in the financing of economic development, in particular raising the level of capital productivity, savings, investments and finally the growth of economic outputs. Although in practical terms the financial sectors are composed of a wide variety of multifarious and complicated institutions, the contributions to the whole community from financial sectors are indiscriminately summarized here in the following points: (i) the degree of monetization in the whole economy; (ii) the development of commercial banks with supervision from central banks or governments; (iii) the development of financial institutions and markets, taking charge of the management of financial assets.

In terms of the specific development situations in the countries studies for this thesis, the above three requisites can be extended as the following discussions. Firstly, when transactions take the form of barter, this is obviously costly in either resources or time, since sellers must spend effort in finding buyers who have the goods which sellers want. Money works as a means of exchange to avoid the problems of highly possible existences of coincidence of wants, and hence money is introduced into the market as a resource to raise the level of capital productivity. With reference to issues of monetization degree in an economy, it can be concluded that when full monetization of the economy occurs, it replaces barter as a means of exchange.

Secondly, the financial intermediaries can be studied together with concerns about the contributions of savings and investments in the economy. In order to keep liquid, savers want to lend for only a short period, while investors wish to borrow for

a relatively longer period. A market without financial intermediations must involve some troubles, even conflicts. Financial intermediaries satisfy both the expectations of short-term lending and long-term borrowing for savers and investors respectively. The well-financial intermediaries are effectively able to encourage greater savings and investments, through reducing both transaction costs and information costs for savers or investors and overcoming the problem of indivisibilities.

Thirdly, since the latest concern for developing countries' financial markets is how efficiently resources can be allocated, the new merit for financial systems is to refer to the introduction of financial liabilities, allowing savers to keep part of their assets in financial form. Furthermore, liquid forms of liabilities in financial markets are becoming one of the most important acquisitions to be employed in allocating resources and, compared with solid forms of liabilities, liquid liabilities are a more efficient means of facilitating the allocation of resources to the most productive sectors of the economy, and in this case the investments can be more flexibly allocated to any sector.

The financial proxies in this thesis are employed in empirical regressions for these reasons:

- (i) the first financial proxy is the monetization (currency) ratio, denoted as MONRT; this indicator is linked with the first of the above requisites as a monetization degree in the economy;
- (ii) the second financial proxy means bank credits to non-financial private sectors, denoted as PRVNF; this measurement is about the second and third

of the above requisites as the commercial bank development and development of financial intermediaries;

- (iii) the third financial proxy means the financial depth or liabilities' growth, denoted as LQLBR; this variable refers to the third of above requisites as the development of financial intermediaries, in particular ideas about efficient allocation of resources by financial intermediaries.

4.5 Empirical Estimations and Results: Evaluation of Stationarity

4.5.1 Methodology for Empirical Estimations

4.5.1.1 Augmented Dickey Fuller and Phillip-Perron unit root tests

Firstly, let us consider the first order autoregressive process like $X_t = \phi X_{t-1} + \varepsilon_t$ where ε_t is white noise. This equation may be written as $X_t - \phi X_{t-1} = \varepsilon_t$ or as $(1 - \phi L)X_t = \varepsilon_t$. This equation to be stationary the root of the characteristic equation $1 - \phi L = 0$ must be greater than unity in absolute value. So this equation has one root only, which is $L = 1/\phi$, and therefore stationarity $1 < \phi < 1$. Thus, the null hypothesis of non-stationary is really $|\phi| \geq 1$ and the alternative hypothesis of stationary is $|\phi| < 1$. Actually, the problem of the unit root is actually the unity of ϕ in above equation, i.e. the problem of non-stationary of the corresponding process. Therefore, a unit root can be described as an alternative approach to present non-stationarity.

If we subtract X_{t-1} from both sides in equation (4.1), the new equation can be

obtained as $X_t - X_{t-1} = \varphi X_t - X_{t-1} + \varepsilon_t$. That can be re-written as $\Delta X_t = \delta X_{t-1} + \varepsilon_t$. Supposed φ is positive, a new version of the hypothesis can be obtained as $H_0: \delta \geq 0$ Non-Stationary against $H_1: \delta < 0$ Stationary. If $\delta = 0$ or $\varphi = 1$, the null hypothesis can be accepted, and the corresponding process is non-stationary. That means the unit root problem, or non-stationary problem can be presented by either $\delta = 0$ or $\varphi = 1$. In other words, the testing of non-stationary in the analysis of time series is actually to examine whether $\delta = 0$ in the regression of equation (4.4) or equivalently whether $\varphi = 1$.

The unit root tests are pioneered by Dickey (1979), Dickey and Fuller (1979, 1981), with the null hypothesis of the presence of unit root against the alternative hypothesis of stationary for the variables in econometric modelling.

Dickey-Fuller considers only the first-order autoregressive process; and if this simple version process is generalized, a more general case of equation can be obtained with a consideration of qth-order autoregressive process instead of only first-order autoregressive process $X_t = \varphi_1 X_{t-1} + \varphi_2 X_{t-2} + \varphi_3 X_{t-3} + \dots + \varphi_q X_{t-q} + \varepsilon_t$. From this equation, the disturbance in first-order autoregressive equation could not white noise, but they could be serially correlated. Actually, if the disturbances in the first-order autoregressive equation were correlated, the Dickey-Fuller unit root test is not valid, and thus the Augmented Dickey Fuller method has to be considered instead of the simple version.

Since the Dickey-Fuller equations, based on first-order autoregressive process, have been augmented with the lagged differenced terms to generate equations, based

on the q th-order autoregressive process, the classical standard Dickey Fuller test applied to the latter equations is named as the augmented Dickey Fuller (ADF) test, which is regarded as a more comprehensive and rigorous unit root test. Although ADF tests are different from DF tests theoretically, the critical values for the Dickey-Fuller still hold for the ADF, and the testing of hypothesis in ADF test is same as described in DF test. Thus, one of the reasons for augmenting the initial Dickey-Fuller equations with extra lagged differenced terms was to eliminate possible autocorrelation in the disturbances. In order to exam how many extra terms we have to include in the equations, the usual Schwartz criterion (SC) or Akaike's information criterion (AIC) could be used in the econometric estimation. In the ADF unit root tests section of this thesis, the standard Schwartz criterion (SC) will be employed in the empirical estimation.

Phillip and Perron test for unit roots is pioneered by Phillip (1987), and augmented by Perron (1988) and Phillip and Perron (1988). Following the estimation equation in the Dickey Fuller approach, the t-test statistics need to be amended in order to consider any bias because of the possible autocorrelation in the disturbance term in the Dickey Fuller regression models. The bias comes out if the variance of the real population like $\sigma = \lim_{T \rightarrow \infty} E(T^{-1} S_T^2)$ which differs from the variance of the residuals in the estimation equation of $\sigma_u = \lim_{T \rightarrow \infty} T^{-1} \sum_{t=1}^T E(u_t^2)$. Consistent estimators of σ^2 and σ_u^2 are: $S_u^2 = T^{-1} \sum_{t=1}^T (u_t^2)$ and $S_{T\ell}^2 = T^{-1} \sum_{t=1}^T (u_t^2) + 2T^{-1} \sum_{t=1}^{\ell} \sum_{t=j+1}^T u_t u_{t=j}$, where ℓ means the lag truncation parameter used to ensure that autocorrelation of the residuals

is fully considered in the estimation. It is evident that if there is no autocorrelation in the equations $S_{T\ell}^2$ is zero and $\sigma^2 = \sigma_u^2$.

This thesis employs the PP test as the second approach to examine the order of the integration of variables in econometric modelling. Both the ADF and PP unit roots tests are considering the results from either equations with trend or equations with trend and constant. Since most of variables in our empirical case are trended, the terms of trend need to be included in our estimation.

4.4.1.2 Stationary Tests with Endogenous Structural Breaks

According to the description above, it is evident that there is a crucial problem in Dickey Fuller and Phillip Perron unit root tests, i.e. both approaches assumed absolutely the deterministic trend is specified correctly. Supposed a time series is stationary around a deterministic time trend which might be able to have a permanent shift, the usual approach for stationarity, such as ADF or PP, will definitely lead to some mistaken results without a consideration of that change. Perron (1989) presents an effective method to examine the roles of a structural break in a time series, which appears to be non-stationary but in fact stationary. In the light of descriptions by Perron (1989), it is evident that apparent persistence in empirical data might be a result of un-considered structural breaks in the econometric modelling. Accordingly, some macroeconomic variables that were judged to have unit roots might really be a stationary process with some underlying structural break points in the estimation process.

Perron's (1989) works are based on an unrealistic assumption that break points are considered as exogenously determined in the econometric modelling, which means break points are *priori* (Perron 1989) and are independent of empirical variables and data. This unrealistic assumption has been criticised by many econometricians, e.g. Andrew and Zivot (1992), Banerjee, Lumsdaine, and Stock (1992), Perron and Vogelsang (1992) and Perron (1997), and these scholars have augmented Perron's (1989) model through a consideration of structural break points as endogenously dominated in the regression modelling. Andrew and Zivot (1992) employ a variety of recursive tests to obtain the asymptotic distribution of the test statistic and to tabulate the critical values. Vogelsang and Perron (1992) use similar approaches to consider the structural breaks endogenously in their empirical studies. Later, Perron (1997) considers the structural break points before applying the empirical data, whereas Perron (1989) argues the structural break points are *prior*. This thesis is employing the Perron (1997) methodology to examine the structural breaks in our empirical analysis, as this approach covers mostly possible structural break points in the empirical data.

According to Perron (1997) methodology, the null hypothesis is that a series is a realisation of time series process characterized by the existence of a unit root and a possibly non-zero drift (Perron 1998). And this method is generalized to allow a one-time change in the structure at a time T_b with $1 < T_b < T$ where a sample size $T+1$ is available. It should be noted, however, the break time of T_b are different from accurate break point, as the regression are only estimated with assumed break dates of

T_b . With a consideration of this null hypothesis, there are two different models to be used in the light of Perron's (1989, 1997) studies: Additive Outlier (AO) Model and Innovational Outlier (IO) model. In empirical estimation procedures, the latter is normally divided into two approaches, i.e. IO1 and IO2 models. The Additive Outlier (AO) model is referred to a series presenting a change suddenly in the break point (T_b), while the Innovational Outlier (IO) model is suitable for a series presenting a change gradually over the time.

The Innovational Outlier (IO) model is performed with two different approaches due to different types of changes in the trend over time. The first Innovational Outlier (IO1) model allows a change only in the intercept under the null and alternative hypothesis, whereas the second Innovational Outlier (IO2) model allows changes not only in intercept but also in the slope. But the unit root tests with both approaches are performed with the t statistics for testing $\delta=1$ in the regression tests. Based on this description, two types of the Innovational Outlier model can be exhibited as following:

$$X_t = \alpha + \theta DU_t + \beta t + \lambda D(T_b)_t + \delta X_{t-1} + \sum_{j=2}^q \gamma_j \Delta X_{t-j+1} + \varepsilon_t, \text{ where } DU_t = 1 \text{ if}$$

$(t > T_b)$ and zero otherwise; $D(T_b) = 1$ if $(t = T_b + 1)$ and zero otherwise;

$$\text{Or } X_t = \alpha + \theta DU_t + \beta t + \rho DT_t + \lambda D(T_b)_t + \delta X_{t-1} + \sum_{j=2}^q \gamma_j \Delta X_{t-j+1} + \varepsilon_t, \text{ where if } (t > T_b)$$

and zero otherwise; $D(T_b) = 1$ if $(t = T_b + 1)$ and zero otherwise.

The dummy variable $D(T_b)_t$ is introduced by Perron (1998). If the t-statistic for δ in absolute value is larger than critical value, the null hypothesis of the unit roots can

be rejected in favour of an alternative hypothesis of stationary around break dates (Tb).

The Additive Outlier (AO) model allows a series to include shifts in the trend over the time rather than some sudden changes in the IO models. The procedures here are applied for two steps. It should be noted that the discussion about two-step procedure is different from the discussion by Perron (1989), since there are some errors in the additive model. This two-step procedure has been criticised by Perron (1993) and more extensively by Vogelsang and Perron (1992). The first step is to estimate the trend function of the series and removed from the original function, and that means to define the new term of \tilde{X}_t as the de-trended series in the Additive Outlier model. Since the Additive Outlier approach is performed with three equations:

$$\text{I) } X_t = \alpha + \beta t + \theta DU_t + \tilde{X}_t$$

$$\text{II) } X_t = \alpha + \beta t + \theta DU_t + \rho DT_t^* + \tilde{X}_t$$

$$\text{III) } X_t = \alpha + \beta t + \rho DT_t^* + \tilde{X}_t$$

The second step is based to test on the sum of the autoregressive coefficients is to unity in the autoregression applied to the estimated noise component \tilde{X}_t :

$$\tilde{X}_t = \delta \tilde{X}_{t-1} + \sum_{i=2}^q \lambda_i D(T_b)_{t-i+1} + \sum_{j=2}^q \gamma_j \Delta \tilde{X}_{t-j+1} + \varepsilon_t \text{ or } \tilde{X}_t = \delta \tilde{X}_{t-1} + \sum_{j=2}^q \gamma_j \Delta \tilde{X}_{t-j+1} + \varepsilon_t$$

This two-step approach permits a test for a unit root that is invariant to the magnitude of the change in slope asymptotically under the null hypothesis.

With understanding three approaches, i.e. the AO, IO1 and IO2 models, the next step for Perron's unit roots test with structural break is how to choose and estimate the break points in these models.. The first method used in the empirical parts of this

thesis is given as UR method, which involves choosing T_b that $t_{\hat{\alpha}}$ is minimized with the definition $t_{\alpha}(i) = \text{Min}_{T_b \in (K+1, T)} t\hat{\alpha}(i, T_b, k) (i = 1, 2, 3)$ (Perron 1997). The second method is named as STUD method, where T_b is chosen to minimize not only the t-statistic on the coefficient linked with the change in the intercept but also the t-statistic on the change in slope. The third method performed as STUDABS method, with which the break date is chosen without a consideration of the sign of the change, so that the break time is selected by the maximum of the t_{θ} or t_{γ} in absolute value.

4.5.2 Empirical Results for Each Estimated Country of NICs

With the econometric methodology involved in previous chapter, this chapter begins to analysis the empirical results in four stylized newly industrialized countries i.e. Singapore, Korea, Malaysia, and Thailand.

The stationary analysis about variables in empirical estimation is to investigate the stationarity characteristics of the variables, which means to examine the order of integration of the variables, and then to predict whether all variables are suitable for our time series analysis. In addition, cointegration techniques in the following chapter requires all variables should be I(1), so this chapter provides some fundamental work for the following study of NICs in Asia. As an important basic empirical analysis for the following chapter of studying NICs, this chapter is composed of two main sections to investigate the structural breaks for economic development with finance for NICs in Asia, and this procedure includes three methods: Augmented Dickey Fuller (ADF), Phillip-Perron (PP) and Perron structural break tests (Perron). The first two methods,

ADF and PP tests, are classical approach to test the stationarity of the variables, and the Perron's route is based on different mechanisms, which considers the some critical effects from endogenous structural breaks on tests of stationarity. Our endogenous structural break tests with a consideration of structural breaks will be employed to inspect the exact points of potential structural breaks, and then to analyze the issues of potential structural breaks.

The first two methods are employed broadly in economic literatures, but the Perron's method is more efficient for developing countries' studies, because developing economies normally involve some obvious endogenous macroeconomic shocks in their growth stage, which is highly possible to cause some crucial misspecification of stationarity examination. This section concentrates on describing the empirical results, and they reported in each country respectively.

4.5.2.1 Examination of Stationarity for Variables in Singapore

The empirical table includes estimated results of variables with the ADF and PP test methods. Both of ADF and PP tests consider the estimation either with intercept only or with trend and constant. The empirical results suggest the variable of economic outputs (LPRGDPSG) in Singapore is integrated of order one, $I(1)$, in 5% level of significance and stationary in their first difference. The same results are presented for the variables of investment ratio (LINVSRSG) and openness (LTROPNSG), as well as all variables of financial indicators¹², LMONRTSG,

¹² For more details for financial indicators, please refer to the previous section of this chapter

LPRVNFSG, and LLQLBRSG

Stationarity Tests: ADF & Philip-Perron Unit Root Tests								
Tests Variables	Level				First Difference			
	Augmented Dickey-Fuller Stationary Test		Philip-Perron Stationary Test		Augmented Dickey-Fuller Stationary Test		Philip-Perron Stationary Test	
	with intercept only	with trend & constant	with intercept only	with trend & constant	with intercept only	with trend & constant	with intercept only	with trend & constant
LPRGDPG	-3.659040* (0.023)	-2.511727 (0.3210)	-3.659040* (0.023)	-2.511727 (0.3210)	-4.0009267* (0.0037)	-4.507724* (0.0050)	-4.0009267* (0.0037)	-4.507724* (0.0050)
LINVSRS	-1.436279 (0.5537)	-1.786038 (0.6900)	-1.867947 (0.3432)	-2.370131 (0.3882)	-3.701775* (0.0083)	-4.158008* (0.0121)	-3.631894* (0.0099)	-4.120221* (0.0132)
LITROPNSG	-1.872956 (0.3408)	-2.177753 (0.4870)	-1.818145 (0.3662)	-1.920219 (0.6240)	-4.214357* (0.0022)	-4.145957* (0.0127)	-5.136907* (0.0002)	-5.087526* (0.0011)
LMONRTSG	-0.458137 (0.8882)	-2.549032 (0.3044)	-0.421505 (0.8950)	-2.586377 (0.2883)	-5.614771* (0.0000)	-5.558770* (0.0003)	-5.602338* (0.0000)	-5.543172* (0.0003)
LLQLBRSG	-1.537306 (0.5052)	-1.169211 (0.9040)	-1.590834 (0.4783)	-1.00040 (0.9331)	-7.107250* (0.00000)	-7.261909* (0.0000)	-7.099383* (0.0000)	-7.378876* (0.0000)
LPRVNFSG	-1.840737 (0.3555)	0.737264 (0.9995)	-1.096783 (0.7068)	0.618537 (0.9993)	-3.495217* (0.0139)	-5.099764* (0.0011)	-3.642133* (0.0096)	-5.104558* (0.0011)

Notes:
1. (**) and (*) indicate 1% and 5% level of significance respectively.
2. Number in parentheses shows p-value.
3. All the variables here are in natural logarithms

The following table denotes the Perron's route to test the stationarity of variables in Singapore case, which considers the effects from endogenous structural breaks on unit root tests.

For Perron's examination route, those with methods UR, STUD and STUBABS are reported completely, but we need to know the empirical outputs from STUD and STUDBAS should theoretically be the same. A mixture of results can be obtained with a jointly discussion with ADF and PP tests: all variables in our empirical model in Singapore appear to be stationary in levels either at the 1% and 5% confident level. All variables here are identified to be integrated of order one, and each variable include one unit root, therefore they are all significantly shown as the I(1) series.

Stationarity Test with endogenous structural break										
Model	UR Method			STUD Method			STUDABS Method			
	Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
Model AO										
LPRGDPSG	2002	1	-3.34910	1980	1	-2.78081	1980	1	-2.78081	
LINVSRSRG	1979	2	-4.08814	1982	2	-3.56669	1982	2	-3.56669	
LTROPNSG	1977	1	-3.40885	1979	1	-3.27899	1979	1	-3.27899	
LMONRTSG	1971	1	-3.20380	1974	0	-2.83506	1974	0	-2.83506	
LIQLBRSG	1992	0	-3.31580	1990	7	-2.78330	1990	7	-2.78330	
LPRVNFSG	1991	5	-3.70419	1995	8	-3.70419	1995	8	-3.70419	
Model IO1										
Model	UR Method			STUD Method			STUDABS Method			
	Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
LPRGDPSG	1996	0	-4.03806	1996	0	-4.03806	1996	0	-4.03806	
LINVSRSRG	2000	1	-3.27187	1994	10	1.95093	1994	10	1.95093	
LTROPNSG	1974	1	-3.67068	1980	6	2.33245	1980	6	2.33245	
LMONRTSG	1993	9	-3.45322	1993	9	-3.45322	1993	9	-3.45322	
LIQLBRSG	1998	7	-2.66443	1991	6	-0.31586	1991	6	-0.31586	
LPRVNFSG	1999	0	-1.71318	1999	0	-1.71318	1999	0	-1.71318	
Model IO2										
Model	UR Method			STUD Method			STUDABS Method			
	Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
LPRGDPSG	1994	9	-4.64849	1994	9	-4.64849	1994	9	-4.64849	
LINVSRSRG	1978	2	-3.58418	1982	2	-3.18745	1982	2	-3.18745	
LTROPNSG	1974	1	-3.80703	1974	1	-3.80703	1974	1	-3.80703	
LMONRTSG	1996	7	-3.77345	1996	7	-3.77345	1996	7	-3.77345	
LIQLBRSG	1988	10	-4.69580	1988	10	-4.69580	1988	10	-4.69580	
LPRVNFSG	1992	0	-2.00656	1991	0	-1.95898	1991	0	-1.95898	

In a summary, all of above empirical results indicate that each of variables in non-stationary when the series are in their levels. But first-differencing the variables removes the non-stationary components in all cases, therefore the null of hypothesis of non-stationary is clearly rejected. All series in Singapore empirical model have been certified to be integrated of order one, I(1), which is as the same as what we expected. Therefore, the three different methods are all able to prove that the economic outputs, investment ratio, trading openness and financial indicators are all regarded as the non-stationary in their levels. And all variables are suitable for further study like cointegration and vector-error correction analysis, as those variables are all integrated of order one.

4.5.2.2 Examination of Stationary for Variables in Malaysia

This subsection is investigating the stationarity of variables in Malaysia case. The empirical results suggest the variable of economic outputs (LPRGDPML) in Malaysia is integrated of order one, $I(1)$, in 5% level of significance and stationary in their first difference. The same results are presented for the variables of investment ratio (LINVSRML) and openness (LTROPNML), as well as all variables of financial proxies (LFML): LMONRTML, LPRVNFML, and LLQLBRML

Stationarity Tests: ADF & Philip-Perron Unit Root Tests								
Tests Variables	Level				First Difference			
	Augmented Dickey-Fuller Stationary Test		Philip-Perron Stationary Test		Augmented Dickey-Fuller Stationary Test		Philip-Perron Stationary Test	
	with intercept only	with trend & constant	with intercept only	with trend & constant	with intercept only	with trend & constant	with intercept only	with trend & constant
LPRGDPML	-0.662860 (0.8454)	-1.897604 (0.6389)	-0.651731 (0.8481)	-2.265990 (0.4429)	-5.530626* (0.0000)	-5.486104* (0.0003)	-5.539774* (0.0000)	-5.495368* (0.00003)
LINVSRML	-1.905858 (0.3266)	-1.588795 (0.7810)	-2.338857 (0.1648)	-1.132850 (0.9116)	-4.722671* (0.0004)	-4.842651* (0.0017)	-4.702288* (0.0004)	-4.789467* (0.0020)
LTRPONML	0.495665 (0.9847)	-2.863780 (0.1839)	0.478753 (0.9841)	-2.859574 (0.1851)	-5.327954* (0.0001)	-5.470223* (0.00003)	-5.240785* (0.0001)	-5.398217* (0.0003)
LMONRTML	-0.957790 (0.7599)	-2.944864 (0.1591)	-1.477014 (0.5358)	-2.984614 (0.1479)	-7.568586* (0.0000)	-6.455037* (0.0000)	-9.377449* (0.0000)	-10.80210* (0.0000)
LLQLBRML	-1.701556 (0.4328)	-3.516163 (0.0519)	-1.712458 (0.4184)	-3.423105 (0.0607)	-7.379348* (0.0000)	-5.008081* (0.0012)	-9.983848* (0.0000)	-14.16889* (0.0000)
LPRVNFML	-2.669353 (0.0875)	-0.777723 (0.9600)	-2.794044 (0.0673)	-0.673309 (0.9689)	-6.578226* (0.0000)	-7.258546* (0.0000)	-6.579544* (0.0000)	-7.286492* (0.0000)

Notes:
1. (**) and (*) indicate 1% and 5% level of significance respectively.
2. Number in parentheses shows p-value.
3. All the variables here are in natural logarithms

According the Perron approaches with endogenous structural breaks in Malaysia, all variables are identified to be integrated of order one, and each variable include one unit root, therefore they can be shown as the $I(1)$ series. However, it should be noted here the variables of LLQLBRML seems to be the $I(0)$ with the Model IO2. These two variables are identified to be $I(1)$ with other two methods, as well as ADF and PP methods, thus they can be regarded as $I(1)$ series in the following studies.

Stationarity Test: Tests with endogenous structural break									
Model	Model A0								
	UR Method			STUD Method			STUDABS Method		
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
LPRGDPML	2003	5	-4.49322	1997	3	-3.14666	1997	3	-3.14666
LINVSRML	1997	1	-4.12531	1995	3	-5.85798*	1995	3	-5.85798*
LTROPNML	1997	1	-3.74350	1972	1	-3.45488	1972	1	-3.45488
LMONETML	1984	7	-3.91172	1985	7	-3.89614	1985	7	-3.89614
LIQIBNML	1980	3	-3.37377	1983	3	-3.11348	1983	3	-3.11348
LPRVNEML	1907	5	-4.36098	1986	5	-4.28929	1986	5	-4.28929
Model	Model I01								
	UR Method			STUD Method			STUDABS Method		
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
LPRGDPML	1977	8	-5.05777	1977	8	-5.05777	1977	8	-5.05777
LINVSRML	1996	1	-4.92167	1996	1	-4.92167	1996	1	-4.92167
LTROPNML	1986	0	-3.68117	1986	0	-3.68117	1986	0	-3.68117
LMONETML	1970	0	-3.82774	1978	7	-3.28498	1978	7	-3.28498
LIQIBNML	1988	8	-5.05541	1988	8	-5.05541	1988	8	-5.05541
LPRVNEML	1997	0	-2.47071	1988	10	1.40669	1988	10	1.40669
Model	Model I02								
	UR Method			STUD Method			STUDABS Method		
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
LPRGDPML	1982	8	-6.05663*	1984	8	-5.32311	1984	8	-5.32311
LINVSRML	1996	1	-4.47501	1991	1	-4.18732	1991	1	-4.18732
LTROPNML	1969	1	-3.71724	1972	1	-3.26118	1972	1	-3.26118
LMONETML	1985	7	-5.08520	1984	10	-4.78390	1984	10	-4.78390
LIQIBNML	1988	9	-5.48698*	1988	9	-5.48698*	1988	9	-5.48698*
LPRVNEML	1983	5	-3.91953	1983	5	-3.91953	1983	5	-3.91953

Notes:

- (*) and (**) indicate 1% and 5% level of significance respectively.
- Tb indicates estimated structural break date; K shows the lag order used in the regression.
- Lag order is selected by general-to-specific method

The empirical results in Malaysia indicate that each variable is non-stationary in their levels. But first-differential variables removes the non-stationary components in all cases, therefore the null of hypothesis of non-stationary is clearly rejected All series in Malaysia empirical model have been certified to be integrated of order one, I(1), which is as the same as what we expected.

4.5.2.3 Examination of Stationarity for Variables in Korea

The stationarity of variables in Korea models are estimated in this section. Both of ADF and PP tests with Korea's data consider the estimation either with intercept only or with trend and constant. The empirical results suggest the variables of economic outputs (LPRGDPKR), investment ratio (LINVSRKR) and trade openness (LTROPNKR) in Korea are shown significantly to be integrated of order one, I(1), in 5% level of significance and stationary in their first difference. The same results are

presented for the three different variables of financial indicators (LFKR):

LMONRTKR, LPRVNFKR, and LLQLBRKR.

Stationarity Tests: ADF & Philip-Perron Unit Root Tests								
Tests Variables	Level				First Difference			
	Augmented Dickey-Fuller Stationary Test		Philip-Perron Stationary Test		Augmented Dickey-Fuller Stationary Test		Philip-Perron Stationary Test	
	with intercept only	with trend & constant	with intercept only	with trend & constant	with intercept only	with trend & constant	with intercept only	with trend & constant
LPRGDPKR	1.149709 (0.9974)	-3.155099 (0.1049)	0.892465 (0.9947)	-3.102025 (0.1166)	-5.596409* (0.000)	-5.71780* (0.0001)	-5.637796* (0.0000)	-5.770080* (0.0001)
LINVSRRKR	-2.394806 (0.1483)	-0.944668 (0.9423)	-3.020215 (0.0505)	-1.614075 (0.7738)	-6.061065* (0.000)	-6.675500* (0.0000)	-5.483727* (0.0000)	-6.507029* (0.0000)
LTROPNKR	-1.813324 (0.3702)	-1.365887 (0.8594)	-1.956532 (0.3047)	-1.260257 (0.8866)	-7.258939* (0.0000)	-7.853408* (0.0000)	-7.258889* (0.000)	-8.45883* (0.0000)
LMONRTKR	-1.105585 (0.7069)	-2.4227 (0.3640)	-1.591996 (0.4795)	-2.247624 (0.4541)	-5.242394* (0.0001)	-5.181479* (0.0005)	-5.265667* (0.0001)	-5.206623* (0.0005)
LPRVNFKR	-1.559731 (0.4944)	-1.10023 (0.9175)	-2.159637 (0.2231)	-1.963056 (0.6073)	-2.860894* (0.0437)	-4.220402* (0.0090)	-7.557804* (0.0000)	-8.111637* (0.0000)
LLQLBRKR	-2.089480 (0.2497)	-1.565983 (0.7910)	-1.970934 (0.2982)	-1.565983 (0.7910)	-4.086532* (0.0025)	-4.147022* (0.0108)	-4.177863* (0.0019)	-4.176455* (0.0100)

Notes:
1. (**) and (*) indicate 1% and 5% level of significance respectively.
2. Number in parentheses shows p-value.
3. All the variables here are in natural logarithms

The following table denotes the Perron's routes to test the stationarity of variables in Korea models, which considers the effects from endogenous structural breaks on unit root tests. All variables of Korea's models here are identified to be integrated of order one, and each variable include one unit root, therefore they can be shown as the I(1) series.

Stationarity Test with endogenous structural break											
Model AO											
Model	UR Method			STUD Method			STUDABS Method				
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	Tb	K
LPRCIPKR	1962	9	-3.5120	1962	9	-3.5120	1962	9	-3.5120		
LINVSRKR	1974	3	-3.5818	1977	3	-3.2295	1977	3	-3.2295		
LITROPNKR	1976	1	-4.1080	1975	10	-3.1903	1975	10	-3.1903		
LMONRTKR	1969	7	-3.1020	1971	7	-3.0355	1971	7	-3.0355		
LPRVNFKR	1970	6	-4.1718	1971	6	-4.0580	1971	6	-4.0580		
LIQJHRKR	2002	10	-3.3187	1969	10	-2.0886	1969	10	-2.0886		
Model IO1											
Model	UR Method			STUD Method			STUDABS Method				
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	Tb	K
LPRCIPKR	1985	9	-4.5857	1985	9	-4.5857	1985	9	-4.5857		
LINVSRKR	1963	10	-2.8928	1964	10	-1.4144	1964	10	-1.4144		
LITROPNKR	2000	10	-4.1565	1994	10	-0.7614	1994	10	-0.7614		
LMONRTKR	1963	7	-5.1439	1963	7	-5.1439	1963	7	-5.1439		
LPRVNFKR	1965	5	-5.9436	1961	7	-3.0921	1961	7	-3.0921		
LIQJHRKR	2002	7	-3.1803	1984	9	1.8280	1984	9	1.8280		
Model IO2											
Model	UR Method			STUD Method			STUDABS Method				
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	Tb	K
LPRCIPKR	1985	9	-4.2282	1972	9	-3.3658	1972	9	-3.3658		
LINVSRKR	1975	3	-3.4848	1965	10	-1.8370	1965	10	-1.8370		
LITROPNKR	1971	10	-4.0968	1973	0	-3.9838	1973	0	-3.9838		
LMONRTKR	1963	3	-5.0861	1973	9	-0.8324	1973	9	-0.8324		
LPRVNFKR	1965	7	-8.2553*	1969	8	-1.8132	1969	8	-1.8132		
LIQJHRKR	1996	7	-3.6165	1986	8	2.3937	1986	8	2.3937		

Notes:
 ➤ (*) and (**) indicate 1% and 5% level of significance respectively.
 ➤ Tb indicates estimated structural break date; K shows the lag order in the regression.
 ➤ Lag order is selected by general-to-specific method.

In a summary, all of above empirical results indicate that each variable in Korea's models are non-stationary in their levels. All series in Korea empirical model have been certified to be integrated of order one, $I(1)$, which is as the same as what we expected. As what we explained before, the $I(1)$ series are the compulsory conditions in the empirical estimation of cointegration procedures, which means all variables involved in the cointegration procedures must contain one unit root—non-stationary in their level and stationary in their first difference.

4.5.2.4 Examination of Stationarity for Variables in Thailand

The stationarity of variables in Thailand models are estimated in this section. The empirical procedures about stationarity for Thailand variables are composed of two different parts: time-graphs description and econometric empirical tests.

The empirical econometric stationarity tests for Thailand regressions include Augmented Dickey-Fuller (ADF), and Perron-Phillips (PP). Both of ADF and PP tests consider the estimation either with intercept only or with trend and constant. The empirical results in Thailand models suggest the variable of economic outputs in Thailand (LPRGDPTH) is integrated of order one, I(1) and stationary in their first difference. The same results are presented for the variables of investment ratio (LINVSRTTH) and openness (LTROPNTH), as well as three different variables of financial proxies (LFTH): LMONRTTH, LLQLBRTH, and LPRVNFTH.

Stationarity Tests: ADF & Philip-Perron Unit Root Tests								
Tests Variables	Level				First Difference			
	Augmented Dickey-Fuller Stationary Test		Philip-Perron Stationary Test		Augmented Dickey-Fuller Stationary Test		Philip-Perron Stationary Test	
	with intercept only	with trend & constant	with intercept only	with trend & constant	with intercept only	with trend & constant	with intercept only	with trend & constant
LPRGDPTH	-0.284934 (0.9197)	-2.453803 (0.3489)	0.284553 (0.9753)	-2.678424 (0.2495)	-4.765655* (0.0003)	-4.680133* (0.0022)	-4.767371* (0.0003)	-4.681997* (0.0022)
LINVSRTTH	-1.956536 (0.3046)	-2.593847 (0.2847)	-1.508336 (0.5216)	-1.682232 (0.7451)	-5.126791* (0.0001)	-5.283957* (0.0004)	-3.97725* (0.0032)	-3.770496* (0.0264)
LTROPNTH	1.126704 (0.9973)	-1.186897 (0.9027)	1.257595 (0.9981)	-1.133742 (0.9131)	-7.029943* (0.0000)	-7.442376* (0.0000)	-7.029970* (0.0000)	-7.546949* (0.0000)
LMONRTTH	-0.739009 (0.8275)	-2.964843 (0.1520)	-0.732120 (0.8293)	-1.965237 (0.6061)	-5.529314* (0.0000)	-5.481620* (0.0002)	5.40004* (0.0000)	-5.349731* (0.0003)
LPRVNFTH	-1.797443 (0.3777)	-1.239852 (0.8911)	-2.128151 (0.2348)	-0.334922 (0.9875)	-3.469618* (0.0129)	-3.854772* (0.0214)	-4.36992* (0.0129)	-3.885652* (0.0198)
LLQLBRTH	-1.014740 (0.7401)	-2.475899 (0.3380)	-0.980944 (0.7524)	-1.073770 (0.9225)	-4.40026* (0.0010)	-4.420307* (0.0052)	-4.15623* (0.0021)	-4.128248* (0.0113)

Notes:
1. (**) and (*) indicate 1% and 5% level of significance respectively.
2. Number in parentheses shows p-value.
3. All the variables here are in natural logarithms

The following table denotes the Perron's routes to test the stationarity of variables in Thailand case. All variables here are identified to be integrated of order one, and each variable include one unit root, therefore they can be shown as the I(1) series.

In a summary, the empirical results indicate that each of variables in non-stationary in their levels. Therefore the null of hypothesis of non-stationary is clearly rejected at the 5% in Thailand's model. All series in Thailand empirical model have been certified to be integrated of order one, I(1), which is as the same as what

we expected.

Stationarity Test												
Tests with endogenous structural break												
Model AO												
Model	UR Method			STUD Method			STUDABS Method					
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	Tb	K	t-stat
LPRGDPTH	1963	7	-3.93867	1960	7	-3.77436	1960	7	-3.77436			
LINVSRTH	1996	6	-4.89065	1993	5	-3.94164	1993	5	-3.94164			
LTROPNTH	1977	5	-3.75715	1972	0	-3.21672	1972	0	-3.21672			
LMONRTH	1970	4	-3.70750	1964	4	-3.58013	1964	4	-3.58013			
LPRVNFTH	2002	1	-5.15796*	1997	7	-3.55736	1997	7	-3.55736			
LIQBRTH	1999	5	-4.16941	1997	1	-3.59442	1997	1	-3.59442			
Model IO1												
Model	UR Method			STUD Method			STUDABS Method					
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	Tb	K	t-stat
LPRGDPTH	1986	7	-5.18895	1986	7	-5.18895	1986	7	-5.18895			
LINVSRTH	1994	6	-4.77464	1996	10	-4.32454	1996	10	-4.32454			
LTROPNTH	1963	0	-2.47186	1985	0	-2.41655	1985	0	-2.41655			
LMONRTH	1987	6	-4.21937	1987	6	-4.21937	1987	6	-4.21937			
LPRVNFTH	2001	7	-4.32458	1996	5	-2.30985	1996	5	-2.30985			
LIQBRTH	1998	7	-3.37934	1998	7	-3.37934	1998	7	-3.37934			
Model IO2												
Model	UR Method			STUD Method			STUDABS Method					
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	Tb	K	t-stat
LPRGDPTH	1977	7	-4.61107	1991	3	-4.18844	1991	3	-4.18844			
LINVSRTH	1985	6	-5.33131	1985	6	-5.33131	1985	6	-5.33131			
LTROPNTH	1973	0	-3.38621	1973	0	-3.38621	1973	0	-3.38621			
LMONRTH	1988	4	-4.08190	1995	3	-3.23020	1995	3	-3.23020			
LPRVNFTH	1995	7	-4.67696	1991	7	-3.88130	1991	7	-3.88130			
LIQBRTH	1994	5	-4.89697	1991	10	-3.44487	1991	10	-3.44487			

Notes:

1) (**) and (*) indicate 1% and 5% level of significance respectively.

2) Tb indicates estimated structural break date; K shows the lag order used in the regression.

3) Lag order is selected by general to specific method

4.5.3 Comparative Analysis across Four Countries of NICs in Asia

The above individual analysis for stationarity in four empirical countries has implied that these countries contain one or more structural break points in the level trend, but finally go to stationary in their first difference. According to economic facts, the periods of break points should be around 1997 financial crisis, 1985 economic recession and 1979 oil crisis. For the indicator of economic outputs, shown as term of $LPRGDP_t^i$, where $i = [Singapore, Korea, Malaysia, Thailand]$, there is not obvious existence of structural break points in Singapore, but for rest countries the structural break points are obvious, especially in Thailand. For the indicator of trading openness, denoted by $LTROPN_t^i$, every country shows the relative obvious structural breaks in the trend, and breaks in Korea and Thailand seem to be more serious. For the

indicator of investment ratio, it is not very clear as it is more likely to involve many unrealistic breaks. The growth of financial sector, denoted by three different indicators of $LMONRT_t^i$, $LPRVNF_t^i$ and $LLQLBR_t^i$, encourages the similar presentations as either economic outputs or the trading openness, and not only Korea and Thailand, but Malaysia also show some obvious break points. In conclusion, Singapore seems less structural breaks and Thailand show more structural breaks. In Korea, Malaysia and Thailand, some of breaks are significant and some are not obviously shown.

Actually, this important information provides us an acceptable reason to consider the stationary tests under the structural break endogenously. In the following section, we will present our empirical results to inspect the exact time of potential structural break points and to analyze the endogenously structural break points in these selected newly industrialized countries of Asian region.

The empirical result of detecting endogenous structural breaks with AO, IO1 and IO2 models are represented as following tables and each table investigate the endogenously structural breaks for four countries in order to provide the comparative studies in this subsection.

The results shown in the following three tables present the endogenously structural breaks for domestic economic outputs, investment ratio and trade openness in four NICs with the variable of $LPRGDP$, $LINVSR$ and $LTROPN$ respectively. First of all, it should be noticed that the critical values in all countries are less than the t-statistic of $\delta=1$ (null hypothesis) in three models (AO, IO1 and IO2) with all of three methods, which means the unit root null hypothesis in three tables for

macroeconomic development indicators, i.e. *LPRGDP*, *LINVSR* and *LTROPN*, cannot be rejected for in all models. In terms of results in Table 1, With three models, the predominant general break dates of variable *LPRGDP* are as the following: for Singapore it is around 1980 oil crisis and around the 1997 financial crisis; for Korea it is around 1985 economic recession; for Malaysia it is around 1997 financial crisis and 1980 oil crisis; for Thailand it is around 1985 economic recession.

Table 1. Endogenously structural breaks of Economic Outputs									
Model AO: $X_t = \alpha + \beta t + \theta DU_t + \rho DT_t + \sum_{j=2}^p \gamma_j \Delta X_{t-j+1} + \varepsilon_t$									
AO	UR Method		STUD Method		STUDABS Method		Tb	K	t-stat
	Tb	K	T-stat	Tb	K	t-stat			
Singapore	2002	1	-3.34910	1997	1	-2.78081	1997	1	-2.78081
Korea	1962	9	-3.51205	1962	9	-3.51205	1962	9	-3.51205
Malaysia	2002	5	-4.49322	1997	3	-3.14666	1997	3	-3.14666
Thailand	1963	7	-3.93867	1960	7	-3.77436	1960	7	-3.77436
Model IO I: $X_t = \alpha + \theta DU_t + \beta t + \rho DT_t + \sum_{j=2}^p \gamma_j \Delta X_{t-j+1} + \varepsilon_t$									
IO I	UR Method		STUD Method		STUDABS Method		Tb	K	t-stat
	Tb	K	T-stat	Tb	K	t-stat			
Singapore	1996	0	-4.03806	1996	0	-4.03806	1996	0	-4.03806
Korea	1985	9	-4.58571	1985	9	-4.58571	1985	9	-4.58571
Malaysia	1996	8	-5.05777	1998	8	-5.05777	1998	8	-5.05777
Thailand	1986	7	-5.18895	1986	7	-5.18895	1986	7	-5.18895
Model IO II: $X_t = \alpha + \theta DU_t + \beta t + \rho DT_t + \rho DT_t + \sum_{j=2}^p \gamma_j \Delta X_{t-j+1} + \varepsilon_t$									
IO II	UR Method		STUD Method		STUDABS Method		Variables	Tb	K
	Tb	K	T-stat	Tb	K	t-stat			
Singapore	1995	9	-4.64849	1996	9	-4.64849	1996	9	-4.64849
Korea	1985	9	-4.22822	1963	9	-3.36385	1963	9	-3.36385
Malaysia	1984	8	-6.0566*	1984	8	-5.32311	1984	8	-5.32311
Thailand	1977	7	-4.61107	1991	3	-4.18844	1991	3	-4.18844

Notes:
 ➤ (*) and (**) indicate 1% and 5% level of significance respectively.
 ➤ Tb indicates estimated structural break date. K shows the lag order used in the regression.
 ➤ Lag order is selected by general-to-specific method.

The second table shows the endogenously structural breaks for investment ratio. According to Table 2, the general predominant break dates of variable *LINVSR* are the following: for Singapore it is around 1980 oil crisis; for Malaysia it is around 1997 financial crisis; for Thailand it is around 1997 financial crisis; but for Korea it is around 1975. The third table shows the endogenously structural breaks for trading openness. According to Table 3, the general predominant break dates of variable *LTROPN* are the following: for Singapore it is around 1980 oil crisis; for Korea it is around 1997 economic recession; for Malaysia it is around 1985 economic concession

and around 1997 financial crisis; for Thailand it is around 1985 economic recession.

Table 2. Endogenously structural breaks of Investment Ratio

Model									
AO: $X_t = \alpha + \beta t + \theta DU_t + \rho DT_t + \rho DT_t^* + \tilde{X}_t$									
UR Method		STUD Method		STUDABS Method		STUDABS Method		STUDABS Method	
Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	Tb
Singapore	1979	2	-4.08814	1982	2	-3.56669	1982	2	-3.56669
Korea	1974	3	-3.5818	1977	3	-3.2295	1977	3	-3.2295
Malaysia	1996	1	-4.47501	1991	1	-4.18732	1991	1	-4.18732
Thailand	1996	6	-4.89065	1993	5	-3.94164	1993	5	-3.94164

$$\text{Model IO I: } X_t = \alpha + \theta DU_t + \beta t + \lambda D(T)_t + \delta X_{t-1} + \sum_{j=2}^8 \gamma_j \Delta X_{t-j,1} + \varepsilon_t$$

Model IO I									
UR Method		STUD Method		STUDABS Method		STUDABS Method		STUDABS Method	
Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	Tb
Singapore	2000	1	-3.27187	1994	10	1.95093	1994	10	1.95093
Korea	1974	3	-3.5818	1977	3	-3.2295	1977	3	-3.2295
Malaysia	1996	1	-4.47501	1991	1	-4.18732	1991	1	-4.18732
Thailand	1996	6	-4.89065	1993	5	-3.94164	1993	5	-3.94164

$$\text{Model IO II: } X_t = \alpha + \theta DU_t + \beta t + \rho DT_t + \lambda D(T)_t + \delta X_{t-1} + \sum_{j=2}^8 \gamma_j \Delta X_{t-j,1} + \varepsilon_t$$

Model IO II									
UR Method		STUD Method		STUDABS Method		STUDABS Method		STUDABS Method	
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
Singapore	1978	2	-3.58418	1982	2	-3.18745	1982	2	-3.18745
Korea	1974	3	-3.5818	1977	3	-3.2295	1977	3	-3.2295
Malaysia	1996	1	-4.47501	1991	1	-4.18732	1991	1	-4.18732
Thailand	1996	6	-4.89065	1993	5	-3.94164	1993	5	-3.94164

Notes:
 ➤ (**) and (*) indicate 1% and 5% level of significance respectively.
 ➤ Tb indicates estimated structural break data; K shows the lag order used in the regression.
 ➤ Lag order is selected by general-to-specific method.

Table 3. Endogenously structural breaks of Trading Openness

Model									
AO: $X_t = \alpha + \beta t + \theta DU_t + \rho DT_t + \rho DT_t^* + \tilde{X}_t$									
UR Method		STUD Method		STUDABS Method		STUDABS Method		STUDABS Method	
Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	Tb
Singapore	1977	1	-3.40885	1979	1	-3.27899	1979	1	-3.27899
Korea	1976	1	-4.10801	1975	10	-3.19038	1975	10	-3.19038
Malaysia	1997	1	-3.74350	1972	1	-3.45488	1972	1	-3.45488
Thailand	1977	5	-3.75715	1972	0	-3.21672	1972	0	-3.21672

$$\text{Model IO I: } X_t = \alpha + \theta DU_t + \beta t + \lambda D(T)_t + \delta X_{t-1} + \sum_{j=2}^8 \gamma_j \Delta X_{t-j,1} + \varepsilon_t$$

Model IO I									
UR Method		STUD Method		STUDABS Method		STUDABS Method		STUDABS Method	
Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	Tb
Singapore	1996	0	-4.03806	1996	0	-4.03806	1996	0	-4.03806
Korea	1985	9	-4.58571	1985	9	-4.58571	1985	9	-4.58571
Malaysia	1996	8	-5.05777	1998	8	-5.05777	1998	8	-5.05777
Thailand	1986	7	-5.18895	1986	7	-5.18895	1986	7	-5.18895

$$\text{Model IO II: } X_t = \alpha + \theta DU_t + \beta t + \rho DT_t + \lambda D(T)_t + \delta X_{t-1} + \sum_{j=2}^8 \gamma_j \Delta X_{t-j,1} + \varepsilon_t$$

Model IO II									
UR Method		STUD Method		STUDABS Method		STUDABS Method		STUDABS Method	
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
Singapore	1995	9	-4.64849	1996	9	-4.64849	1996	9	-4.64849
Korea	1985	9	-4.22822	1963	9	-3.36585	1963	9	-3.36585
Malaysia	1984	8	-6.0566*	1984	8	-5.32311	1984	8	-5.32311
Thailand	1977	7	-4.61107	1991	3	-4.18844	1991	3	-4.18844

Notes:
 ➤ (**) and (*) indicate 1% and 5% level of significance respectively.
 ➤ Tb indicates estimated structural break data; K shows the lag order used in the regression.
 ➤ Lag order is selected by general-to-specific method.

The next three tables indicate that the structural breaks for financial growth are

examined endogenously by four proxies of financial growth:

LMONRT , *LPRVNF* and *LLQLBR* in four countries. As shown in the following three Tables, the critical values in all countries are less than the t-statistic of $\delta=1$ (null hypothesis) in three models (AO, IO1 and IO2) with all of three methods, which means the unit root null hypothesis in three tables for financial growth cannot be rejected for *LMONRT* *LPRVNF* and *LLQLBR* in all models. With three models, (AO, IO1, IO2) the predominant general break dates of first financial growth proxy, *LMONRT* , are the following: for Singapore it is around 1997 financial crisis; for Korea it is noting about three general economic crisis; for Malaysia it is around 1985 economic concession and around 1997 financial crisis; for Thailand it is around 1985 economic recession.

The predominant general break dates for second financial variable *LPRVNF* are the following: for Malaysia it is around 1980 oil crisis; for Thailand it is around 1997 economic recession and around 1980 oil crisis. It should be noted that results in Malaysia and Thailand are the similar with first proxy for financial growth. But compared with the above tables, the potential structural break points in Singapore and Korea are more variance: two points for Singapore are near 1997 and 1991; and Korea has only one possible break period of 1970-1971.

The predominant general break dates for the third financial variable *LLQLBR* are the following: for Singapore it is around 1997 and 1991; Korea involves two periods of around 1970 and 2000; Thailand's break point is only about 1997 and Malaysia is about 1980. On top of above results, the structural breaks of financial proxies in Thailand are significantly shown to be around the period of 1997

Financial Crisis. Malaysia is more likely to involve financial fluctuations in both periods of Oil Crisis and Economic Recession from 1979 to 1982 and Global Economic Recession from 1985 to 1986. But the Korea's financial growth is more likely to be affected by domestic political and economic fluctuations in either around 1970 and 1980. Singapore's financial growth is shown to involve possible fluctuations in 1997 and 2000.

Table 4.1 Endogenously structural breaks of
Financial Growth of Aggregate Monetization Ratio

AO: $X_t = \alpha + \beta t + \theta DU_t + \rho DT_t + \tilde{X}_t$									
Model	UR Method		STUD Method		STUDABS Method				
AO	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
Singapore	1971	1	-3.20380	1974	0	-2.83506	1974	0	-2.83506
Korea	1969	7	-3.1020	1971	7	-3.0355	1971	7	-3.0355
Malaysia	1984	7	-3.91172	1985	7	-3.89614	1985	7	-3.89614
Thailand	1970	4	-3.70750	1964	4	-3.58013	1964	4	-3.58013

IO I: $X_t = \alpha + \theta DU_t + \beta t + \lambda DT_t + \delta X_{t-1} + \sum_{j=1}^5 \gamma_j X_{t-j} + \varepsilon_t$									
Model	UR Method		STUD Method		STUDABS Method				
IOI	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
Singapore	1993	9	-3.45322	1993	9	-3.45322	1993	9	-3.45322
Korea	1969	7	-3.1020	1971	7	-3.0355	1971	7	-3.0355
Malaysia	1970	0	-3.82774	1978	7	-3.28498	1978	7	-3.28498
Thailand	1970	4	-3.70750	1964	4	-3.58013	1964	4	-3.58013

IO II: $X_t = \alpha + \theta DU_t + \beta t + \rho DT_t + \lambda DT_t + \delta X_{t-1} + \sum_{j=1}^5 \gamma_j \Delta X_{t-j} + \varepsilon_t$									
Model	UR Method		STUD Method		STUDABS Method				
IO II	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
Singapore	1996	7	-3.77345	1996	7	-3.77345	1996	7	-3.77345
Korea	1969	7	-3.1020	1971	7	-3.0355	1971	7	-3.0355
Malaysia	1985	7	-5.08520	1984	10	-4.78390	1984	10	-4.78390
Thailand	1970	4	-3.70750	1964	4	-3.58013	1964	4	-3.58013

Notes:
 > (*) and (**) indicate 1% and 5% level of significance respectively.
 > Tb indicates estimated structural break date; K shows the lag order used in the regression.
 > Lag order is selected by general-to-specific method.

Table 4.2 Endogenously structural breaks of
Financial Growth of Private Borrowings

AO: $X_t = \alpha + \beta t + \theta DU_t + \rho DT_t + \rho DT_t^* + \tilde{X}_t$									
Model		LR Method		STUD Method		STUDABS Method			
AO		Tb	K	T-stat	Tb	K	t-stat	Tb	K
Singapore	1991	5	-3.70419	1995	8	-3.70419	1995	8	-3.70419
Korea	1970	6	-4.1718	1971	6	-4.0580	1971	6	-4.0580
Malaysia	1987	5	-4.36098	1986	5	-4.28929	1986	5	-4.28929
Thailand	2002	1	-5.1579*	1997	7	-3.55736	1997	7	-3.55736

$$\text{Model IO I: } X_t = \alpha + \theta DU_t + \beta t + \lambda D(T_b)_t + \delta X_{t-1} + \sum_{j=2}^g \gamma_j \Delta X_{t-j+1} + \varepsilon_t$$

Model IO I									
LR Method		STUD Method		STUDABS Method					
Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	
Singapore	1999	0	-1.71318	1999	0	-1.71318	1999	0	-1.71318
Korea	1970	6	-4.1718	1971	6	-4.0580	1971	6	-4.0580
Malaysia	1987	5	-4.36098	1986	5	-4.28929	1986	5	-4.28929
Thailand	2002	1	-5.1579*	1997	7	-3.55736	1997	7	-3.55736

$$\text{Model IO II: } X_t = \alpha + \theta DU_t + \beta t + \rho DT_t + \lambda D(T_b)_t + \delta X_{t-1} + \sum_{j=2}^g \gamma_j \Delta X_{t-j+1} + \varepsilon_t$$

Model IO II									
LR Method		STUD Method		STUDABS Method					
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
Singapore	1992	0	-2.00656	1991	0	-1.95808	1991	0	-1.95808
Korea	1970	6	-4.1718	1971	6	-4.0580	1971	6	-4.0580
Malaysia	1987	5	-4.36098	1986	5	-4.28929	1986	5	-4.28929
Thailand	2002	1	-5.1579*	1997	7	-3.55736	1997	7	-3.55736

Notes:

- (**) and (*) indicate 1% and 5% level of significance respectively.
- Tb indicates estimated structural break date. K shows the lag order used in the regression.
- Lag order is selected by general-to-specific method.

Table 4.3 Endogenously structural breaks of
Financial Growth of Liquid Liabilities Ratio

AO: $X_t = \alpha + \beta t + \theta DU_t + \rho DT_t + \rho DT_t^* + \tilde{X}_t$									
Model		LR Method		STUD Method		STUDABS Method			
AO		Tb	K	T-stat	Tb	K	t-stat	Tb	K
Singapore	1992	0	-3.31580	1990	7	-2.78330	1990	7	-2.78330
Korea	2002	10	-3.3187	1969	10	-2.0886	1969	10	-2.0886
Malaysia	1980	3	-3.37377	1983	3	-3.11348	1983	3	-3.11348
Thailand	1999	5	-4.16941	1997	1	-3.59442	1997	1	-3.59442

$$\text{Model IO I: } X_t = \alpha + \theta DU_t + \beta t + \lambda D(T_b)_t + \delta X_{t-1} + \sum_{j=2}^g \gamma_j \Delta X_{t-j+1} + \varepsilon_t$$

Model IO I									
LR Method		STUD Method		STUDABS Method					
Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat	
Singapore	1998	7	-2.66443	1991	6	-0.31586	1991	6	-0.31586
Korea	2002	10	-3.3187	1969	10	-2.0886	1969	10	-2.0886
Malaysia	1980	3	-3.37377	1983	3	-3.11348	1983	3	-3.11348
Thailand	1999	5	-4.16941	1997	1	-3.59442	1997	1	-3.59442

$$\text{Model IO II: } X_t = \alpha + \theta DU_t + \beta t + \rho DT_t + \lambda D(T_b)_t + \delta X_{t-1} + \sum_{j=2}^g \gamma_j \Delta X_{t-j+1} + \varepsilon_t$$

Model IO II									
LR Method		STUD Method		STUDABS Method					
Variables	Tb	K	T-stat	Tb	K	t-stat	Tb	K	t-stat
Singapore	1988	10	-4.69580	1988	10	-4.69580	1988	10	-4.69580
Korea	2002	10	-3.3187	1969	10	-2.0886	1969	10	-2.0886
Malaysia	1980	3	-3.37377	1983	3	-3.11348	1983	3	-3.11348
Thailand	1999	5	-4.16941	1997	1	-3.59442	1997	1	-3.59442

Notes:

- (**) and (*) indicate 1% and 5% level of significance respectively.
- Tb indicates estimated structural break date. K shows the lag order used in the regression.
- Lag order is selected by general-to-specific method.

With the consideration of our results shown in the tables, the general break periods obtained correspond closely to the expected dates associated with the gradual impacts of the oil crisis around 1980 (1979-1981), the economic recession around 1985(1984-1986), and economic crisis in 1997 (1996-1998). Most of the structural breaks for the per capita real GDP for four countries occur in the period of 1996-1999, coinciding 1997 financial crisis. After 1997 financial crisis, real GDP per capita accelerated continuously because of some efficient economic reforms, and thus the economic growth remains in a stable level again after such potential structural breaks.

Furthermore, it should be noticed the individual case of Singapore in this thesis. Among four selected countries, Singapore is believed to be a successful economy to overcome the economic concessions and financial crisis. It is, of course, because of the stronger economic background and other political reasons, however, it is still believed that Singapore government has made more efficient reforms for the post economic recession, such as deeper reforms for financial sectors, reduce the ratio of fixed investment in the GDP, and so on, whereas in other relative undeveloped countries policy selection and implementation was not good, especially around the 1985 economic recession and 1997 financial crisis. According to our studies in this thesis, the potential endogenous structural breaks are very obvious and significant in most of indicators in relative underdeveloped countries rather than Singapore, In summary, the Singapore and Korea's economies remain the stable level after the economic crisis and concession, and second is Malaysia and Thailand; the policies

by Indonesia and Malaysia governments are not so efficient to keep the economic growth stably.

After the past three crucial economic crises, most of newly industrialized countries in Asia-Pacific region are well positioned to be an ever-greater force all over the world. Although India and China are more and more famous as their sharply development and attractive economic reforms, these newly industrialized countries in region are still shines in the international economic landscape.

Summary of Comparative Studies and Facts

Estimated Country	Periods of Recession	Economic Growth	Investment Ratio	Trade Openness	Financial Development			Economic Facts
					MONRT	PRVNF	LQBR	
Singapore	First Recession	-	+	-	-	-	-	Singapore is believed to be a successful economy to overcome the economic concessions and financial
	Second Recession	-	-	-	-	-	-	crisis Singapore government has made
	Third Recession	+	-	+	-	-	-	more efficient reforms for the post economic recession
Korea	First Recession	-	-	-	-	-	-	These relatively less-developed countries policy selection and implementation was not good, especially around the 1985 economic recession and 1997 financial crisis.
	Second Recession	+	-	+	-	-	-	
	Third Recession	-	-	-	-	-	-	
Malaysia	First Recession	-	-	-	-	-	+	potential endogenous structural breaks are very obvious and significant in most of indicators in relative underdeveloped countries rather than Singapore
	Second Recession	+	-	+	+	+	+	
	Third Recession	+	-	+	-	-	-	
Thailand	First Recession	-	-	-	-	-	-	underdeveloped countries rather than Singapore
	Second Recession	+	-	+	-	-	-	
	Third Recession	-	+	-	-	+	+	

Notes: 1) The first recession is 1979-1981; the second recession is around 1985; the third recession is around 1997-1998

2) “+” means the possible breaks detected by our tests; “-” means the breaks are not detected by our tests.

4.6 Conclusion and Remarks with Financial Crisis in Asia

This chapter finished investigate the stationarity of variables in four typical countries of NICs in Asia, with two traditional methods and one new idea of involving possible endogenous structural breaks. The empirical results have shown that all variables in our models are satisfied the compulsory conditions to conduct the advanced econometric analysis for long run relationships between economic development and financial growth. At the same time, the empirical results in this chapter prove that economic growth in these four typical countries of NICs in Asia is still in the up-trend trend although there are three major economic crises to affect them. Moreover, the economic fluctuations, with structural breaks, do not affect their sustainable growth trend. From this view, our further analysis of long run and dynamic investigations become much more meaningful as the financial systems should exert more roles in major factors of economic development, in particularly for outputs, investment and trade.

Now it may be instructive to look briefly at the features of the so-called Asian Crisis. Recent experiences of these economies show a number of major characteristics or features which may help to define the framework of the crisis. We discuss some of these stylized facts. Note that the objective here is to not to get at the roots of the problems of the Pacific-Asia economies, but rather to see whether the concepts and ideas postulated in this section have wider relevance to these economies which have generally had high economic growth and major expansion of the financial sector prior to the crisis in the late 1990s. We first look at the some crucial stylized facts and then

consider their implications:

First, the current account deficits were caused by private sector macro-imbalances; in other words, the macroeconomic accounts of the households and firms in aggregate were responsible (government budgets were generally healthy and most in modest surplus). Overall private sector savings was less than investment and this was reflected in current account deficits (foreign borrowings). In most other countries, the saving-investment gap is due to a reduction in household or corporate savings. However, in the Pacific-Asian national standards, so the so-called 'problem' was excessive investment. Overinvestment as apposed to overconsumption created the excess domestic demand. The financial sector may have been less than successful in curbing excess investment, but certainly cannot be blamed for its existence. In some ways, the economy was a victim of its own success.

Secondly, much of this high level of investment was financed by foreign borrowing, but this inflow was not necessarily based on FDI and equity investment, but rather on borrowing from the international commercial banking sectors. So the capital account showed excessive transfer of capital inflow but these only increased corporate debt and exposure to foreign currency risk. A devaluation was particularly harmful because it caused insolvency and then bankruptcy. The fact that much of borrowing was unhedged (given the stability of foreign exchange relative prices over the previous decades) implied greater instability and a faster downward spiral.

Thirdly, there was a huge growth of credit to the private sector from the financial sector. Asymmetric information problems arose, but lack of corporate

governance within the financial sector allowed these issues to be swept under the carpet. So long as growth rates remained at double digit figures, it was easy to borrow to finance investment since the returns from growth exceeded borrowing costs and risk premia. When the downturn appeared in growth rates, the boom became a bust and the downward spiral mirrored the earlier upward spirals. In many ways, these economies were faced with a “Ponzi game” where intertemporal and terminal constraints on borrowing were not obeyed.

The conclusion, even if somewhat weakened by the negative case study of Pacific Asia, is clear. High-quality financial expansion and development is a vital input towards economic growth. In this respect, finance is no different from other forms of physical capital. Just as roads or infrastructures are good for growth provided they are of high quality and not excessive in terms of needs, so also is financial expansion good for growth. Finally, it is worth getting a summary of purposes of this chapter: firstly, this chapter shows that every country of NICs in Asia is not affected by these potential structural breaks in both variables of financial growth and economic development. This means the expectation of up-trends of economic development with finance is confirmed, but the detailed relationships are investigated in the following chapter; secondly, this chapter provides an important basic idea for possible investigation of long run and dynamic relationships, as the econometric models for long run and dynamic relationships require compulsorily the non-stationarity for all of involved variables. But several well-known economic recessions could affect this non-stationarity, but the results from this chapter provide that all variables involved in

the examinations of long run and dynamic relationships are definitely non-stationary variables without any serious affects by three serous economic recession.

Chapter Five¹³

Analysis of Causation¹⁴ for Economic Development and Finance in NICs of Asia¹⁵

5.1 Introduction of NICs Empirical Estimations

5.1.1 Introduction

In recent decades, global economic growth has been surprisingly high, fuelled mainly by dramatic growth rates in developing nations, including the spectacular economic performance of East Asia. At the same time, there has been an incredible increase in monetary flow in the international financial market, as well as a speedy rise in the size of the global financial sector. In the light of this framework, there has been a variety of arguments on the dialectical causations of economic growth and finance development. Specifically, the critical question arises here: whether finance causes growth, or whether their growths are coterminous with or dominated by each other. In addition, does this relationship depend on the stages of economic growth with more (or fewer) levels of economic development (as evidenced by real GDP per capita) affecting the causation?

The notion of financial growth can be defined in a number of ways, including the scope of financial institutions and sectors, the extent of services of financial

¹³ This chapter uses the same countries' data and variables as the chapter four in NICs. Thus the variables and data will not be introduced again in this chapter

¹⁴ Causations include both long run cointegration relationships and dynamic causations via VEC models in each country

¹⁵ NICs in Asia includes Korea, Singapore, Malaysia and Thailand in this thesis

intermediaries, and the size of financial systems. Financial intermediation does not necessarily imply that it works as an intermediate good in the production process, but it is theoretically acknowledged to be an essential input into economic outputs, and hence, it is vital for production. In other words, the size of financial sectors, large or small, should be as much a basic part of the real economy as basic sectors of economy, such as construction, agriculture, or manufacturing. Based on these ideas, the economic growth-finance nexus can be efficiently and consistently estimated only if the artificial differences between real sectors and financial sectors of the economy are eradicated in the theoretical framework. Moreover, the financial sector should be acknowledged as one major part of the aggregate macroeconomic production function. Keeping these ideas in mind, the appropriate theoretical framework must consider all essential elements as potentially dominated endogenously in the economic process, which leads us to consider endogenous growth theories as the core theoretical framework in this chapter.

Many developing countries failed to recognize the conditions needed to establish a complete financial system for themselves until the 1970s. In the 1960s, the financial sectors were used only as tools to help finance interventionist policies, and those policies were made in the forms of credit allocations directly from governments. But the crisis from external debts obviously underlined the importance of a well-performing financial system in mobilizing internal resources. Therefore, during the past ten years, many developing countries have created many economic policies to liberalize and create better financial systems. Moreover, most developing countries in

recent decades have been involved in the process of structural adjustments, in order to correct the deficiencies resulting from their initial strategies of import substitution. In recent decades, many developing countries have made amazing strides in economic development and, at the same time, have developed efficient financial systems to provide a high quality of financial services. Thus, the links between economic and financial developments, colourfully described as “Main Street and Wall Street”, have resumed additional importance.

This thesis seeks to evaluate the empirical experiences of some specific countries of newly industrialized countries, based on the theoretical foundations of growth models. In these countries, the financial sectors account for a significant weight in the whole economy, as well as making major contributions to employment. Due to the well-performing financial systems, these countries have become creditable examples for other developing countries, since their financial experiences clearly provide good guidelines in dealing with the roles of financial sectors in economic growth performances. At the same time, these countries are trying out more far-reaching reforms of the financial sectors in economic developments, because most of them suffered under the Asian financial crisis of 1997.

This chapter summarizes the empirical findings in Asia and provides a taxonomic analysis to explain the four different kinds of causations, based on the VECM frameworks, for countries at various stages of economic development. In summary, subchapter 2 shows a basic analysis of zero-order correlations among economic outputs and three different financial growth proxies in each country. Subchapter 3

presents an introduction of econometric methodology which provides a basic knowledge to our empirical analysis of both each individual country and dynamic study with taxonomy. Subchapter 4 deals with time series models to investigate the interrelationships between finance and development for specific NICs of Asia. It also summarizes the empirical findings and provides a taxonomic analysis to explain the four different kinds of causations, based on the VECM frameworks, for countries at various stages of economic development. Although this chapter is about financial development per se, a long-run phenomenon, it may be instructive to say a few words about financial crisis, which is a short-run concept and often signals the negative aspect of financial systems. Finally, it is worth mentioning that this chapter of empirical estimations is in fact linked with some hypothesis and studies in our previous theoretical chapter, in particularly some comparative studies based on the idea of taxonomy for different stages of economic development. It is worth to mention that this chapter is using the same data source as previous chapter in NICs, but with different research purpose and methodology. Thus, this chapter will not present the repeated work of both data investigations and literature reviews.

5.1.2 A Brief Review of Asian Economies

The Newly Industrialized Countries in East Asia span nearly the whole pattern of economic growth and levels of living standards found within the developing world. The economies in East Asia have recorded a remarkable and surprising economic growth after World War II, especially in the period from the 1960s to 1970s. In fact,

international agents in the 1950s published some reports about the positive potential economic development in East Asia, when most countries were at the lowest level of development. Although most countries have suffered from several world economic crises, the macroeconomic growth performance is still one of the most outstanding regions in the world, particularly in the eight so-called “High-performing economies” (HPAEs: Japan, Republic of Korea (South Korea), Malaysia, Indonesia, Taiwan, China, Hong Kong and Singapore).

The consequences of these rapid growth rates were that the per capita GDPs (1995) in Singapore and Hong Kong were USD 22,600 and USD 23,900, respectively, compared with an average of only USD 19,400 for the OECD members. In the meantime, some countries in the East Region were just a bit less well off: South Korea USD 11,900; Malaysia USD 10,400, Thailand USD 8,000, and so on. These surprising figures and trends provide the basic reason why economic issues in East Asia have become the object of so much analytical interest, which covers a broad scope of research fields, particularly in trade sectors, financial sectors, investments, and others. This paper involves four typical economies of East Asia in empirical estimations and analytical discussions: Singapore, Korea, Malaysia and Thailand, and the financial development of these countries will be investigated together with macroeconomic developments, as well as investments and trading sectors. These four countries actually indicate four different stages of economic growth in the development world: Singapore represents the high-income and industrialized economy, which is generally regarded as a typically successful example in the

developing world; Korea has been a member of OECD since 1996, which means it has reached the status of a high-middle income country; Malaysia and Thailand are both new industrialized countries (NICs), but Malaysia is still in a relatively higher position than Thailand in the economic development stage.

The development of financial systems in these four countries has been assessed because of their extraordinarily successful economic growth performance, which has contributed to the speedy development of financial sectors in these countries. The content of financial development has been acknowledged as greater than in many other developing countries, and the main contents can be summarized as interest-rate deregulation, greater competition in banking systems, the liberalization of restrictions in financial markets and cross-border capital flows, and so on. Financial liberalization has involved the deregulation of deposit rates, and the introduction of financial instruments, equities and bonds. In Singapore, the instruments for liberalizing interest rates were completed around 1975-1976, and this was completed in Korea in the early period of the 1980s, in Malaysia around 1978, and in Thailand in about 1989. In fact, time-deposit rates in Thailand moved in slow steps, since rates were still more or less controlled by the government. Generally, the liberalization of interest rates preceded that of the financial and stock markets. With the exception of Thailand, short-term financial markets in these countries grew rapidly, following the liberalization of interest rates. The development of bond markets in these countries has been restrained by government policies in Korea, Malaysia and Thailand; although Singapore is normally acknowledged as the second biggest market in Asia,

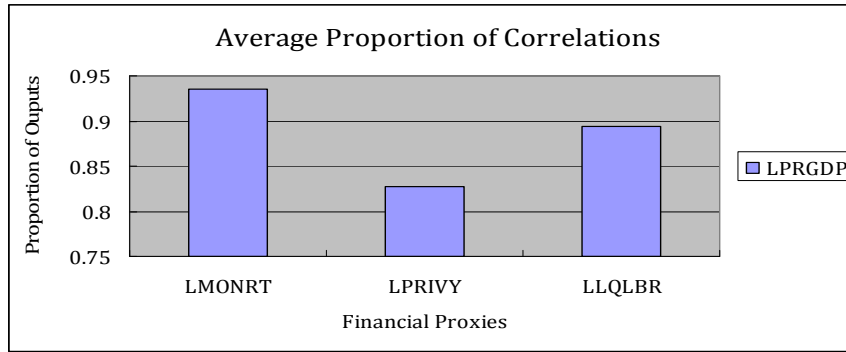
following Japan, foreign bonds dominate this market—98% are Asian Dollar Bonds. Another important market in financial systems is the equity market, and these countries' equity markets nearly tracked their amazing integral economic performance. The earliest stock market among these countries dates back over a hundred years in Malaysia, and greater performances exist in both Korea and Singapore's stock exchange markets, both of which are two of the most important indicators concerning Asian economic situations. The Thai stock exchange experienced only modest growth initially, but developed speedily after the 1979 oil crisis.

5.2 Analysis of Correlations among Variables

Following the same data investigations as previous chapter, we are beginning the empirical estimations for investigations of development-finance nexus with arguments of real sectors and financial sectors. This chapter reports the correlation matrix with zero-order route for specific countries in the time-series empirical estimations of Newly Industrialized Countries in this thesis. It is worth to recalling that the economic output is denoted as LPRGDP, and three proxies for financial growth are shown as LMONRT, LPRVNF and LLQLBR in each individual country.

Correlations Matrix for Individual Country				
Matrix for Singapore				
	LPRGDP_SG	LMONRT_SG	LPRIVY_SG	LLQLBR_SG
LPRGDP_SG	1.000000	0.885624	0.970061	0.931335
LMONRT_SG	0.885624	1.000000	0.839318	0.870386
LPRIVY_SG	0.970061	0.839318	1.000000	0.924569
LLQLBR_SG	0.931335	0.870386	0.924569	1.000000
Matrix for Korea				
	LPRGDP_KR	LMONRT_KR	LPRIVY_KR	LLQLBR_KR
LPRGDP_KR	1.000000	0.900168	0.891024	0.862956
LMONRT_KR	0.900168	1.000000	0.975635	0.974763
LPRIVY_KR	0.891024	0.975635	1.000000	0.984752
LLQLBR_KR	0.862956	0.974763	0.984752	1.000000
Matrix for Malaysia				
	LPRGDP_ML	LMONRT_ML	LPRIVY_ML	LLQLBR_ML
LPRGDP_ML	1.000000	0.929124	0.960727	0.941887
LMONRT_ML	0.929124	1.000000	0.971704	0.934388
LPRIVY_ML	0.960727	0.971704	1.000000	0.962702
LLQLBR_ML	0.941887	0.934388	0.962702	1.000000
Matrix for Thailand				
	LPRGDP_TH	LMONRT_TH	LPRIVY_TH	LLQLBR_TH
LPRGDP_TH	1.000000	0.982340	0.971739	0.983723
LMONRT_TH	0.982340	1.000000	0.956421	0.999005
LPRIVY_TH	0.971739	0.956421	1.000000	0.960991
LLQLBR_TH	0.983723	0.999005	0.960991	1.000000
Matrix for Philippine				
	LPRGDP_PH	LMONRT_PH	LPRIVY_PH	LLQLBR_PH
LPRGDP_PH	1.000000	0.960065	0.092449	0.725285
LMONRT_PH	0.960065	1.000000	0.278700	0.988679
LPRIVY_PH	0.092449	0.278700	1.000000	0.206687
LLQLBR_PH	0.725285	0.988679	0.206687	1.000000
Matrix for Indonesia				
	LPRGDP_IN	LMONRT_IN	LPRIVY_IN	LLQLBR_IN
LPRGDP_IN	1.000000	0.955084	0.578429	0.922747
LMONRT_IN	0.955084	1.000000	0.665844	0.994997
LPRIVY_IN	0.578429	0.665844	1.000000	0.702123
LLQLBR_IN	0.922747	0.994997	0.702123	1.000000

This table about individual country's correlation-matrix demonstrates that there highly exist correlations between the economic outputs (LPRGDP) and the indicators of financial growth (LMONRT, LPRIVY, LLQBR) in each specific country within this thesis. As financial growth is denoted as three major proxies, each of which represents different stages of financial growth, nearly all financial proxies are highly correlated with economic outputs in each country.



The above figure shows the average proportion to present the average correlation between financial proxies and economic outputs, and the correlation between LMONRT and LPRGDP is nearly 95 percent, but correlation between LPRIVY and LPRGDP is only 82.7 percent.

Comparative Matrix of Correlation			
Country	MN_YC	PR_YC	LQ_YC
Singapore	0.8856	0.9701	0.9313
Korea	0.9002	0.8910	0.8629
Malaysia	0.9291	0.9607	0.9419
Thailand	0.9823	0.9717	0.9837
Philippine	0.9601	0.5924	0.7253
Indonesia	0.9551	0.5784	0.9227
Average	0.9354	0.8275	0.8947

Notes: MN_YC means the correlation between LMONRT and LPRGDP; PR_YC means the correlation between LPRIVY and LPRGDP; LQ_YC means the correlation between LLQLBR and LPRGDP

In terms of different stages of the economic development, the proportions of correlations between financial proxy of LMONRT and economic outputs are decreasing from advanced development stage (Singapore) to less development stage (Indonesia), and this is the same as our theoretical understanding: the roles of aggregate money stocks in the whole financial system, even in the macroeconomic performance, are more important in lower stage of developing countries than industrialized or nearly-industrialized nations. On the other hand, the financial proxy of PRIVY is becoming more correlated with economic outputs in high-development stages of nations than in lower-development stage of economies. As the proxy of

PRIVY means the indicators for credits and claims to private enterprises, the roles of private sectors in financial systems are obviously becoming more significant in these open macro-economies. The correlation proportion of another financial proxy of LLQLBR with economic outputs is acknowledged to be average over each economy, as LQLBR is a new measure for financial system linked to liquid liabilities, which has been broadly used by governments in South East Asia for latest decades since it seems more efficient to measure financial growth compared with traditional proxies, such as quasi-money stocks, narrow money stocks and others.

Although correlation can not imply causation directly, the high proportions of correlations structure among the variables are normally acknowledged to be some results from causality. The empirical results also demonstrates the different financial proxies in each country are likely to be correlated with each other. The normal method to deal with correlated variables is to perform the principle component analysis (PCA) to integrate all proxies into one single variable. However, the method of PCA is less likely to capture all possible information from each financial proxy; for single country analysis, it might be better to use PCA, however, this thesis is concentrating on the comparative studies across each country, and in the meanwhile this thesis is also interesting on the interrelationships linked with countries at different development stages, based on an idea of taxonomy stage of development. For instance, our empirical results imply economic outputs higher-development stage countries are more correlated with LPRIVY, but less with LMONRT. Therefore, this thesis is using different financial proxies into estimated equations in each country, in order to

provide the empirical results for comparative studies across countries.

5.3 Methodology for Causations in Steady State and Dynamic Process

This subchapter introduces econometric methodology to investigate causations in steady state and dynamics for NICs of Asia. Following the previous chapter of structural breaks in NICs, the variables for economic development and financial growth are shown to be non-stationary and only involve one unit root in these variables' levels. This subchapter is describing the two main econometric frameworks:

1) cointegration vectors based on stable VAR models, which serve for our investigation and analysis of interrelationships at steady state between the variables for economic development and the proxies of financial growth in NICs of Asia; 2) vector error correction models, which are the estimation models for analyzing the dynamic causations for economic development with investment, trade and finance.

5.3.1 Investigation of Cointegrations based on Stable Models

According to discussion in the previous subchapter, there is a significant link between non-stationary processes and the concept of long run equilibrium and this link is defined as the notion of cointegration. Since the introduction of the cointegration firstly by Granger (1981), many econometrists further formalized this concept by introducing various of tests for the existence of cointegration relationship in the long run. All of these tests can be divided into two routes: one route is to test the cointegration in single equations, and the another route is to test the cointegration in

multiple equations.

The typical method for cointegration in single equation is formalized by Engle and Granger (1987), which is called Engle-Granger approach (or EG approach). In the light of empirical econometric tests, Engle-Grange approach is always regarded as the first successful attempt to test the cointegration relationship in the analysis of time series. It is believed that Engle-Granger is one of the most convenient methods for cointegration test, as EG approach is both very easy to implement and to explain. However, there are many critical shortcomings of the Engle-Granger approach. The most significant one is that: if there are more than two variables in the model, there would be more than one cointegration relationship in the regression, and then Engle-Granger approach is not suitable for this possibility because EG approach only using residuals from a single relationship; therefore, the vital problem is that it does not show us the exact number of cointegrating vectors. Due to this problem caused by EG approach, it is believed EG approach is not suitable for the empirical analysis of this thesis. Because there are more than two variables in our empirical models, there could be more than one cointegration relationship, so that Engle-Granger approach will not be discussed in this thesis.

Since our empirical regressions are based on the multiple equations, and some critical problems in Engle-Granger method when more than two variables are in the cointegration estimation, the Johansen (1988) approaches might be the suitable to test the cointegration relationships and further vector error-correction mechanism (VECM) analysis. These approaches are based on the stable vector autoregressive (VAR)

models; therefore, before testing the cointegration, it is essential to explain the VAR model briefly, and to discuss the relationship between VAR and cointegration theoretically.

5.3.1.1 Vector Autoregressive Models and Cointegrations

It is very common in economics studies to employ some models, in which some variables are not only independent variables for a given dependent variables, but also these variables can be explained by some variables which used to be determined by themselves, and in other words these variables have interactive effects for each other in the models. Then we have simultaneous-equations models, where it is vital to distinct the differences between endogenous and exogenous variables. This issue refer to that classification among the variables was criticized by many economic scholars, and one of most important is the criticism by Sims (1980).

In the light of these criticisms, if there are some simultaneous relationships among variables in the model, all of these variables must be regarded as in the same way. That means there should no difference between endogenous and exogenous variables. Thus if we accept this idea by Sims (1980), the differences among variables are abandoned, and then all variables can be treated as endogenous variables. In other words, each equation has the same regressors in the models, and these models are called vector autoregressive (VAR) models.

Since this empirical chapter is more concentrated on cointegration analysis, there is only some general explanation for the VAR model and we begin analysis with

a first-order vector autoregressive (VAR (1)) model.

Support we are not whether the variables are exogenous or endogenous in the model, each variable need to treat symmetrically. Then there is a simple version of model as following:

$$y_t = \alpha_{10} - \alpha_{12}x_t + \beta_{11}y_{t-1} + \beta_{12}x_{t-1} + \varepsilon_{yt}$$

$$x_t = \alpha_{20} - \alpha_{22}y_t + \beta_{21}y_{t-1} + \beta_{22}x_{t-1} + \varepsilon_{xt}$$

where the series y_t is affected by both past and current value of series x_t , and the series x_t is affected by both past and current value of series y_t . Since the longest lag length here is only 1, these two equations compose a first-order VAR model, denoted with VAR (1).

However, this first-order VAR model is not a normal reduced-form model, as y_t has an impact of $-\alpha_{21}$ on x_t , and x_t has an impact of $-\alpha_{12}$ on y_t . Alternatively, this VAR model can be represented as reduced-form model; and with some mathematical deduction, we can rewrite this first-order VAR model as:

$$y_t = \gamma_{10} - \gamma_{11}y_{t-1} + \gamma_{12}x_{t-1} + \mu_{1t}$$

$$x_t = \gamma_{20} - \gamma_{21}y_{t-1} + \gamma_{22}x_{t-1} + \mu_{2t}$$

The VAR model composed by above forms is called the standard form or reduced form of VAR model; and the VAR model constituted by previous forms of equations is structural form or primitive form of VAR model. It should be noted that the error terms in standard form of VAR model, μ_{1t} and μ_{2t} , are composites of the errors ε_{xt} and ε_{yt} in structural VAR system. The reduced form of VAR system has a distinctive feature: all endogenous variables are represented in terms of only its

lagged series, whereas they relied on both its lagged series and other variables' series in the structural form of VAR model. Thus, in this model, there are no other exogenous variables.

After an introduction of VAR (1) model, we begin to analysis a general vector autoregressive system of m variables. A vector autoregressive process of order k can be represented as the matrix form:

$$Y_t = \delta + A_1 Y_{t-1} + \dots + A_k Y_{t-k} + v_t = \delta + \sum_{j=1}^k A_j Y_{t-j} + v_t$$

which is denoted as VAR (k).

There are some significant assumptions following a VAR model for the assumptions of a reduced form simultaneous equations system: 1) $v_{it} \sim N(0, w_{ii})$, for all t , and $i=1, 2, \dots, m$, where $w_{ii} = \text{var}(v_{it})$; 2) $E(v_{it} v_{is})=0$, for $t \neq s$, and $i=1, 2, \dots, m$; 3) $E(v_{it} v_{jt})=w_{ij}$, for all t , and $i, j=1, 2, \dots, m$, where $w_{ij}=\text{cov}(v_{it} v_{jt})$. Alternatively these three assumptions can be represented as the matrix form: $v_t \sim N(0, \Omega)$, with $E(v_t, v_s')=0$ and $\Omega = E(v_t, v_s')$. Based on these assumptions, a stationary vector X_t stochastic process should have fulfill several conditions: $E(X_t)=\mu$ for all t ; $\text{var}(X_t) < \infty$ for $j=1, 2, \dots, m$ and all t ; $\text{cov}(X_t, X_{t+k})=E[(X_t - \mu)(X_{t+k} - \mu)]=\Gamma_k$ for all t . With this definition of stationary vector, a VAR (k) model could be stationary if its mean and covariance matrices are bounded, and since the polynomial is defined by $|I - A_1\lambda - A_2\lambda^2 - \dots - A_k\lambda^k| = 0$, all its roots should be outside the complex unit circle (Judge, 1998).

Furthermore, when we conduct the VAR estimation, the general method normally assumes that the order of VAR, or named the lag length, is known already.

However, in most empirical studies, the VAR order is not known exactly, and thus we should use series of tests to find out a suitable order, in order to get a stationary VAR model. This will be discussed in next subchapter along with the discussion of cointegration analysis and estimation.

5.3.1.2 Basic Theoretical Explanations

In the light of the definition of cointegration, there could be more than one cointegration vector if an estimation model has more than two variables. In other words, there could be several equilibrium relationships to control the joint evolution of those variables in this model. Therefore, if there is n number of variables and cointegration exists in our estimation model, we could have up to $n-1$ number of cointegration vectors; but if $n=2$, the cointegration vector must be unique. It was mentioned before that Engle-Granger approach is an effective method to test unique cointegration method, however, when there are more than one cointegration vectors in the model, the Engle-Granger approach will result in some serious problems, and then spurious results. Therefore, all of these issues take us to consider an alternative method to estimate the cointegration and this is Johansen approach. The Johansen approach is based on works of Johansen (1998), and similarly of Stock and Watson (1998), and all of these initial works is to identify the cointegration and to provide estimates of the cointegrating and adjustment vector matrices, with the maximum likelihood method (MLE). In recent years, Johansen approach has been augmented and extended by many other econometricians, but the general ideas and empirical

procedures are still constant with initial works by Johansen (1998), Stock and Watson (1998).

In order to explain the Johansen approach to estimate cointegration, it is necessary to expand the error-correction model with single equations to the model with multiple equations. Thus we begin analysis from a single-equation model, with an assumption of four endogenous variables, i.e. Y_t , P_t , K_t and F_t . With a consideration of discussion of vector autoregressive model (VAR) in previous subchapter, these four endogenous variables constitute a matrix notation for $Z_t = [Y_t, P_t, K_t, F_t]$ and

$$Z_t = A_1 Z_{t-1} + A_2 Z_{t-2} + A_3 Z_{t-3} + \dots + A_k Z_{t-k} + \mu_t$$

Then this matrix notation can be transformed in a Vector Error Correction Model (VECM):

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \Gamma_3 \Delta Z_{t-3} + \dots + \Gamma_{k-1} \Delta Z_{t-(k-1)} + \Pi Z_{t-1} + \mu_t.$$

Where $\Gamma_i = (I - A_1 - A_2 - \dots - A_k)$ and $\Pi = -(I - A_1 - A_2 - \dots - A_k)$.

The Π matrix is actually 4*4 due to the fact that it is assumed four variables $Z_t = [Y_t, I_t, P_t, F_t]$. The Π matrix involves information regarding the long run relationships. In fact, $\Pi = \alpha\beta'$ where α include the speed of adjustment to equilibrium coefficients while β' will be the long run matrix of coefficients. Accordingly, the term of $\beta'Z_{t-1}$ equals to the error-correction term of $(Y_{t-1} - \beta_0 - \beta_1 X_{t-1})$ in a single equation framework, but now in a multivariate model, such as a VAR framework, $\beta'Z_{t-1}$ could comprises up to (n-1) vectors instead of unique one.

In order to understand these basic notions, we are using a simple VAR model with two lags and four endogenous variables in terms of basic frameworks. This simple sample can be represented as matrix form as:

$$\begin{pmatrix} \Delta Y_t \\ \Delta I_t \\ \Delta P_t \\ \Delta F_t \end{pmatrix} = \tilde{\Gamma}_0 \begin{pmatrix} \Delta Y_{t-1} \\ \Delta I_{t-1} \\ \Delta P_{t-1} \\ \Delta F_{t-1} \end{pmatrix} + \Pi * \begin{pmatrix} Y_{t-1} \\ I_{t-1} \\ P_{t-1} \\ F_{t-1} \end{pmatrix} + \tilde{\varepsilon}$$

Where $\Pi = \alpha\beta'$ and if we extend the notion of Π , then there is a more detailed matrix:

$$\begin{pmatrix} \Delta Y_t \\ \Delta I_t \\ \Delta P_t \\ \Delta F_t \end{pmatrix} = \tilde{\Gamma}_0 \begin{pmatrix} \Delta Y_{t-1} \\ \Delta I_{t-1} \\ \Delta P_{t-1} \\ \Delta F_{t-1} \end{pmatrix} + \begin{pmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} \end{pmatrix} * \begin{pmatrix} \beta_{11} & \beta_{21} & \beta_{31} & \beta_{41} \\ \beta_{12} & \beta_{22} & \beta_{32} & \beta_{42} \\ \beta_{13} & \beta_{23} & \beta_{33} & \beta_{43} \end{pmatrix} * \begin{pmatrix} Y_{t-1} \\ I_{t-1} \\ P_{t-1} \\ F_{t-1} \end{pmatrix} + \tilde{\varepsilon}$$

For simplicity we only analyse the error-correction term in the first equation i.e. the equation with ΔY_t ; and if the first row of the term Π is Π_1 , then $\Pi_1 \tilde{Z}_{t-1}$ can be represented as:

$$\begin{aligned} \Pi_1 \tilde{Z}_{t-1} &= (\alpha\beta')_1 * Z_{t-1} \\ &= ([\alpha_{11}\beta_{11} + \alpha_{12}\beta_{12} + \alpha_{13}\beta_{13}] * [\alpha_{11}\beta_{21} + \alpha_{12}\beta_{22} + \alpha_{13}\beta_{23}] \\ &\quad * [\alpha_{11}\beta_{31} + \alpha_{12}\beta_{32} + \alpha_{13}\beta_{33}] * [\alpha_{11}\beta_{41} + \alpha_{12}\beta_{42} + \alpha_{13}\beta_{43}]) * \tilde{Z}_{t-1} \end{aligned}$$

According to the above equations, it clearly indicates the terms of $(\alpha_{11}, \alpha_{12}, \alpha_{13})$ represents respective speed of adjustment for cointegration vectors in this model.

5.3.1.3 Optimal Lag lengths for VAR models

One of most important step in the empirical procedure of cointegration tests is the issue of finding the optimal lag length, because we would like to have Gaussian error

terms in our regression, and Gaussian error terms are standard normal error terms which do not suffer from non-normality, autocorrelation, and heteroscedasticity etc.

In the empirical procedures, for a given VAR with a given lag length, the first step to evaluate the lag length in a VAR model is to inspect the mathematical stability of the system. When all roots of the companion matrix of the VAR system are less than one in absolute value, this VAR system is regarded as a stable equation system (Johansen, 1995).

Once the mathematical stability holds in this VAR system, then the statistical stability of the VAR must be assessed. Johansen (1995) argues that it is significant to avoid many lags in a VAR system, as the number of parameters could grow quickly with the lag length, and then this model must suffer from misspecification with long lag length, which is required for a white noise process. Accordingly, it is better to use a rather small lag length due to the small sample size in the empirical sample of this thesis, and also another important merit to use small lag is because of the size and the order attributes of the test statistics for the critical values of the trace statistics under the small samples. According to Pesaran (1997), for annual series, a lag of one has been proved to be a best choice for the stable VAR system. According to Johansen (1995) method, it is based on the time independence of the residuals of the VAR system, where the optimal lag length exists in a case where the residuals are uncorrelated in the system; the autocorrelation and cross-correlation of individual residuals are first plotted to inspect any obvious autocorrelation in the system, and if it exists, the portmanteau test is employed to detect the magnitude of the residual

autocorrelations. In a stable VAR system, therefore, the residuals must be normally distributed, free of auto-correlation and have no heteroscedasticity.

5.3.1.4 Determining the Number of Cointegrating Vectors

According to previous explanation about the cointegration, the procedures of determining vectors in β is actually equivalent to inspecting which columns of α are equal to zero (Johansen 1988). In other words, testing for cointegration is equivalent to determining the rank of the matrix Π , and the matrix Π is provided through inspecting the number of γ linearly independent columns in Π . Furthermore, when Π has a reduced rank and there are $\gamma \leq (n-1)$ linearly independent columns, therefore there are $\gamma \leq (n-1)$ cointegrating relationship. This methodology of inspecting cointegration is firstly developed by Johansen (1988), and augmented by Johansen and Juselius (1990), Osterwald-Lenum (1992) and Enders (1995).

In empirical procedures of testing the cointegration, there are generally two methods in terms of corresponding test statistics to inspect the number of cointegration relations, and the estimation of the matrix Π is involved in both methods.

The first method is based on a likelihood ratio about the trace of the matrix Π and thus this method is called the trace Eigenvalue statistic, which is denoted as λ_{trace} . The trace statistic argues whether the trace can be increased by adding more eigenvalues beyond the γ th eigenvalues. The null hypothesis in this model is that the number of cointegrating vectors is less than or equal to γ . Suppose we have

n characteristic roots denoted by $\lambda_1 > \lambda_2 > \dots > \lambda_n$, and if the variables are not cointegrated, the rank of Π is zero and all the characteristic roots equal zero. Accordingly, when all $\hat{\lambda}_i = 0$, then the trace statistic will equal zero. In other words, the closer the characteristic roots are to unity the more negative is $\ln(1 - \hat{\lambda}_i)$ term, so that the larger the trace statistic. This statistic can be expressed as following:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_{r+1})$$

The second method is based on the familiar mathematical framework, and this method is called as maximum statistics, denoted as λ_{max} . In the light of understanding maximum statistics, if the rank of Π is equal to 1, then we can get $0 < \lambda_1 < 1$, and therefore the first expression $(1 - \hat{\lambda}_1) < 0$, while all the rest will be equal to zero. To examine how many of the numbers of the characteristic roots are significantly different from zero this test can be represented as: $\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1})$

In empirical studies, the trace statistic test is usually employed in the literatures especially for the small sample size. According to Monte Carlo simulation, Lutkepohl, Saikkonen and Trenkler (2001), the trace test tends to have more heavily distorted sizes but their power performance is superior to that of the maximum eigenvalues competitor. Accordingly, the empirical estimation of cointegration is using the trace test to determine the number of cointegrating vectors. The usual critical values for both trace and maximum tests are provided by Johansen and Juselius (1990), however, this thesis will not use these general critical values directly, since these critical values is based on some regression with big sample size. The sample size in this thesis is relative small, and even the biggest is less than 55 observations, therefore, we will use

the corrected critical values for trace tests in our empirical estimations, which are generated by Monte Carlo simulation based on small sample size.

5.3.2 Analysis of Error Correction models

The main information from previous subchapters was that trended time series would lead to some serious problems in empirical econometric estimation because of spurious regressions. As most macroeconomic variables are trended, the problem of spurious regression is highly likely to exist in empirical economic analysis, especially in econometric time-series regression. The classical approach of resolving this problem is to difference the series until the stationary series is obtained, and then do the general regression analysis, such as Ordinary Least Squares (OLS) method, with those stationary series. But some econometric studies have proved this classical approach is not *ideal* (D .Asteroide 1998). The estimation with differenced variables has no long-run solution, so that the general regression analysis with differenced series will result in the loss of long-run properties.

Those empirical problems with the classical approach lead to a consideration of the estimation with level variables instead of differenced variables, and this approach is sufficiently able to provide both short-run and long-run properties, and also the stationarity can be maintained simultaneously for all variables in the model. The basic idea for this approach is that if economic variables are non-stationary and of the same order, which are linked mainly through a theoretical model, we should test whether it is possible to combine them together into a single series which is itself

non-stationary. If that combined series can be obtained, then the series that presents this property is named as cointegrated. There is a simple version of example with two variables X_t and Y_t , both of which are supported to be integrated of the order 1 ($\{X_t, Y_t\} \sim I(1)$). The general regression with two $I(1)$ variables X_t and Y_t must generate the spurious results, since every linear combination of those two variables will be still a $I(1)$ process. If there is a genuine long run relationship between X_t and Y_t , and even although both of them will be trended over time, there will be a common trend that links them together. In order to obtain a long run relationship, or to achieve the long run equilibrium, we should find a linear combination of X_t and Y_t that is stationary variable—I (0). Then a linear combination of X_t and Y_t can be directly taken from estimating the following regression:

$$Y_t = \beta_1 + \beta_2 X_t + \varepsilon_t, \text{ and residuals are taken as } \hat{\varepsilon}_t = Y_t - \hat{\beta}_1 - \hat{\beta}_2 X_t$$

Thus, if residuals $\hat{\varepsilon}_t$ are stationary ($\hat{\varepsilon}_t \sim I(0)$), the series X_t and Y_t are defined to be cointegrated.

5.3.2.1 Mechanism of Vector Error-Correction Models (ECM)

It is impossible to get the satisfactory estimates of $\hat{\beta}_1$ and $\hat{\beta}_2$ if variables $\{X_t, Y_t\}$ are both $I(1)$ in the regression. The traditional method is to run the regression with the differenced variables $\Delta X_t \sim I(0)$ and $\Delta Y_t \sim I(0)$, and the correct estimates of $\hat{\beta}_1$ and $\hat{\beta}_2$ can be obtained. But this approach only tells us the short run relationship among the variables in the model, and there is no information about the long run relationship or equilibrium among the variables. In order to know both information of

long run and short run relationship, the notions of cointegration and error-correction mechanism (ECM) are too much useful.

Following the same conditions as previous description, we can recall the equations: $Y_t = \beta_1 + \beta_2 X_t + \varepsilon_t$, where $\hat{\varepsilon}_t = Y_t - \hat{\beta}_1 - \hat{\beta}_2 X_t$. Support this equation is no longer spurious and it links X_t and Y_t in the long run. If X_t and Y_t are cointegrated, $\hat{\varepsilon} \sim I(0)$, then an ECM can be specified to present the relationship between X_t and Y_t : $\Delta Y_t = a_0 + b_1 \Delta X_t - \pi \hat{\varepsilon}_{t-1} + \mu_t$. This ECM equation provides the information of both long run and short run relationship. In this estimation, the impact multiplier b_1 can express the short run effect, which implies the immediate impacts of a change in X_t will have on a change in Y_t . Here π presents the adjustment effect, which measures extend to which any disequilibrium in the previous period effects any adjustment in the current period. Therefore, we can have the new forms to present residuals as $\hat{\varepsilon}_{t-1} = Y_{t-1} - \hat{\beta}_1 - \hat{\beta}_2 X_{t-1}$. This representation tells us that β_2 shows the long run response.

Thus it is evident that ECM is a very convenient approach measuring the correction from disequilibrium of the previous period, and also that can be explained by a good economic implication. In addition, as variables in the ECM are transformed as stationary series, the trends from the variables can be eliminated, and therefore the spurious problem can be resolved. Furthermore, the most implication of the ECM is: the cointegration between variables indicates there should be some adjustment process which prevents the errors in the long run relationship becoming larger and larger.

In terms of above explanations, it is believed that there is a too much close relationship between cointegration and error-correction mechanism (ECM), and thus it is crucial for cointegration analysis to study more contents about error-correction mechanism (ECM). This paper begins talking ECM with a more mathematical approach, and the ECM will be transformed to a convenient re-parameterised form of the general linear autoregressive distributed lag (ARDL) model.

Based on the above ideas, suppose the series of Y and X are both of $I(1)$, neither the long run nor short run ARDL model can avoid the problem of spurious regression in the estimation. The classical approach, estimation with the first differenced variables, can not provide the long run information. Thus we are considering a more suitable method to resolve this problem, and the ECM can be taken to re-parameterise the original dynamic model as follows:

$$\Delta Y_t = r_0 \Delta X_t - (1-a)[Y_{t-1} - \beta_0 - \beta_1 X_{t-1}] + \varepsilon_t$$

$$\Delta Y_t = r_0 \Delta X_t - \pi[Y_{t-1} - \beta_0 - \beta_1 X_{t-1}] + \varepsilon_t \text{ where } \pi = (1-a)$$

The main advantage of employing ECM model is that the re-parameterised model not only denotes the short run dynamic effects, but also shows the long run influences, since the long run equilibrium is expressed by the term of $[Y_{t-1} - \beta_0 - \beta_1 X_{t-1}]$ and the short run dynamic effects are also captured by differenced terms in the model. In addition, the OLS estimation is valid in the ECM model since ΔY_t and ΔX_t are stationary series, and if Y and X cointegrated, the terms of $[Y_{t-1} - \beta_0 - \beta_1 X_{t-1}]$ convergences to the stationary.

In the VEC Models, the coefficient π implies the speed of adjustment in case

of disequilibrium. If this model is in long run equilibrium, there is no speed of adjustment from disequilibrium, so that the terms of $[Y_{t-1} - \beta_0 - \beta_1 X_{t-1}]$ is zero. But if this model is in short run dynamic process, the term of $[Y_{t-1} - \beta_0 - \beta_1 X_{t-1}]$ is not zero and measures the distance the system is away from equilibrium.

The above models are all assumed to estimate with only one lagged terms, and now we are considering a more general model with more than one lagged terms. The general short run ARDL model is $Y_t = u + \sum_{i=1}^n a_i Y_{t-i} + \sum_{i=0}^m r_i X_{t-i} + u_t$. As the same idea

from one lagged term, the long run ARDL model with generalized lagged terms can be denoted as $Y^* = B_0 + B_1 X^*$, where $Y_t^* = Y_t = Y_{t-1} = \dots = Y_{t-p}$ and

$X_t^* = X_t = X_{t-1} = \dots = X_{t-p}$, $B_0 = \frac{u}{1 - \sum a_i}$, $B_1 = \frac{\sum Y_i}{1 - \sum a_i}$. It can be re-parameterized

as a simple version of equation $\Delta Y_t = u + \sum_{i=1}^{n-1} a_i \Delta Y_{t-i} + \sum_{i=0}^{m-1} r_i X_{t-i} + \theta_1 Y_{t-1} u_t + \theta_2 X_{t-1} + \varepsilon_t$

From this equation, the long run coefficient is given by $1/\theta_1$ and $-\theta_2/\theta_1$. Given that, we can write down the ECM as follows:

$$Y_t = u + \sum_{i=1}^{n-1} a_i \Delta Y_{t-i} + \sum_{i=0}^{m-1} r_i \Delta X_{t-i} - \pi(Y_{t-1} - \hat{\beta}_0 - \hat{\beta}_1 x_{t-1}) + \varepsilon_t, \text{ where } \pi = -\theta_1, \hat{\beta}_0 = 1/\theta_1$$

and $\hat{\beta}_1 = -\theta_2/\theta_1$.

Support $Y_{t-1} - \hat{\beta}_0 - \hat{\beta}_1 x_{t-1} = e_t$, the ECM can be specified as:

$$\Delta Y_t = u + \sum_{i=1}^{n-1} a_i \Delta Y_{t-i} + \sum_{i=0}^{m-1} r_i \Delta X_{t-i} - \pi \hat{e}_{t-1} + \varepsilon_t$$

So far, the ECM equation can be presented as equation (4.44). The parameter π is the most important part as error correction coefficient. The coefficient π is named as adjustment coefficient as well, because it can tell us how much of the adjustment to

equilibrium takes place each period, or how much of the equilibrium error is corrected. If the series in this model are cointegrated, i.e. there are some cointegration relationships among them, the error correction coefficient will be stationary-- $\hat{e}_t \sim I(0)$ and thus $\hat{e}_{t-1} \sim I(0)$. This is the important link between the cointegration and error correction mechanism (ECM), and also this relationship is basic to conduct the cointegration test and ECM analysis in the empirical econometric cases.

5.3.2.2 Weak Exogeneity in VEC models

When cointegration relations exist, the next step is to proceed with tests of weak exogeneity. According to basic explanations about cointegration in previous subchapters, it is believed that matrix Π involves information about the long run relationships, and this matrix can be represented as $\Pi = \alpha * \beta'$, where β' means the matrix of the long run coefficients and α indicates the speed of adjustment coefficients. Suppose there are $\gamma \leq n-1$ cointegrating vectors in the long run coefficients (β'), this suggest that at least $(n - \gamma)$ columns of α equals zero. Accordingly, after examining the cointegrating vectors in the estimation, we should proceed with inspecting which of variables might be weakly exogenous.

One of the main merits of the Johansen cointegration approach is that we are allowed to examine the cointegrating vectors with restricted forms. In the light of the basic explanation about cointegration, we recall the matrix:

$$\begin{pmatrix} \Delta Y_t \\ \Delta I_t \\ \Delta P_t \\ \Delta F_t \end{pmatrix} = \tilde{\Gamma}_0 \begin{pmatrix} \Delta Y_{t-1} \\ \Delta I_{t-1} \\ \Delta P_{t-1} \\ \Delta F_{t-1} \end{pmatrix} + \begin{pmatrix} \alpha_{11} \alpha_{12} \alpha_{13} \\ \alpha_{21} \alpha_{22} \alpha_{23} \\ \alpha_{31} \alpha_{32} \alpha_{33} \\ \alpha_{41} \alpha_{42} \alpha_{43} \end{pmatrix} * \begin{pmatrix} \beta_{11} \beta_{21} \beta_{31} \beta_{41} \\ \beta_{12} \beta_{22} \beta_{32} \beta_{42} \\ \beta_{13} \beta_{23} \beta_{33} \beta_{43} \end{pmatrix} * \begin{pmatrix} Y_{t-1} \\ I_{t-1} \\ P_{t-1} \\ F_{t-1} \end{pmatrix} + \tilde{\varepsilon}$$

In this equation, the procedure of testing weak exogeneity is actually the same as testing which of the column of $\tilde{\alpha}$ equals to zero in the empirical estimation. Support there is only one cointegrating vector in this system, then $\tilde{\alpha} = (\alpha_{11} \alpha_{21} \alpha_{31} \alpha_{41})'$, and α_{11} represents of adjustment for the equation with the dependent variable ΔY_t ; α_{21} represents of adjustment for the equation with the dependent variable ΔI_t ; α_{31} represents of adjustment for the equation with the dependent variable ΔP_t ; α_{41} represents of adjustment for the equation with the dependent variable ΔF_t . Therefore, it is believed that each of the elements in $\tilde{\alpha}$ involves information regarding which cointegrating vector enters which short run dynamic equation, along with the speed of the short run adjustment to long run equilibrium.

Support α_{11} , this indicates there is no short-run adjustment to equilibrium for ΔY_t . If all elements in $\tilde{\alpha}_{1j}$ are equal to zero, then it is evident that the cointegrating vectors in $\tilde{\beta}$ are not involved in any equations for ΔY_t . In other words, there would be no loss of information from not estimating the determinants ΔY_t . Accordingly, this variable is weakly exogeneity, or is named as weak exogeneity variable; then this variable should be omitted from the left-hand side of the model, and it is only able to exist in the right hand of the system.

In empirical regression to test weak exogeneity, the null hypothesis (H_0) to test weak exogeneity is for variable ΔY_t is represented as $\alpha_{1j} = 0$. That means if we cannot reject $\alpha_{1j} = 0$, the cointegrating vector in β do not enter at all in the equation

for ΔY_t , and thus this variable can be regarded as weak exogeneity and should be omitted from the regression. If we can reject $\alpha_{1j}=0$, this variable is not weak exogeneity.

5.4 Empirical Studies and Analysis in Each Country of NICs in Asia

5.4.1 General Introduction and Testable Models in Each Country

The previous subchapters have explained the methodology of individual time series for NICs in Asia. From this subchapter, the empirical results for each country will be reported, analyzed and interpreted, based on the time series estimation for these countries. Following the previous econometric methodology, there are several different steps of empirical estimations for each country study: building a stable VAR model and checking its stability, detecting the cointegration vectors in the stable VAR model, setting the stable vector error correction (VEC) models and checking its stability, as well as analyzing the empirical results with the stable VEC models.

The empirical study is composed of four NICs of Asia: Singapore, Malaysia, Korea, Thailand, investigating the endogenous relationships among the variables of economic outputs, financial indicators, investment ratio and trade openness in each country respectively. The previous chapter of structural breaks in NICs of Asia has shown the non-stationarity for all variables in each country, which is important for our estimations in this chapter because this characteristic of non-stationary is very crucial for time series analysis in the procedures of examining cointegration vectors and

vector error correction models.

The empirical estimations are based on an endogenous growth theory to scrutinize some possible relationships between financial growth and economic development in individual countries' economy, covering the period of 1960 to 2007. Because of the endogenous conditions, the vector autoregressive can be the best basic conceptual framework for cointegration and VECM analysis, since variables are assumed to be endogenously determined with each other. Based on a stable VAR model, the existence of cointegration relationships can be investigated with Johansen procedures, together with testing the numbers of cointegration vectors in the stable VAR model. The vector error correction models (VECM) can describe their causations in both dynamic process and steady state, especially when there are cointegration relationships among these variables.

The testable frameworks for each country of Singapore, Malaysia, Korea and Thailand are respectively described as follows:

For Singapore $ZSG_t = (LPRGDPSG_t, FSG_t, INVSRSg_t, TROPNSG_t)$,

where $LFSG_t = [MONRTSG_t, PRVNFSG_t, LQLBRSG_t]$.

For Malaysia $ZML_t = (LPRGDPML_t, LFML_t, LINVSRL_t, LTROPNML_t)$,

where $LFKR_t = [LMONRTML_t, LPRVNFML_t, LLQLBRML_t]$

For Korea $ZKR_t = (LPRGDPKR_t, LFKR_t, LINVSRL_t, LTROPNKR_t)$,

where $LFKR_t = [LMONRTKR_t, LPRVNFKR_t, LLQLBRKR_t]$.

For Thailand $ZTH_t = (LPRGDPTH_t, LFTH_t, LINVSRL_t, LTROPNTH_t)$,

where $LFTH_t = [LMONRTTH_t, LLQLBRTH_t, LPRVNFTH_t]$

Here, the terms of *LPRGDPSG, LPRGDPML, LPRGDPKR, LPRGDPTH* means economic outputs in these NICs' economy as Singapore, Malaysia, Korea and Thailand respectively. The terms of *INVSRSg, INVSrML, INVSrKR, and INVSrTH* represent the investment ratio in each country. The terms of *TROPNSG, TROPNML, TROPNKR, and TROPNTH* denote the trade openness in each country. The terms of *LFSG, LFML, LFKR, LFTH* mean a combination of indicators for financial growth in Singapore, Malaysia, Korea and Thailand, which involves three different financial proxies—aggregate monetization ratio (*LMONRTSG, LMONRTML, LMONRTKR, LMONRTTH*), non-financial borrowings to private sectors (*LPRVNFSG, LPRVNFML, LPRVNFKR, LPRVNFTH*), and liquid liabilities ratio (*LLQLBRSG, LLQLBRML, LLQLBRKR, LLQLBRTH*); and these financial proxies differ across each country in terms of every country's real situations. As the specific meanings of variables have been detailed explained in the previous chapter, we will not present some explanations in this chapter.

5.4.2 Empirical Estimations of Singapore Models

5.4.2.1 Estimations and Results in Singapore

In the Singapore economy, there are three different financial indicators that constitute the models of ZSG_t : Monetization Ratio (*MONRTSG*), Non-financial Private Borrowings (*PRVNFSG*), and Liquid Liabilities (*LBLQSG*). These indicators have been intercepted in previous sectors. In addition, there are three different estimation

systems involving three different financial growth proxies: $LMONRTSG_t$, $LPRVNFSG_t$, and $LLQLBRSG_t$. All variables use logarithmic forms in the empirical estimation here. The basic version of an econometric model, which provides a basic framework for cointegration and error-correction models, can be presented as follows:

$$\tilde{Z}_t = \tilde{A}_0 + \tilde{A}_1 \tilde{Z}_{t-1} + \tilde{A}_2 \tilde{Z}_{t-2} + \dots + \tilde{A}_k \tilde{Z}_{t-k} + \tilde{u}_t,$$

Here \tilde{Z}_t means a matrix including of all endogenous variables of LPRGDPSG, LFSG, LINVSRSG and LTROPNSG, and \tilde{u}_t means a matrix including the uncorrelated white-noise error terms. In the empirical case study of Singapore, second-order VAR models are used, as the longest lag length is equal to two in empirical estimations. This can be denoted as VAR(2). The VAR (2) model in Singapore can be represented as following:

$$\tilde{Z}_t = \tilde{A}_0 + \tilde{A}_1 \tilde{Z}_{t-1} + \tilde{A}_2 \tilde{Z}_{t-2} + \tilde{u}_t$$

This basic form can be presented as a full version with four endogenous variables:

$$\begin{aligned} LYSG_t &= \gamma_1 + \sum_{k=1}^2 a_{1k} LYSG_{t-k} + \sum_{k=1}^2 b_{1k} LFSG_{t-k} + \sum_{k=1}^2 c_{1k} LIRSG_{t-k} + \sum_{k=1}^2 d_{1k} LTRSG_{t-k} + u_{1t} \\ LFSG_t &= \gamma_2 + \sum_{k=1}^2 a_{2k} LYSG_{t-k} + \sum_{k=1}^2 b_{2k} LFSG_{t-k} + \sum_{k=1}^2 c_{2k} LIRSG_{t-k} + \sum_{k=1}^2 d_{2k} LTRSG_{t-k} + u_{2t} \\ LIRSG_t &= \gamma_3 + \sum_{k=1}^2 a_{3k} LYSG_{t-k} + \sum_{k=1}^2 b_{3k} LFSG_{t-k} + \sum_{k=1}^2 c_{3k} LIRSG_{t-k} + \sum_{k=1}^2 d_{3k} LTRSG_{t-k} + u_{3t} \\ LTRSG_t &= \gamma_4 + \sum_{k=1}^2 a_{4k} LYSG_{t-k} + \sum_{k=1}^2 b_{4k} LFSG_{t-k} + \sum_{k=1}^2 c_{4k} LIRSG_{t-k} + \sum_{k=1}^2 d_{4k} LTRSG_{t-k} + u_{4t} \end{aligned}$$

This is the standard form, alternatively named as reduced form of VAR (2) model for Singapore financial-economic growth empirical studies.

The decision to use the $k=2$ as our expected optimal lag length¹⁶ in our models should be explained. As discussed in econometric methodology subchapters¹⁷, the

¹⁶ This thesis does not use “Var Lag Order Selection Criteria” or “Var Lag Exclusion Wald Test”, but using the “general-to-specific” methods, suggested by Johansen.

¹⁷ Please refer to the section about econometric methodology as before

general-to-specific testing method suggests that lag=1 could be the best optimal lag length for our cases. It is worth considering the reviews of how to select the optimal lag length. There are several steps to select the most suitable and effective lag number for the model: firstly, we assume that the number of 1 to 4 could be all possible for the estimation with annual data; secondly, in terms of Johansen's idea, the less lag is better for estimation, therefore, the lag=1 becomes the best choice; thirdly, even lag=1 might be the best choice, the final stage of dynamic analyses relies on VEC models, which require that our VAR models should have minimum two lags in the beginning of the estimation. Thus, the lag=2 becomes a possible best choice; finally, this thesis uses the econometric methods to examine whether the model with lag=2 can be stable or not. The stable econometric model is compulsory condition for any further analyses with advanced econometric models, like VEC models. In addition, the traditional method of "Var Lag Order Selection Criteria" or "Var Lag Exclusion Wald Test" can not provide a route to examine whether our models are stable or not stable.

In the light of econometric theoretical discussion, the VAR model with lag=1, denoted as VAR(1), is not suitable for studies of the short-run relationship in the vector error correction (VEC) model. The EC models with both VAR(1) and VAR(2) can be described as follows:

$$\Delta Z_t = \Pi Z_{t-1} + u_t \text{ for VAR(1) and } \Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Pi Z_{t-1} + u_t \text{ for VAR(2)}$$

According to these models, it is evident that the VEC model can provide more coefficient information for dynamic relationships. Hence it is better to select the VAR(2) model in our empirical regressions, We now need to examine whether the

VAR(2) model with Singapore is a stable model. This is considered in the following subchapter.

5.4.2.1.1 Stability of Singapore VAR models

A stable VAR with optimal lag length must satisfy both conditions of mathematical and statistical stabilities. As what Johansen (1988) suggests for developing economies, the general-to-specific testing method suggests a range of one to four is realistic lag length selection for annual data studies. lag=2 is used as the expected optimal lag length for the VAR (2) model with Singapore, but mathematical and statistical methods are needed to investigate the stability conditions¹⁸ for this model. The empirical results of testing the mathematical stability¹⁹ for the VAR models are described as follows:

Table 1

Mathematical stability for unrestricted VAR models						
VAR	LMONRTSG		LPRVNFSG		LLQLBRSG	
Systems with different financial proxies	Root	Modulus	Root	Modulus	Root	Modulus
	0.992498	0.992498	0.986450	0.986450	0.975336	0.975336
	0.748132- 0.439386i	0.867619	0.734974- 0.334505i	0.807515	0.873794- 0.123823i	0.882524
	0.748132+ 0.439386i	0.867619	0.734974+ 0.334505i	0.807515	0.873794+ 0.123823i	0.882524
	0.611482- 0.200971i	0.643662	0.754722- 0.103857i	0.761835	0.697478- 0.359743i	0.784787
	0.611482+ 0.200971i	0.643662	0.754722+ 0.103857i	0.761835	0.697478+ 0.359743i	0.784787
	-0.346689	0.346689	-0.224532- 0.216500i	0.311909	0.318237	0.318237
	0.316284	0.316284	-0.224532+ 0.216500i	0.311909	-0.197470	0.197470
	0.073756	0.073756	0.189788	0.189788	-0.058418	0.058418
	Conclusion :					
No root lies outside the unit circle in all models						
VAR satisfies the stability condition for all models						

¹⁸ The stability means these VAR models can satisfy both mathematical and statistical stable conditions simultaneously.

¹⁹ The econometric knowledge of testing the stability is detailed explained in the previous section

The above empirical results reveal that the all of our VAR models satisfy the conditions of mathematical stability, as there are not only roots outside the unit circles.

The next stage involves checking the statistical stability, that is, evaluate the residuals for the VAR (2) model. The evaluations of statistical stability involve tests of autocorrelation, heteroscedasticity, and normality for both system residuals in the VAR models and individual residual from each equation in the model. The empirical results for vector/system residual for VAR (2) models are in the following table.

Table 2

Statistical stability (Diagnostic) tests for VAR systems							
Systems with financial proxies	System Autocorrelation		System Normality			System Heteroscedasticity	
	Statistics	P-value	Statistics	P-value	Statistics	P-value	
Monetization	LM(1)= 19.0598	0.2656	Jarque-Bera(8)= 9.5401	0.2988			
Ratio	LM(4)= 14.0132	0.5977	Kurtosis Chi^2= 7.2791	0.1219	Chi^2(160)= 164.7339		0.3824
(LMONRTSG)	LM(8)= 13/0035	0.5992	Skewness Chi^2= 2.2609	0.6879			
Private	LM(1)= 21.5130	0.1596	Jarque-Bera(8)= 12.1578	0.1443			
Borrowings	LM(4)= 18.5141	0.2947	Kurtosis Chi^2= 6.8340	0.1449	Chi^2(160)= 185.8809		0.0789
(LPRVNFSG)	LM(8)= 19.6544	0.2362	Skewness Chi^2= 5.3238	0.2557			
Liquid Liabilities	LM(1)= 20.9356	0.1810	Jarque-Bera(8)= 8.6040	0.3768			
(LLQLBRSG)	LM(4)= 11.2399	0.7944	Kurtosis Chi^2= 4.2735	0.3703	Chi^2(160)= 182.1282		0.1110
	LM(8)= 9.4911	0.8918	Skewness Chi^2= 4.3305	0.3631			
Notes:							
➤ All results here are based on the unrestricted VAR models							

As most of the residuals in the VAR systems can pass the normality test, it can be concluded here that lag=2 is an optimal lag length, which can provide a stable model to perform cointegration analysis with our endogenous variables.

Another vital function from the VAR model is to provide a stable analytical model for further economic analysis and explanations with sophisticated econometric manners, in particular for cointegration and EC models.

5.4.2.1.2 Cointegration Tests and Explanations

According to the earlier discussion of stationarity tests, the variables involved in our empirical estimation have been verified to be non-stationary series, all of which have the strong trends in their level and contains one unit root. The economic literature has certified that trended time series can cause vital problems in empirical procedures of econometric estimation, especially estimation with some conventional regression methods, such as classical linear regression model (CLRM). Moreover, the CLRM with these non-stationary series must, inevitably, could result in some spurious results. A simple way of overcoming this is to difference the series until they become stationary, and then to use the CLRM again. This manner, however, will lead to two crucial problems. Firstly, one is a non-invertible moving average error process and then have serious estimation problems, and secondly, more importantly, the differenced variables can not provide a unique, long run solution.

Based on the stable VAR(2) models, the cointegration tests are performed with Johansen likelihood-based inference cointegration procedures to investigate multivariate cointegrating relationships among the endogenous variables of LPRGDPSG, LFSG, LINVSRSG, LTROPNSG within Singapore's growth-finance-nexus. With the empirical results from cointegration procedures, the VEC models can be established and described with possible cointegration procedures, the VEC models can be established and described with possible cointegration relationships, and then both short-run and long-run causations among variables can be intercepted.

One of the most important stages within cointegration procedures is to select an optimal determining deterministic model for possible cointegrating equations. According to previous studies, it has been confirmed that each variable in our model has an obvious trend in its level; therefore, the Model 2, Model 3 and Model 4 are possible models for our empirical tests. As the joint-hypothesis method was theoretically discussed in methodology part, it suggests the Model 3 is always the optimal deterministic model for those variables which are strongly tended. As a result, it can be concluded the Model 3 is an optimal model, which means the intercept in the CE is assumed to be cancelled out in the VAR, leaving only one intercept in the short-run model.

In the procedures of selecting the correct deterministic model for cointegration test, the Model 3 is an optimal model due to natural characteristics of annual data in Singapore. The model indicates that it is assumed the intercept in the CE is to be cancelled out in the VAR model, leaving only one intercept in the short-run model. Based on our interpretations, the analysis of determining rank of cointegrating vectors can be described as follows:

Table 3

Cointegration Procedures for Singapore					
$\widehat{ZSG}_t = \widehat{A}_0 + \widehat{A}_1 \widehat{Z}_{t-1} + \widehat{A}_2 \widehat{Z}_{t-2} + \widehat{u}_t$					
where $ZSG_t = (LPRGDPSG_t, LFSG_t, LINVSRSG_t, LTROPNSG_t)$					
LF-variables	Hypothesis	Eigenvalues	Statistics	Critical-value	Prob-value
Monetization	$r = 0$	0.5727	53.001	47.8561	0.0152
Ratio	$r \leq 1$	0.3246	22.395	29.7971	0.2771
(LMONRTSG)	$r \leq 2$	0.1912	8.2691	15.4947	0.4371
Bank Claims to	$r = 0$	0.6820	68.0278	47.8561	0.0002
Private Sector	$r \leq 1$	0.2804	18.7749	29.7971	0.5092
(LLQLBRSG)	$r \leq 2$	0.0784	4.62506	15.4947	0.8473
Liquid	$r = 0$	0.5686	65.9756	54.0790	0.0031
Liabilities	$r \leq 1$	0.2805	31.5027	35.1928	0.1186
(LLQLBRSG)	$r \leq 2$	0.2462	18.0061	20.2618	0.0992
Notes:					
1) Critical value is based on 5% significant level;					
2) MacKinnon-Haug-Michelis (1999) p-values is applied here;					
3) This result is based on unrestricted stable VAR(2) models.					
4) There is only one cointegration vector for each case here.					

Based on the above empirical results, the cointegration test demonstrates obviously that there exists a unique cointegrating vector for each of our regression model with different financial proxy. This confirms the existence of a unique cointegrating relationship in the model. The existences of cointegration relationships indicate that there is a long-run causation among our variables with the empirical data and models and, therefore, in the long run the economic growth and finance nexus can be verified to exist in the Singapore economy.

As described above, three difference indicators were applied to cover various aspects of financial systems, which are all used to test the empirical cointegration relationships with economic outputs. The earlier results demonstrate that the cointegration vectors exist in each model with different financial indicators, and hence all of our financial indicators have long-run relationships with economic outputs in Singapore. Moreover, these results mirror our hypothesis about Singapore growth-finance nexus.

The above discussion raises a number of key questions: what exact coefficients to represent these long run relationships? Are significant dynamics among these

variables? If there are significant dynamics, what coefficients address these dynamics?

To answer these questions, we need to conduct advanced analysis and explanation from error-correction models.

The previous estimations have determined the number of cointegration vectors based on the unrestricted and stable VAR models, and, thus, the complex information of matrix Π can be specified with those empirical results. The important terms of β' and α in the VEC model can be specified as following:

$$\Pi = \alpha * \beta', \text{ where } \alpha' = (\alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14}) \text{ and } \beta' = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14})$$

$$EC = \beta_{11}LPRGDPSG_{t-1} + \beta_{21}LFSG_{t-1} + \beta_{31}LINVSRSG_{t-1} + \beta_{41}LTROPNSG_{t-1}$$

As there are four variables in the VEC model, the equations in VEC models can be specified as follow:

$$\Delta LPRGDPSG_t = \alpha_{11} + \gamma_{11}\Delta LPRGDPSG_{t-1} + \gamma_{12}\Delta LFSG_{t-1} + \gamma_{13}\Delta LINVSRSG_{t-1} + \gamma_{14}\Delta LTROPNSG_{t-1} + c_1$$

$$\Delta LFSG_t = \alpha_{21} + \gamma_{21}\Delta LPRGDPSG_{t-1} + \gamma_{22}\Delta LFSG_{t-1} + \gamma_{23}\Delta LINVSRSG_{t-1} + \gamma_{24}\Delta LTROPNSG_{t-1} + c_2$$

$$\Delta LINVSRSG_t = \alpha_{31} + \gamma_{31}\Delta LPRGDPSG_{t-1} + \gamma_{32}\Delta LFSG_{t-1} + \gamma_{33}\Delta LINVSRSG_{t-1} + \gamma_{34}\Delta LTROPNSG_{t-1} + c_3$$

$$\Delta LTROPNSG_t = \alpha_{41} + \gamma_{41}\Delta LPRGDPSG_{t-1} + \gamma_{42}\Delta LFSG_{t-1} + \gamma_{43}\Delta LINVSRSG_{t-1} + \gamma_{44}\Delta LTROPNSG_{t-1} + c_4$$

Where $\Pi = \alpha * \beta'$, where $\alpha' = (\alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14})$ and $\beta' = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14})$,

$$LFSG = (LMONRTSG, LPRVNFSG, LLQLBRSG)$$

Here, the matrix of Π involves the significant information about the long- and short-run relationships in our models: β' reveals the cointegration relationships, which reveal the coefficients to present the interrelationships in the steady state and α represents the adjustment coefficients in the empirical models. The matrix of $\tilde{\gamma}$ tells us the dynamic short-run causations among variables for each empirical case in Singapore.

5.4.2.1.3 The Stable VEC Models and Weak Exogeneity

In order to acquire the efficient and stable cointegration coefficients and dynamic coefficients, it is important to remove insignificant adjustment coefficients, which could cause weak exogeneity. These insignificant adjustment coefficients can be shown on the unrestricted VEC models, as shown in the following table.

Table 4

Tests of adjustment coefficients($\tilde{\alpha}$) for VEC models				
$\Delta ZSG_t = \tilde{\Gamma}_1 \Delta ZSG_{t-1} + \tilde{\Pi} ZSG_{t-1} + u_t$ where $ZSG_t = (LPRGDP_{t-1}, LFSG_t, LMNVSRS_{t-1}, LTROPVNSG_{t-1})$ and $\tilde{\Pi} = \tilde{\alpha} \times \tilde{\beta}'$				
LF-variables	Adjustment Coefficient		Restrictions for adjustment coefficients	
parameter	statistics	S.D.	critical	coefficients
Monetization	$\Delta LPRGDP$	0.0299	0.0301	0.9927
Ratio	$\Delta LMONVRT$	0.0667	0.0841	0.7931
(LMONRTSG)	$\Delta LMNVSRS$	0.1155	0.0573	2.0151*
	$\Delta LTROPV$	0.2151	0.0586	3.6679*
Private	$\Delta LPRGDP$	0.0481	0.0175	2.7537*
Borrowings	$\Delta LMONVRT$	0.0018	0.0326	0.0567
(LPRVNFSG)	$\Delta LMNVSRS$	0.1158	0.0314	3.6948*
	$\Delta LTROPV$	0.1905	0.0396	0.4810
Liquid	$\Delta LPRGDP$	0.0295	0.0089	3.3214*
Liabilities	$\Delta LMONVRT$	0.0172	0.0079	2.1749*
(LLQLBRS6)	$\Delta LMNVSRS$	0.0374	0.0120	3.1068*
	$\Delta LTROPV$	0.0052	0.0245	0.2108
	$\Delta LPRGDP$	0.2706	0.0594	4.5552*

Notes:
 1) All critical values in this table are absolute values of real results.
 2) "*" means significant in 95% confidence level and "**" means significant in 90% confidence level.
 3) All results here are based on the stable unrestricted VAR and VECM models

According to above tables, there are several adjustment insignificant coefficients involved in our VEC models. In order to avoid the problems of weak exogeneity in the VEC models and in further analysis, it is necessary to delete possible insignificant adjustment coefficients in the models. This will allow us to conduct further economic analysis. For the case with LMONRTSG, the adjustment coefficients for $\Delta LYSG$ and $\Delta LMNSG$ are insignificant, while with LPRVNFSG, the adjustment coefficients

for $\Delta LPRVNFSG$ and $\Delta LTROPNSG$ are insignificant. In the case of LLBLBLQSG, the adjustment coefficient for $\Delta LTRSG$ are insignificant.

Although it is possible to set up some restrictions on these insignificant adjustment coefficients, it is compulsory to examine whether or not our restrictions can be accepted. This examination conducted in VEC models with Likelihood Ratio (LR) tests for restrictions, and Chi-square statistical values. The results are presented below:

Table 5

Likelihood Ratio for Restrictions on adjustment coefficients based on VECM analysis				
LF-variables	Restrictions for adjustment coefficients	Chi-square	Probability	Accept or Reject restrictions
Monetization Ratio (LMONRTSG)	$\alpha_1 = 0$ & $\alpha_2 = 0$	4.704208	0.095169	Accept
Private Borrowings (LPRVNFSG)	$\alpha_2 = 0$ & $\alpha_4 = 0$	0.221592	0.895121	Accept
Liquid Liabilities (LLQLBRSG)	$\alpha_4 = 0$	0.034220	0.853240	Accept
Notes:				
1) The critical value of 0.05 for probability at 95% level is used here.				
2) All results here are based on the stable unrestricted VAR and VECM models				

The above tables indicate that all restrictions on adjustment coefficients cannot be rejected at the 95% level, since p-values are greater than 0.05. The restrictions on adjustment coefficients can be accepted in our VEC models, therefore.

In order to provide stable VEC models, the stability tests must be investigated by both mathematical and statistical routes. The mathematical routes for checking VECM stability is through the roots of autoregressive (AR) characteristic polynomial. The empirical results for mathematical stability for VECM are shown as following table.

Table 6

Mathematical stability for vector error correction(VEC) models						
Systems	LMONRTSG		LPRVNFSG		LLQLBRSG	
	Root	Modulus	Root	Modulus	Root	Modulus
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
	0.714982	0.714982	0.707715- 0.295630i	0.766980	0.726384- 0.219560i	0.758842
	0.659669	0.659669	0.707715+ 0.295630i	0.766980	0.726384+ 0.219560i	0.758842
	-0.349425	0.349425	-0.354384	0.354384	0.299059	0.299059
	0.189699- 0.023409i	0.191138	0.044384- 0.115539i	0.123770	-0.216853	0.216853
	0.189699+ 0.023409i	0.191138	0.044384+ 0.115539i	0.123770	-0.010750	0.010750
All VEC models satisfied the stability through checking Roots of Characteristic Polynomial						

The above results show that the VEC models satisfy the mathematical stability.

The next test is statistical stability. This step is regarded as the diagnostic tests for residuals, which are composed of the autocorrelation, normality and heteroscedasticity tests. The empirical results for diagnostic tests are concluded as following table.

Table 7

Diagnostic tests for system/vector residuals of VECM models								
LF-variables	Vector Autocorrelation			Vector Normality		Vector Heteroscedasticity		
	Statistics	P-value		Statistics	P-value	Statistics	P-value	
Monetization Ratio (LMONRTSG)	LM(1)= 20.0590	0.2176		Jarque-Bera(8)= 8.1367	0.4202			
	LM(4)= 18.4999	0.2955		Kurtosis Chi^2= 2.4156	0.6598	Chi^2(160)= 95.28690		0.6146
	LM(8)= 16.1822	0.3956		Skewness Chi^2= 5.7211	0.2210			
Private Borrowings (LPRVNFSG)	LM(1)= 19.0303	0.2671		Jarque-Bera(8)= 10.9045	0.2072			
	LM(4)= 16.5956	0.4122		Kurtosis Chi^2= 4.6453	0.3257	Chi^2(160)= 102.2548		0.4187
	LM(8)= 19.2334	0.2567		Skewness Chi^2= 6.2591	0.1806			
Liquid Liabilities (LLQLBRSG)	LM(1)= 17.0971	0.3793		Jarque-Bera(8)= 6.6966	0.5697			
	LM(4)= 10.8351	0.8195		Kurtosis Chi^2= 1.73622	0.7841	Chi^2(160)= 106.2946		0.3145
	LM(8)= 12.2933	0.7235		Skewness Chi^2= 4.9604	0.2914			
Notes:								
1) All critical values in this table are absolute values of real results.								
2) All results here are based on the stable unrestricted VAR and VECM models								

The above tests indicate our VEC models are stable, since they passed the mathematical and statistical stability tests.

5.4.2.2 Analysis of Singapore Models in Steady State and Dynamics

The above procedures have certified that our VEC models are stable, and capable of servicing our economic interpretations for interrelationships between the indicators of

financial growth and the variables for three dominant developmental aspects (economic outputs, investment ratio and trade openness) in the macroeconomic performances of Singapore, Malaysia, Korea and Thailand over the last 50 years.

The empirical analyses of NICs study are based on the stable vector-error correction (VEC) models, which can provide more comprehensive interpretations compared with other time series analyses. This is because VEC models are composed of more extensive notions, in particular, the notion of possible cointegration relationships among these endogenous variables. However, the VAR models are still the efficient frameworks to organize all endogenous variables in terms of endogenous growth theories. Furthermore, it is asserted that VEC model must provide much better understanding of interrelationships among endogenous variables, which are detected to involve cointegration relationships.

Based on the previous results for each country, the cointegrating coefficients ($\tilde{\beta}$) in VEC models imply the potential long-run causations among these variables. As it has been proved that there is unique cointegrating vector among variables in the model, these cointegration coefficients $\tilde{\beta}$ can be abstracted from empirical results within VEC models, which are normally addressed as the form of error correction (EC) equations:

$$EC = \tilde{\beta}_1 LY_t - \tilde{\beta}_2 LF_t - \tilde{\beta}_3 LIR_t - \tilde{\beta}_4 LTR_t - \tilde{C}, \text{ where } \tilde{\beta} = (\beta_1, \beta_2, \beta_3, \beta_4)$$

In the empirical procedures of expressing the relationships in steady state, the term of EC are assumed to be close to zero at steady state equilibrium, which indicates a long-run stage of economic development. The coefficients of $\beta_1, \beta_2, \beta_3, \beta_4$ reveal the

long-run causations among economic outputs, indicators for financial growth, investment ratio and trade openness.

Assuming the term of EC is close to zero, the cointegration coefficients can present the long run coefficients. After understanding the information from matrix $\tilde{\alpha}$ and $\tilde{\beta}$, other important terms of $\tilde{\gamma}$ are applied to expose the potential information of dynamic causations among these variables. The matrix of $\tilde{\gamma}$ here is identified as dynamic coefficients. The information from both cointegration coefficients ($\tilde{\beta}$) and dynamic coefficients ($\tilde{\gamma}$) is identified as the comprehensive analysis for the causations among variables in Singapore's growth-finance models.

5.4.2.2.1 Analysis of Singapore Models in Steady State

Now we are using the above empirical results to analyse the Singapore models, with four endogenous variables to represent economic outputs, investment ratio, trade openness, as well as consideration of financial growth. The EC equations for Singapore's frameworks can be represented thus:

Table 8

Cointegration coefficients ($\tilde{\beta}$) with Error-Correction (EC) equations		
$\Delta ZSG_t = \tilde{\Gamma}_1 \Delta ZSG_{t-1} + \tilde{\Pi} ZSG_{t-1} + a_t$ where $ZSG_t = (LPRGDPSG_t, LFSG_t, LINVSRSG_t, LTROPNSG_t)$ and $\tilde{\Pi} = \tilde{\alpha} \times \tilde{\beta}'$		
LF-variables	Cointegration coefficients ($\tilde{\beta}$) and long run causations	
Monetization Ratio (LMONRTSG)	EC equations	$EC = LPRGDPSG - 1.652 * LMONRTSG - 1.260 * LINVSRSG - 0.853 * LTROPNSG - C$
	With EC=0 (Long run causations)	$LPRGDPSG = 1.652 * LMONRTSG + 1.260 * LINVSRSG + 0.853 * LTROPNSG + C$
Private Borrowings (LPRVNFSG)	EC equations	$EC = LPRGDPSG - 0.798 * LPRVNFSG + 0.142 * LINVSRSG - 0.206 * LTROPNSG - C$
	With EC=0 (Long run causations)	$LPRGDPSG = 0.798 * LPRVNFSG - 0.142 * LINVSRSG + 0.206 * LTROPNSG + C$
Liquid Liabilities (LLQLBRSG)	EC equations	$EC = LPRGDPSG - 3.039 * LLQLBRSG - 0.261 * LINVSRSG + 1.594 * LTROPNSG - C$
	With EC=0 (Long run causations)	$LPRGDPSG = 3.039 * LLQLBRSG + 0.261 * LINVSRSG - 1.594 * LTROPNSG + C$
Notes: ➤ ** means significant in 95% confidence level and *** means significant in 90% confidence level. ➤ All coefficients on LPRGDP are normalized as the value of one.		

The above table suggests that the long run relationships among economic outputs, financial growth, investment and trade are represented as the terms of cointegration coefficients, denoted as $\tilde{\beta}_{SG}$ in the VEC models. The EC equations in these models can be transformed to the long run equations as following:

$$LPRGDPSG = 1.652 * LMONRTSG + 1.260 * LINVSRSG + 0.853 * LTROPNSG + C ,$$

where financial growth is measured as aggregate monetization ratio

$$LPRGDPSG = 0.798 * LPRVNFSG + 0.142 * LINVSRSG + 0.206 * LTROPNSG + C ,$$

where financial growth is measured as non-financial private borrowings

$$LPRGDPSG = 3.039 * LLQLBRSG + 0.261 * LINVSRSG + 1.594 * LTROPNSG + C ,$$

where financial growth is measured as liquid liabilities ratio

The coefficients of [1.652], [0.798] and [3.039] in all equations are examined to have the significance for each estimation system, as their t-statistics results are bigger than the t-critical value [1.96] at 5% confident level. These coefficients reveal the significant effects of financial indicators on long-run economic outputs, and these effects are identified to be positive relationship. The terms of coefficients for investment ratio or trade openness show less significant effects, as the coefficients of

[0.853] and [1.594] are insignificant in these systems involving long-term interrelationships between either investment or trade and economic outputs in Singapore. Furthermore, the coefficients for financial growth in long run equations are obviously more significant than coefficients for investment or trade indicators.

It can be concluded, therefore, there exists a positively significant interrelationships among the variables of economic outputs and financial growth in Singapore steady state of equilibrium. This relationship between outputs and financial growth is identified to be much stronger than other two relationships between outputs and either investment and trade. The next question is whether there exist dynamic causations in transitional stages over the period of 1960 to 2007 in Singapore with a model involving economic outputs, and two real sectors²⁰ of investment and trade, as well as variables for financial sectors. As prediction in our theoretical chapter, the Two-Sector model suggests that the financial sectors can affect the economic development with the same roles as real sectors. The next subchapter will analyse the dynamic causations for models in Singapore, based on VEC models.

5.4.2.2.2 Analysis of Singapore's Models in Dynamic Process

We have discussed the long-run equilibrium among the models involving both real sectors of investment and trade and financial proxies in Singapore. We now discuss the dynamic causations of financial growth and macroeconomic indicators to measure economic development in Singapore, using economic outputs, investment and trade

²⁰ The economy is divided into two sectors in terms of Two-Sector Models in the theoretical chapter of this thesis.

openness. In terms of VEC models, the dynamic causations are represented in the term of $\tilde{\gamma}_{SG}$ in empirical regressions, whereas the terms of $\tilde{\beta}_{SG}$ give us the information in long-term steady state equilibriums. The detailed information about dynamic causations is shown in the following table:

Table 9

Dynamic coefficients (γ) in VEC models									
Systems with different financial indicator	$\Delta LPRGDP_{SG}$		$\Delta LFSG$		$\Delta LNTVSRG$		$\Delta LTROPNSG$		S.D.
	γ	S.D.	γ	S.D.	γ	S.D.	γ	S.D.	
Monetization	$\Delta LPRGDP_{SG}$	0.5013*	0.2068	0.1204*	0.0538	1.2949*	3.2371	0.7557**	0.3910
Ratio (LMONRISG)	$\Delta LMONRISG$	0.1918*	0.0907	0.1167	0.2519	0.2424*	0.1226	0.5676	0.4717
	$\Delta LNTVSRG$	0.0684	0.0799	0.0885	0.1219	0.1898	0.1547	-0.5793*	0.1512
	$\Delta LTROPNSG$	0.0044	0.0718	0.4330	0.2892	-0.9746	0.1389	-0.0640	-0.4716
Private	$\Delta LPRGDP_{SG}$	0.2271	0.1439	0.7448*	0.2657	0.70447*	0.2549	0.2079	0.3235
Borrowings (LPRVNSG)	$\Delta LPRVNSG$	0.1323**	0.0734	0.2289*	0.1131	0.3866*	0.1661	0.5578*	0.2108
	$\Delta LNTVSRG$	-0.0256	0.0758	0.1950**	0.1140	-0.0067	0.1346	-0.5275*	0.1708
	$\Delta LTROPNSG$	-0.0511	0.0671	0.1774*	0.0314	-0.1330	0.1193	0.1431	0.1515
Liquid Liabilities (LIQLBRSg)	$\Delta LPRGDP_{SG}$	0.3709*	0.1191	0.1867**	0.1053	0.97777*	0.2724	0.2126	0.3277
	$\Delta LIQLBRSg$	0.2139*	0.0834	0.1499	0.1858	0.0499	0.0407	0.3674**	0.2095
	$\Delta LNTVSRG$	0.0301	0.0547	0.0978*	0.0217	0.2380	0.1249	-0.3490	0.1526
	$\Delta LTROPNSG$	0.0208	0.0598	0.0153	0.1330	-0.0930	0.1365	0.1230	0.1642

Notes:

➤ The term of "*" means significant at 95% confident level, "**" means significant at 90% confident level

➤ The term of "γ" means dynamic coefficients based on vector error correction model

➤ This VEC model is verified to be the stable VEC model

The dynamic causations among economic outputs, variables for two real sectors of investment and trade, variables for financial sectors of financial growth, will be

analysed by different estimation systems with three financial proxies: MONRT for aggregate monetization ratio, PRVNF for borrowings to non-financial private sectors and LQLBR for liquid liabilities in Singapore.

5.4.2.2.1 Dynamic Causations with MONRT in Singapore

For the case involving monetization ratio as indicator for financial growth, the specific coefficients can be represented as follows:

Table 10.1

Singapore Economic Development with Monetization Ratio				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDPSG_{t-1}$	$MONRTSG_{t-1}$	$INVSRSRG_{t-1}$	$TROPNSG_{t-1}$
$PRGDPSG_t$	0.5013*	0.1918*	0.0684	0.0044
$MONRTSG_t$	0.1204*	0.1167	0.0885	0.4430
$INVSRSRG_t$	1.2949*	0.2424*	0.1898	0.9746
$TROPNSG_t$	0.7557**	0.5676	0.5793*	0.0640
Notes:				
➤ The term of “*” means significant at 95% confident level; “**” means significant at 90% confident level				

There are two-way causations between economic outputs and monetary ratio, as the coefficients of [0.191] and [0.120] are both significant. The causations between LMONRTSG and LINVSRSRG are detected to be one way only, as the coefficients of [0.242] is significant to show impacts from finance to investment, but another way is not detected, as it is an insignificant coefficient of [0.008]. No causations about trade openness and financial growth are detected with both insignificant coefficients of [0.568] and [0.433], which mean there are no significant links between finance and trade for Singapore's dynamic models. However, the investment ratio and trade openness will not response due to our VEC models. On the other hand, the response

for financial growth can be significant, due to either change in economic outputs and investment ratio, but noting from trade openness.

5.4.2.2.2 Dynamic Causations with PRVNF in Singapore

The EC models with private borrowings, PRVNF, can be empirically specified to the Singapore economy, as shown in the following table:

Table 10.2

Singapore Economic Development with Private Borrowings				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDPSG_{t-1}$	$PRVNFSG_{t-1}$	$INVSRSRG_{t-1}$	$TROPNSG_{t-1}$
$PRGDPSG_t$	0.2271	0.1323**	-0.0256	-0.0511
$PRVNFSG_t$	0.7448*	0.2289*	0.1950**	0.1774*
$INVSRSRG_t$	0.70447*	0.3866*	-0.0067	-0.1330
$TROPNSG_t$	0.2079	0.5578*	-0.5275*	0.1431
Notes:				
➤ The term of “*” means significant at 95% confident level; “**” means significant at 90% confident level				

According to first and second lines, the bi-direction causations between economic outputs and private borrowings are important, as the coefficients of [0.132] and [0.745] are significant in both ways. There are also remarkable bi-direction causations between private borrowings (LPRVNFSG) and investment ratio (LINVSRSRG), as the coefficients of [0.195] and [0.387] are significant in second and third line respectively. There are two-way significant relationships between financial growth indicator of private borrowings and trade openness, which is suggested through two significant coefficients of [0.557] and [0.177] in fourth and second equations.

These results suggest a bi-direction significant influence between trade openness to private borrowings, whereas the system with MONRT did not suggest a significant double-way relationship. Thus, one can conclude that there is a strong evidence to show positive, significant relationships between variables of economic development and financial growth in two systems, which can positively support the strong nexus of economic development and financial growth from Singapore financial systems. This suggests that economic growth exerts a crucial role in the process of Singapore's economic development.

5.4.2.2.3 Dynamic Causations with LQLBR in Singapore

For the third system with indicator of liquid liabilities to measure financial growth, the specific coefficients for EC equations in VEC systems can be presented as following table:

Table 10.3

Singapore Economic Development with liquid liabilities				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDPSG_{t-1}$	$LQLBRSG_{t-1}$	$INVSRSNG_{t-1}$	$TROPNSG_{t-1}$
$PRGDPSG_t$	0.3709*	0.2139*	0.0301	0.0208
$LQLBRSG_t$	0.1867**	0.1499	0.0978*	0.0153
$INVSRSNG_t$	0.9777*	0.0499	0.2380	0.0930
$TROPNSG_t$	0.2126	0.3674**	0.3490	0.1230
Notes:				
➤ The term of “*” means significant at 95% confident level; “**” means significant at 90% confident level				

According to the first and second lines, there are two-ways significant coefficient between economic outputs and financial growth indicators of liquid liabilities, shown as significant coefficients of [0.187] and [0.214] in either way respectively. According

to the second and third lines, there is only one-way direction of dynamic influence from investment ratio to financial growth of liquid liabilities, due to the significant coefficient of [0.098]. The opposite way is not supported by insignificant coefficient of [0.050]. The relationship between trade openness and liquid liabilities is shown as one-way causation in the dynamic process. There is only a significant influence from financial growth to trade openness, but there is no return influence.

The results with LQLBR suggest that bi-direction dynamic causations exist only in the case of economic outputs and financial growth, but in other two approaches with investment ratio and trade openness there are both one-way causations between economic development indicators and financial growth variables.

5.4.2.3 Comparative studies of Singapore and remarks

To summarize, three different estimations, involving three variables for financial growth, have been presented. They demonstrate the dynamic causations among the variable to measure economic development: economic outputs (LPRGDPSG), investment ratio (LINVSRSG) and trade openness (LTROPNSG) with three different financial growth systems: Model 1 with MONRTSG, Model 2 with PRVNFSG, Model 3 with LQLBRSG. These estimations are presented in the following table:

Table 11

Singapore Dynamic Analysis				
Based on stable Singapore VEC Models				
Systems with different financial proxies	System I with MONRTSG		System II with PRVNFSG	System III with LQLBRSG
Economic Outputs & Financial Growth	LPRGDPSG \Rightarrow LMONRTSG	+	LPRGDPSG \Rightarrow LPRVNFSG	+
	LMONRTSG \Rightarrow LPRGDPSG	+	LPRVNFSG \Rightarrow LPRGDPSG	+
Investment Ratio & Financial Growth	LINVSRSRG \Rightarrow LMONRTSG	-	LINVSRSRG \Rightarrow LPRVNFSG	+
	LMONRTSG \Rightarrow LINVSRSRG	+	LPRVNFSG \Rightarrow LINVSRSRG	+
Trade Openness & Financial Growth	LTROPNSG \Rightarrow LMONRTSG	-	LTROPNSG \Rightarrow LPRVNFSG	+
	LMONRTSG \Rightarrow LTROPNSG	-	LPRVNFSG \Rightarrow LTROPNSG	+
<u>Notes:</u> "+" means the significant either 5% or 10% significant level; "-" means the insignificant either at 5% or 10% significant level				

With regard to the dynamics of economic outputs with variables of financial growth, the bi-direction dynamic relations between economic outputs and financial growth indicators are showed to be significant in three different systems except the system with liquid liabilities. Their relationships can be shown as follows: bi-direction significant dynamic causations between the first indicator for economic development, i.e. economic outputs and two financial growth indicators: monetization ratio and non-financial private borrowings in Singapore, but for the estimation system with financial growth indicator of liquid liabilities, there is an only one-way significant influence from financial growth and economic outputs.

For the first indicator for important real sectors of investment ratio in Singapore, the bi-direction significant causations exist only in the estimation system with private borrowings to non-financial sectors. For other estimation systems involving financial growth indicators of monetization ratio or liquid liabilities, however, the results are mixed, as there are significant impacts from financial growth to economic development in the system with monetization ratio, but opposite relations exist with liquid liabilities.

The relations between trade openness and financial growth are much less weak than other two estimations with economic outputs or investment ratio, except the estimation with non-financial private borrowings. With regard to the system dealing with non-financial private borrowings, the bi-direction dynamic causation between financial growth and trade openness is as important as the other two indicators of economic outputs and investment ratio in measuring economic development.

Overall, the ratio of significant dynamic causations over all dynamic relations is approximately 66.67%, and for the system with financial indicator of non-financial private borrowings, the significant dynamic causation is 100% over all relations. Furthermore, in empirical words for the Singapore economy, the influences from financial growth on economic development are more significant than influences from investment ratio and trading openness. In the meanwhile, these influences are positive from both directions. These conclusions are in the line with Singapore economic and financial development in real situations. In addition, the influences from financial growth on economic development are more significant than influences from investment ratio and trading openness. In the meanwhile, these influences are positive from both directions. These conclusions are in the line with Singapore economic and financial development in Singapore's actual economic development.

In summary, this subchapter uses the cointegration and vector error correction models to present the long- and short-run dynamic causations to investigate the link between economic development and financial growth. The overall study is composed of three different variables to measure the economic development, which can be

regarded to represent the main aspects of economic development in developing countries, in particular for these newly industrialized countries in Asian region. Compared with other studies, this thesis considers the distinctive merits and shortcomings of employing different financial indicators in the empirical regressions.

In terms of empirical results in Singapore's long run equilibrium and short run dynamic process, the following conclusions can be drawn. In the long run equilibriums, significantly positive relationships are detected between financial growth and economic developments with each financial indicator. These relationships are supported by the existences of cointegration vectors and significances of cointegrating coefficients. For the short-run dynamic causations between economic development and financial growth, the most significant bi-direction causations are suggested between economic outputs and financial growth. Furthermore, among all indicators for financial growth, the variable of non-financial private borrowings is shown to exert the most significant roles in the process of economic development. These results confirm our expectations and very close to actual situations. The advanced level of development of Singapore's financial systems can be attributed to explain these significant causations. The comparative studies across individual countries will be presented later in this thesis after the estimations with all four NICs have been conducted.

5.4.3 Empirical Estimations of Malaysia Models

5.4.3.1 Estimations and Results in Malaysia

Following Singapore study, the following subchapters investigate the same issues with other countries of Malaysia, Korea, and Thailand as what we discussed above with Singapore. In order to avoid repeated studies, the results for Malaysia, Korea and Thailand are shown with relative shorter words compared with Singapore, but the analyses are based on country's actual development.

The basic framework for estimation in Malaysia can be presented as a full version with four endogenous variables in Malaysia:

$$\begin{aligned} LPRGDPML_t &= \gamma_1 + \sum_{k=1}^2 a_{1k} LPRGDPML_{t-k} + \sum_{k=1}^2 b_{1k} LFML_{t-k} + \sum_{k=1}^2 c_{1K} LINVSRML_{t-k} + \sum_{k=1}^2 d_{1k} LTROPNML_{t-k} + u_{1t} \\ LFML_t &= \gamma_2 + \sum_{k=1}^2 a_{2k} LPRGDPML_{t-k} + \sum_{k=1}^2 b_{2k} LFML_{t-k} + \sum_{k=1}^2 c_{2k} LINVSRML_{t-k} + \sum_{k=1}^2 d_{2k} LTROPNML_{t-k} + u_{2t} \\ LINVSRML_t &= \gamma_3 + \sum_{k=1}^2 a_{3k} LPRGDPML_{t-k} + \sum_{k=1}^2 b_{3k} LFML_{t-k} + \sum_{k=1}^2 c_{3K} LINVSRML_{t-k} + \sum_{k=1}^2 d_{3k} LTROPNML_{t-k} + u_{3t} \\ LTROPNML_t &= \gamma_4 + \sum_{k=1}^2 a_{4k} LPRGDPML_{t-k} + \sum_{k=1}^2 b_{4k} LFML_{t-k} + \sum_{k=1}^2 c_{4K} LINVSRML_{t-k} + \sum_{k=1}^2 d_{4k} LTROPNML_{t-k} + u_{4t} \end{aligned}$$

where $LFML_t = \{LMONRTML_t, LPRVNFML_t, LLQLBRML_t\}$

This is the standard form, alternatively named as reduced form of VAR (2) model for Malaysia empirical studies. In order to conduct the further estimations, the next stage is to investigate whether the VAR (2) model with Malaysia is stable, which involves the mathematical and statistical stability for VAR models.

5.4.3.1.1 Stability of Malaysia VAR models

As same as procedures in Singapore models, lag=2 is used as the expected optimal lag length for the VAR model, but mathematical and statistical methods are needed to

investigate the stability conditions for this model. The empirical results of testing the mathematical stability for the VAR models with Malaysia as shown as follows:

Table 12

Mathematical stability for unrestricted VAR models						
VAR Systems with different financial proxies	LMONRTML		LPRVNFML		LLQLBRML	
	Root	Modulus	Root	Modulus	Root	Modulus
	0.981091	0.981091	0.975298	0.975298	0.965708	0.965708
	0.912044	0.912044	0.782075 - 0.139428i	0.794406	0.909875 - 0.097975i	0.915135
	0.603038	0.603038	0.782075 + 0.139428i	0.794406	0.909875 + 0.097975i	0.915135
	0.05110- 0.0504216i	0.506850	0.659969	0.659969	0.357767 - 0.292194i	0.461925
	0.05610+0.0504216i	0.506850	0.129088 - 0.320381i	0.345410	0.357767 + 0.292194i	0.461925
	0.38327-0.139124i	0.405914	0.129088 + 0.320381i	0.345410	0.448733	0.448733
	0.38327+0.139124i	0.405914	0.163924 - 0.178597i	0.242421	-0.002851 - 0.268579i	0.268594
	0.009133	0.009133	0.163924 + 0.178597i	0.242421	-0.002851 + 0.268579i	0.268594
No root lies outside the unit circle in all models						
VAR satisfies the stability condition for all models						

The next table shows the statistical stability in Malaysia.

Table 13

Statistical stability tests for VAR systems							
LF-variables	System Autocorrelation			System Normality		System Heteroscedasticity	
	Statistics		P-value	Statistics		Statistics	P-value
	LM(8)=	12.0178	0.7428	Skewness Chi^2=	5.21003	0.2664	
Monetization Ratio (LMONRTML)	LM(1)=	24.0460	0.0895	Jarque-Bera(8)=	22.4749	0.0041	
	LM(4)=	15.2975	0.5030	Kurtosis Chi^2=	12.3835	0.0145	Chi^2(160)= 173.3621 0.2224
	LM(8)=	12.1444	0.7340	Skewness Chi^2=	10.0914	0.0489	
Private Borrowings (LPRVNFML)	LM(1)=	21.6225	0.1558	Jarque-Bera(8)=	13.9348	0.0835	
	LM(4)=	24.9559	0.0706	Kurtosis Chi^2=	4.8840	0.2994	Chi^2(160)= 159.3675 0.4992
	LM(8)=	13.8439	0.6103	Skewness Chi^2=	9.0507	0.0598	
Liquid Liabilities (LLQLBRML)	LM(1)=	16.0988	0.4461	Jarque-Bera(8)=	10.6535	0.2221	
	LM(4)=	7.0659	0.9720	Kurtosis Chi^2=	5.0423	0.2830	Chi^2(160)= 174.7317 0.2014
	LM(8)=	10.3666	0.8468	Skewness Chi^2=	5.6113	0.2301	
Notes:							
All results here are based on the unrestricted VAR models							

For the autocorrelation and the heteroscedasticity tests for VAR systems, p-values are bigger than 0.05, and thus we cannot reject the hypothesis of non-autocorrelations and heteroscedasticity for system residuals at 95% confident level. There are not problems of both autocorrelations and heteroscedasticity for all VAR models. For the normality tests, the VAR models with LPRVNFML, LLQLBRML satisfy the normality conditions, which mean there are not normality problems for system residuals in these VAR models. But the VAR model with LMONRTML seems to be partial problems of

normality problems for system residuals. It is better to check the normality conditions for individual residuals within this VAR model shown in the following table.

Table 14

Normality tests for individual residuals in VAR(2) model with monetization ratio								
Variables	Skewness	Chi-square	[p-value]	Kurtosis	Chi-square	[p-value]	Jarque-Bera	[p-value]
LPRGDPML	-1.116049	8.926552	[0.0028]	4.034047	1.915746	[0.1663]	10.84230	[0.0044]
LMONRTML	0.261155	0.488789	[0.4845]	1.802091	2.571018	[0.1088]	3.059798	[0.2166]
LINVSRL	0.258551	0.479908	[0.4888]	1.645293	3.288124	[0.0698]	3.767204	[0.1520]
LTROPNML	0.165795	0.165795	[0.6572]	1.396180	4.608597	[0.0418]	4.805595	[0.0905]

The above empirical results indicate most of tests pass the normality test, as their p-values are bigger than 0.05, and therefore there are not normality problems for most of individual residual in the VAR with LMONRTML.

As most of residuals in Malaysia's models can pass the both mathematical and statistical stability, it can be concluded here that lag=2 is an optimal lag length for our VAR models, which is stable to perform cointegration analysis with our endogenous variables.

5.4.3.1.2 Cointegration tests and explanations

Based on the stable Malaysia's VAR models, the next stage is to perform the cointegration tests to investigate multivariate cointegrating relationships among the endogenous variables of LPRGDPML, LFML, LINVSRL, and LTROPNML within Malaysia's growth-finance nexus. The empirical results of Malaysia demonstrate that there exists a unique cointegrating vector for each model, which confirms the existence of a unique cointegrating relationship in these models. The existence of cointegration relationships indicate that there is a long run causation among our

variables, and therefore in the long run the economic growth and finance nexus can be verified to exist in Malaysia economy.

Table 15

Cointegration Procedures for Malaysia models					
$\Delta ZML_t = \tilde{\Gamma}_1 \Delta ZML_{t-1} + \tilde{\Pi} ZML_{t-1} + u_t$ Where $ZML_t = (LPRGDPML_t, LFML_t, LINVSRML_t, LTROPNML_t)$, $\tilde{\Pi} = \tilde{\alpha} \times \tilde{\beta}'$ and $LFML_t = \{LMONRTML_t, LPRVNFML_t, LLQLBRML_t\}$					
LF-variables	Hypothesis	Eigenvalues	Statistics	Critical-value	Prob-value
Monetization Ratio (LMONRTML)	$r = 0$	0.589002	53.78375	47.85613	0.0125
	$r \leq 1$	0.193370	15.54958	29.79707	0.7435
	$r \leq 2$	0.123580	6.309278	15.49471	0.6590
Private Borrowings (LPRVNFML)	$r = 0$	0.452760	52.43028	47.85613	0.0175
	$r \leq 1$	0.392899	27.71270	29.79707	0.0854
	$r \leq 2$	0.128919	7.251228	15.49471	0.5486
Liquid Liabilities (LLQLBRML)	$r = 0$	0.584279	64.71421	54.07904	0.0042
	$r \leq 1$	0.292392	28.72686	35.19275	0.2103
	$r \leq 2$	0.227124	14.54639	20.26184	0.2535
Notes:					
1) MacKinnon-Haug-Michelis (1999) p-values is applied here;					
2) This result is based on unrestricted stable VAR models in Malaysia case.					

The above tables demonstrate that the cointegration vectors exist in each model with different financial indicators, and hence all of our four financial indicators completely have the long run relationships with the economic outputs in Malaysia.

The previous discussion has shown that each empirical model in Malaysia case involves one cointegration vector, which indicates the single cointegration relationship among variables in Malaysia. In order to study further issues of these causations in Malaysia, the complex information of matrix Π in VEC models need to be specified here. The important terms of β' and α in the VEC model can be specified as following:

$$\Pi = \alpha * \beta', \text{ where } \alpha' = (\alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14}) \text{ and } \beta' = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14})$$

$$\text{and } EC_{ML} = \beta_{11}LPRGDPML_{t-1} + \beta_{21}LFML_{t-1} + \beta_{31}LINVSRML_{t-1} + \beta_{41}LTROPNML_{t-1}$$

$$\text{Where } LFML_t = \{LMONRTML_t, LPRVNFML_t, LLQLBRML_t\}$$

The individual equation for EC_{ML} system equations can be specified as followings:

$$\Delta LPRGDPML_t = \alpha_{11} + \gamma_{11}\Delta LPRGDPML_{t-1} + \gamma_{12}\Delta LFML_{t-1} + \gamma_{13}\Delta LINVSRML_{t-1} + \gamma_{14}\Delta LTROPNML_{t-1} + c_1$$

$$\begin{aligned}\Delta LFML_t &= \alpha_{21} + \gamma_{21} \Delta LPRGDPML_{t-1} + \gamma_{22} \Delta LFML_{t-1} + \gamma_{23} \Delta LINVSRML_{t-1} + \gamma_{24} \Delta LTROPNML_{t-1} + c_2 \\ \Delta LINVSRML_t &= \alpha_{31} + \gamma_{31} \Delta LPRGDPML_{t-1} + \gamma_{32} \Delta LFML_{t-1} + \gamma_{33} \Delta LINVSRML_{t-1} + \gamma_{34} \Delta LTROPNML_{t-1} + c_3 \\ \Delta LTROPNML_t &= \alpha_{41} + \gamma_{41} \Delta LPRGDPML_{t-1} + \gamma_{42} \Delta LFML_{t-1} + \gamma_{43} \Delta LINVSRML_{t-1} + \gamma_{44} \Delta LTROPNML_{t-1} + c_4\end{aligned}$$

Where $\Pi = \alpha * \beta'$,

$$\alpha' = (\alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14}), \beta' = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}),$$

and $LFML_t = \{LMONRTML_t, LPRVNFML_t, LLQLBRML_t\}$

Here, the matrix of Π involves the significant information about the long- and short-run causations in Malaysia: β' reveals the long-run relationships in steady state, and $\tilde{\gamma}$ can tell us the dynamic short-run causations in Malaysia.

5.4.3.1.3 The stable VEC models and weak exogeneity

The problem of weak exogeneity should be solved before conducting the investigation of long- and short-run relationships with VEC models, and, therefore, it is important to remove some insignificant adjustment coefficients $\tilde{\alpha}$. These insignificant adjustment coefficients can be shown on the unrestricted Malaysia's VEC models, shown in the following table.

Table 16

Tests of adjustment coefficients($\tilde{\alpha}$) for Malaysia's VECM models					
$\Delta ZML_t = \tilde{\Gamma}_1 \Delta ZML_{t-1} + \tilde{\Pi} ZML_{t-1} + u_t$					
Where $ZML_t = (LPRGDPML_t, LFML_t, LINVSRML_t, LTROPNML_t)$, $\tilde{\Pi} = \tilde{\alpha} \times \tilde{\beta}'$					
and $LFML_t = \{LMONRTML_t, LPRVNFML_t, LLQLBRML_t\}$					
Different Systems with Financial Proxies	Parameter	Adjustment Coefficient statistics	S.D.	critical	Restrictions for Adjustment coefficients
Monetization Ratio (LMONRTML)	$\Delta LPRGDPML$	0.160081	0.09801	1.63337	$\alpha_1 = 0$
	$\Delta LMONRTML$	0.663086	0.14284	4.64211	
	$\Delta LINVSRML$	0.976582	0.35157	2.77778	$\alpha_4 = 0$
	$\Delta LTROPNML$	0.000337	0.18148	0.00186	
Private Borrowings (LPRVNFML)	$\Delta LPRGDPML$	0.347401	0.12790	2.71618	$\alpha_3 = 0$
	$\Delta LPRVNFML$	0.367865	0.08612	4.27158	
	$\Delta LINVSRML$	0.050834	0.11410	0.44553	$\alpha_4 = 0$
	$\Delta LTROPNML$	0.036348	0.06149	0.59112	
Liquid Liabilities (LLQLBRML)	$\Delta LPRGDPML$	0.060334	0.01726	3.49660	$\alpha_2 = 0$
	$\Delta LLQLBRML$	0.011344	0.03886	0.29191	
	$\Delta LINVSRML$	0.048533	0.07682	0.63178	$\alpha_4 = 0$
	$\Delta LTROPNML$	0.093009	0.03815	2.43824	
Notes:					
1) All critical values in this table are absolute values of real results.					
2) “*” means significant in 95% confidence level and “***” means significant in 90% confidence level.					
3) All results here are based on the stable unrestricted VAR and VECM models					

For the case with LMONRTML, the adjustment coefficients for $\Delta LPRGDPML$ and $\Delta LTROPML$ are insignificant, while for the case with LPRVNFML, the adjustment coefficients for $\Delta LINVSRML$ and $\Delta LTROPNML$ are insignificant. In the case of LLQLBRML, the adjustment coefficients for $\Delta LLQLBRML$ and $\Delta LTROPNML$ are insignificant. In order to check whether our restrictions on adjustment coefficients can be accepted, the Likelihood Ratio (LR) tests are performed, together with Chi-square statistical values. The results are presented as following table:

Table 17

Likelihood Ratio for Restrictions on adjustment coefficients based on VECM analysis				
Different Systems with Financial Proxies	Restrictions	Chi-square	Probability	Results
Monetization Ratio (LMONRTML)	$\alpha_1 = 0$ & $\alpha_4 = 0$	3.004195	0.222663	Accept
Private Borrowings (LPRVNFML)	$\alpha_3 = 0$ & $\alpha_4 = 0$	0.316758	0.853526	Accept
Liquid Liabilities (LLQLBRML)	$\alpha_2 = 0$ & $\alpha_4 = 0$	0.511177	0.774461	Accept
Notes:				
1) The critical value of 0.05 for probability at 95% level is used here.				
2) All results here are based on the stable unrestricted VAR and VECM models				

The above tables indicate that all restrictions on adjustment coefficients cannot be rejected in 95% level, since p-values are greater than 0.05. The restrictions on adjustment coefficients in all Malaysia's VEC models can be accepted.

The next stage is to perform the stability tests for VEC models. These stability tests are basic procedure for further economic analysis in Malaysia, as the economic analyses require the stable VEC models. The results for mathematical stability for VEC models are shown as follows:

Table 18

Mathematical stability for vector error correction(VEC) models						
Different VEC systems with financial proxies	LMONRTML		LPRVNFML		LLQLBRML	
	Root	Modulus	Root	Modulus	Root	Modulus
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
	0.629102	0.629102	0.772353	0.772353	0.788477	0.788477
	0.002994 - 0.366796i	0.366808	0.246464 - 0.449456i	0.512596	0.350853	0.350853
	0.002994 + 0.366796i	0.366808	0.246464 + 0.449456i	0.512596	0.070818 - 0.326288i	0.333885
	0.246301	0.246301	0.144117	0.144117	0.070818 + 0.326288i	0.333885
	0.005086	0.005086	0.007982	0.007982	0.141093	0.141093
All VEC models satisfied the stability through checking Roots of Characteristic Polynomial						

The above tests indicate that all VEC models satisfy the mathematical stability.

The next step is the statistical stability, being composed of the autocorrelation, normality and heteroscedasticity tests.

Table 19

Diagnostic tests for system/vector residuals of VECM models									
Different Systems	Vector Autocorrelation			Vector Normality		Vector Heteroscedasticity			
		Statistics	P-value		Statistics	P-value		Statistics	P-value
Monetization	LM(1)=	16.06232	0.4486	Jarque-Bera(8)=	32.98438	0.0020			
Ratio (LMONRTML)	LM(4)=	15.51077	0.3533	Kurtosis Chi^2=	26.95012	0.0041	Chi^2(160)=	119.2878	0.0915
	LM(8)=	15.82502	0.4652	Skewness Chi^2=	22.03426	0.0037			
Private	LM(1)=	11.62254	0.7695	Jarque-Bera(8)=	18.60746	0.0510			
Borrowings (LPRVNFML)	LM(4)=	11.58445	0.7721	Kurtosis Chi^2=	8.483912	0.0754	Chi^2(160)=	83.25473	0.8868
	LM(8)=	23.42437	0.1029	Skewness Chi^2=	14.12355	0.0550			
Liquid	LM(1)=	19.64596	0.2366	Jarque-Bera(8)=	10.64403	0.2227			
Liabilities (LLQLBRML)	LM(4)=	16.76176	0.4012	Kurtosis Chi^2=	1.741104	0.7832	Chi^2(160)=	117.1676	0.1156
	LM(8)=	9.407236	0.8957	Skewness Chi^2=	8.902926	0.0636			
Notes:									
1) All critical values in this table are absolute values of real results.									
2) All results here are based on the stable unrestricted VAR and VECM models									

According to empirical tests, all of them have passed the autocorrelations and heteroscedasticity for system residuals. But for the normality tests for system residuals, most of them passed it except when VEC model with LMONRTML. Now it is necessary to investigate the normality conditions for individual residuals within this VEC model.

Table 20

Normality tests for individual residuals in VEC(2) model with monetization ratio								
Variables	Skewness	Chi-square	[p-value]	Kurtosis	Chi-square	[p-value]	Jarque-Bera	[p-value]
LPRGDPML	-1.657429	19.68735	[0.0000]	6.478393	21.67777	[0.0000]	41.36512	[0.0000]
LMONRTML	0.160292	0.184136	[0.6678]	2.084968	1.500134	[0.2207]	1.684279	[0.4308]
LINVSRL	0.543996	2.120841	[0.1453]	2.526915	0.400991	[0.5266]	2.521832	[0.2834]
LTROPNML	0.076491	0.041932	[0.8377]	1.628280	3.371228	[0.0663]	3.413160	[0.1815]

The above empirical results indicate most of individual residual within the VEC model pass the normality test, as their p-values are bigger than 0.05. In summary, there are not normality problems for most of individual residual in this VEC model with LMONRTML.

5.4.3.2 Analysis of Malaysia's Long-run and Dynamic Models

The above procedures have certified that Malaysia's VEC models are stable. Now we can use these stable models to investigate those causations. As it has been proved that there is only one cointegration vector with Malaysia models, these cointegration coefficients ($\tilde{\beta}$) can be abstracted from empirical results within VEC models, which are normally addressed as the form of EC equations:

$$EC_{ML} = \beta_1 LPRGDPML_t - \beta_2 LFML_t - \beta_3 LINVSRL_t - \beta_4 LTROPNML_t - C,$$

where $\tilde{\beta} = (\beta_1, \beta_2, \beta_3, \beta_4)$, and $LFML_t = \{LMONRTML_t, LPRVNFML_t, LLQLBRML_t\}$

The coefficients of $\beta_1, \beta_2, \beta_3, \beta_4$ reveal the relationships at steady state among economic outputs, proxies of financial growth, investment ratio and trade openness in Malaysia.

5.4.3.2.1 Analysis of Malaysia Models in Steady State

As shown in the following table, the long run interrelationships among economic

outputs, financial growth, investment and trade in Malaysia are represented as the terms of cointegration coefficients, denoted as $\tilde{\beta}_{ML}$ in the VEC models.

Table 21

Cointegration coefficients ($\tilde{\beta}$) with Error-Correction (EC) equations		
$\Delta ZML_t = \tilde{\Gamma}_1 \Delta ZML_{t-1} + \tilde{\Pi} ZML_{t-1} + u_t$ where $ZML_t = (LPRGDPML_t, LFML_t, LINVSRML_t, LTROPNML_t)$ and $\tilde{\Pi} = \tilde{\alpha} \times \tilde{\beta}'$		
Three Systems	Cointegration coefficients ($\tilde{\beta}$) and long run causations	
Monetization Ratio (LMONRTML)	EC equations	$ECML = LPRGDPML - 0.837 * LMONRTML - 0.028 * LINVSRML - 0.315 * LTROPNML - C$
	With EC=0 (Long run causations)	$LPRGDPML = 0.837 * LMONRTML + 0.028 * LINVSRML + 0.315 * LTROPNML + C$
Private Borrowings (LPRVNFML)	EC equations	$ECML = LPRGDPML - 0.927 * LPRVNFML - 0.636 * LINVSRML - 0.407 * LTROPNML - C$
	With EC=0 (Long run causations)	$LPRGDPML = 0.927 * LPRVNFML + 0.636 * LINVSRML + 0.407 * LTROPNML + C$
Liquid Liabilities (LLQLBRML)	EC equations	$EC = LPRGDPML - 0.623 * LLQLBRML - 0.099 * LINVSRML - 1.058 * LTROPNML - C$
	With EC=0 (Long run causations)	$LPRGDPML = 0.623 * LLQLBRML + 0.099 * LINVSRML + 1.058 * LTROPNML + C$
Notes:		
➤ “*” means significant in 95% confidence level and “***” means significant in 90% confidence level.		
➤ All coefficients on LPRGDP are normalized as the value of one.		

The error correction (EC) equations in these VEC models can be transformed to the long run equations as following:

$$LPRGDPML = 0.837 * LMONRTML + 0.028 * LINVSRML + 0.315 * LTROPNML + C,$$

where financial growth is measured as aggregate monetization ratio

$$LPRGDPML = 0.927 * LPRVNFML + 0.636 * LINVSRML + 0.407 * LTROPNML + C,$$

where financial growth is measured as non-financial private borrowings

$$LPRGDPML = 0.623 * LLQLBRML + 0.099 * LINVSRML + 1.058 * LTROPNML + C,$$

where financial growth is measured as liquid liabilities ratio

The coefficients of [0.837], [0.927] and [0.623] in all equations are examined to be significant, as their t-statistics results are bigger than the t-critical value [1.96] at 5% confident level. These coefficients ($\tilde{\beta}_{ML}^1$) reveal the crucial effects of financial

indicators on long-run economic outputs, and these effects positive. The terms of coefficients for investment ratio or trade openness show less significant effects, as the coefficients are insignificant in these systems in Malaysia. Furthermore, the coefficients for financial growth in long run outputs are obviously more significant than coefficients for investment or trade indicators.

The coefficients of financial proxies are the most significant among three significant proxies of finance, investment and trade. It can be, therefore, summarized economic outputs in Malaysia significantly and positively depends on financial growth, investment ratio, and trade openness. For example, among these three significant factors, the coefficient of monetization ratio, are most important, as coefficients of [0.837] is bigger than [0.028],[0.315]. Accordingly, the aggregate monetization ratio is more important than investment ratio and trade openness for Malaysia outputs. The similar situation can be applied for other two systems with non-financial private borrowings and liquid liabilities

It can be, therefore, concluded there exist a definitely significant long-run causations among the variables of economic outputs and financial growth in Malaysia steady state equilibrium. This relationship between outputs and financial growth is identified to be much stronger than other two relationships between outputs and either investment and trade in long run steady state.

5.4.3.2.2 Analysis of Malaysia's Models in Dynamic Process

We now study the dynamic causations of financial growth and macroeconomic

indicators to measure economic development in Malaysia, using economic outputs, investment and trade openness. In terms of vector error-correction (VEC) models, the dynamic causations is represented as the term of $\tilde{\gamma}_{SG}$ in empirical regressions, whereas the terms of $\tilde{\beta}_{ML}$ tell us the information in long-term steady state equilibriums. The detailed information about dynamic causations is shown in following table:

Table 22

Dynamic coefficients (γ) in VEC models For dynamic interactions of endogenous variables									
Systems with Different Financial Proxies		$\Delta LPRGDP_{PML}$		ΔLFM_L		$\Delta LNVSRM_L$		$\Delta LTROPV_{PML}$	
		γ	S.D.	γ	S.D.	γ	S.D.	γ	S.D.
Monetization Ratio	$\Delta LPRGDP_{PML,-1}$	0.443370*	0.23383	1.068489*	0.33919	2.474658	0.83867	0.556072	0.43262
	$\Delta LMONRT_{ML,-1}$	0.349411	0.19554	0.025457**	0.13903	0.228939	0.34375	0.095854	0.15732
(LMONRTML)	$\Delta LNVSRM_{L,-1}$	0.059342	0.05504	0.104046	0.11984	0.223613	0.19740	0.152054	0.10182
	$\Delta LTROPV_{PML,-1}$	0.000542	0.09108	0.066048	0.13212	0.077522	0.32666	0.238164	0.16850
Private Borrowings (LPRVNFML)	$\Delta LPRGDP_{PML,-1}$	0.405659*	0.15351	0.173028	0.18239	1.23419*	0.53335	0.281044	0.28735
	$\Delta LPRVNF_{PML,-1}$	0.023440	0.05268	0.022741*	0.13810	0.22401**	0.13305	0.259961	0.19862
	$\Delta LNVSRM_{L,-1}$	0.093489**	0.05356	0.197202**	0.11041	0.258505	0.18610	0.16076**	0.10027
	$\Delta LTROPV_{PML,-1}$	0.146182**	0.08915	0.093410	0.23370	0.303160	0.30976	0.111812	0.16689
Liquid Liabilities (LLQLBRML)	$\Delta LPRGDP_{PML,-1}$	0.386171*	0.12871	0.20709	0.18373	1.167627	0.56228	0.51500**	0.27515
	$\Delta LLQLBR_{PML,-1}$	0.247878*	0.18591	0.17597*	0.11371	0.096911*	0.03752	0.162915	0.18364
	$\Delta LNVSRM_{L,-1}$	0.028770	0.03768	0.04383	0.08306	0.225196	0.16460	0.151159	0.08055
	$\Delta LTROPV_{PML,-1}$	0.051930	0.07272	0.09496	0.16031	0.413461	0.31769	0.086857	0.15546

Notes:
 ** means significant at 95% confident level;
 *** means significant at 90% confident level

5.4.3.2.2.1 Dynamic Causation with MONRT in Malaysia

In the first case, monetization ratio is used to measure financial growth. The error correction (EC) equations based on vector error correction (VEC) models can be specified as following table to present the dynamic coefficients between monetization

ratio in Malaysia and three different macroeconomic indicators of economic outputs, investment ratio and trade openness.

Table 23.1

Malaysia Economic Development with Monetization Ratio				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDPML_{t-1}$	$MONRTML_{t-1}$	$INVSRL_{t-1}$	$TROPNML_{t-1}$
$PRGDPML_t$	0.443370*	0.349411	0.059342	0.000542
$MONRTML_t$	1.068489*	0.025457**	0.104046	0.066048
$INVSRL_t$	2.474658	0.228939	0.223613	0.077522
$TROPNML_t$	0.556072	0.095854	0.152054	0.238164
Notes:				
➤ The term of “*” means significant at 95% confident level; “**” means significant at 90% confident level				

According to first and second lines, there is one-way causation between economic outputs and aggregate monetization ratio, as the dynamic coefficients of insignificant [0.349] and significant [1.068] are shown, which mean only significant influence from economic outputs to financial growth of monetization ratio. There is other interesting information from above table: investment ratio or trade openness, based on the case involving monetization ratio as financial growth indicator, and there are not any dynamic causations within this VEC systems between financial growth indicator of monetization ratio and either investment ratio and trade openness.

Accordingly, for the system with monetization ration, economic output is shown to have a strong interrelationship with monetization ratio, and this relationship is one-way. This means the financial growth, denoted as monetization ratio, is very weakly linked with economic development in Malaysia.

5.4.3.2.2.2 Dynamic Causations with PRVNF in Malaysia

In the second case, financial growth is measured as non-financial private borrowings. For each individual equation in this VEC system with LPRVNFML, the EC models can be empirically specified due to Malaysia economy below:

Table 23.2

Malaysia Economic Development with Private Borrowings				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDPML_{t-1}$	$PRVNFML_{t-1}$	$INVSRL_{t-1}$	$TROPNML_{t-1}$
$PRGDPML_t$	0.405659*	0.023440	0.093489**	0.146182**
$PRVNFML_t$	0.173028	0.022741*	0.197202**	0.093410
$INVSRL_t$	1.23419*	0.22401**	0.258505	0.303160
$TROPNML_t$	0.281044	0.259961	0.16076**	0.111812
Notes:				
➤ The term of “*” means significant at 95% confident level; “**” means significant at 90% confident level				

These coefficients in above table demonstrate the dynamic causations among the variables of financial growth as private borrowings and three macroeconomic indicators as economic outputs, investment ratio and trade openness in Malaysia economy over the period of 1960 to 2007.

According to first and second lines, there exist one-way link between economic outputs and private borrowings, as the dynamic coefficients of [0.023] is insignificant but another coefficient of [0.173] is significant; and accordingly, the economic outputs exert a significant role in financial growth denoted as private borrowings in this equation. The more strongly significant relationships are shown between financial growth and another macroeconomic indicator of investment ratio. The dynamic

bi-direction causations between financial growth and investment ratio are strongly supported by our empirical results, shown as both significant coefficients of [0.224] and [0.197] to represent significant influences. For influences about trade openness in this system, the causations between trade and other factors in Malaysia economy are much less significant than other variables. There is only one-way causation in the dynamic system: the one-way impact is shown as significant coefficients [0.146] only.

5.4.3.2.2.3 Dynamic Causations with LQLBR in Malaysia

In the third case that financial growth is measured as the ratio of liquid liabilities over nominal outputs, the error correction (EC) models with third financial indicator of liquid liabilities can be reported in the following table.

Table 23.3

Malaysia Economic Development with liquid liabilities				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDPML_{t-1}$	$LQLBRML_{t-1}$	$INVSRL_{t-1}$	$TROPNML_{t-1}$
$PRGDPML_t$	0.386171*	0.247878*	0.028770	0.051930
$LQLBRML_t$	0.20709	0.17597*	0.04383	0.09496
$INVSRL_t$	1.167627	0.096911*	0.225196	0.413461
$TROPNML_t$	0.51500*	0.162915	0.151159	0.086857
Notes:				
➤ The term of “*” means significant at 95% confident level; “***” means significant at 90% confident level				

These coefficients demonstrate the dynamic causations among the variables of economic outputs, liquid liabilities ratio, investment ratio and trade openness in Malaysia economy over the period of 1960 to 2007. According to first and second lines, there is only one-way link between economic outputs and liquid liabilities, due

to a significant coefficient of [0.248] and another insignificant coefficient [0.207] are presented in the system.

According to the second and third equation, there exist one-way causation between financial growth and investment ratio, as coefficient of [0.044] is insignificant in the second equation of this VEC system. But the coefficient of [0.097] is significant in the third equation, which indicates one-way influence from financial growth to investment ratio in the dynamic process. For influences about trade openness in this system, the second equation and fourth equation show that interrelationship between trade and financial growth in Malaysia economy is not significant based on this VEC system, as the both insignificant coefficients of [0.162] and [0.095]. Thus, when the VEC system is involved with liquid liabilities as financial proxy, the trade openness can be regarded as much less important impacts compared with investment ratio and economic outputs in Malaysia transitional developing stages.

5.4.3.3 Comparative studies inside Malaysia and conclusions

These three different estimations, with three variables for financial growth, demonstrate the dynamic causations among the variables to measure economic development: economic outputs (LPRGDPML), investment ratio (LINVSRML) and trade openness (LTROPNML) with three different financial growth systems: Model I with MONRT, Model II with PRVNFML, and Model III with LQLBR. These estimations are presented as the following table. The comparative studies across these

three estimation systems are presented in this subchapter.

Regarding the dynamics of economic outputs with variables of financial growth, the bi-direction dynamic relations between economic outputs and financial growth indicators in Malaysia are shown to be one-way significant from economic outputs to financial growth indicators. These results strongly support the null hypothesis that financial growth in Malaysia is crucially affected by economic development; on the other words, the macroeconomic development, such as outputs, investment and trade, exerts a powerful role in financial growth.

For the second indicator for economic development in Malaysia dynamic process—investment ratio, the bi-direction significant causations only exist in the estimation system with non-financial private financial borrowings. But for other estimation systems involving financial growth indicators of monetization ratio or liquid liabilities, the results show there are very weak links between financial growth and economic development in the system with either monetization ratio and liquid liabilities, in particularly in the system with monetization ratio, as there are no causations to be significantly shown between investment ratio and monetization ratio in Malaysia.

For the last indicator for economic development—trading openness, the relations between economic development and financial growth are much less weak than other two estimations with economic outputs or investment ratio, except the estimation with non-financial private borrowings. There is only one significant influence in the system with financial growth indicator of liquid liabilities. Nothing of significant links are

detected in another two systems.

Overall, the ratio of significant dynamic causations over all relations is approximately 38.89%, and for the system with financial indicator of non-financial private borrowings, the significant dynamic causation is most significant among all systems with three different financial growth indicators. Furthermore, in empirical words for Malaysia economy, the influences from financial growth on economic development are more significant than influences from investment ratio and trading openness. In the meanwhile, these conclusions are in the line with Malaysia economic and financial development in real situations. In addition, the influences from investment ratio on financial growth are more significant than links with trading openness. These influences are positively significant from both directions in the system with private borrowings.

Table 24

Malaysia Dynamic Analysis						
Dynamic Causations						
Systems with different financial proxies	System I with MONRTML		System II with PRVNFML		System III with LQLBRML	
Economic Outputs & Financial Growth	LPRGDPML \Rightarrow LMONRTML	+	LPRGDPML \Rightarrow LPRVNFML	+	LPRGDPML \Rightarrow LLQLBRML	+
	LMONRTML \Rightarrow LPRGDPML	-	LPRVNFML \Rightarrow LPRGDPML	-	LLQLBRML \Rightarrow LPRGDPML	-
Investment Ratio & Financial Growth	LINVSRL \Rightarrow LMONRTML	-	LINVSRL \Rightarrow LPRVNFML	+	LINVSRL \Rightarrow LLQLBRML	-
	LMONRTML \Rightarrow LINVSRL	-	LPRVNFML \Rightarrow LINVSRL	+	LLQLBRML \Rightarrow LINVSRL	+
Trade Openness & Financial Growth	LTROPNML \Rightarrow LMONRTML	-	LTROPNML \Rightarrow LPRVNFML	-	LTROPNML \Rightarrow LLQLBRML	-
	LMONRTML \Rightarrow LTROPNML	-	LPRVNFML \Rightarrow LTROPNML	+	LLQLBRML \Rightarrow LTROPNML	-
Notes:						
1. "+" means the significant either 5% or 10% significant level, "-" means the insignificant either at 5% or 10% significant level.						

The above interpretations reveal both long run and short run causations of economic growth-finance models, involving the endogenous variables of economic outputs,

three financial growth indicators, investment ratio and trade openness in Malaysia economy. Firstly, the existence of the cointegration relationships indicates the long-run relationships between indicators of economic development and proxies of financial growth. Moreover, the long-run interrelationships between three economic development indicators and three financial growth proxies are significant in long run equilibrium. In empirical words for Malaysia economy, the influences from financial growth on economic development are provide to be more significant than influences from investment ratio and trading openness.

In summary, this subchapter uses the cointegration and vector error correction models to present the long run and short-run dynamic causations to investigate the economic development with financial growth. The overall study is composed of three different variables to measure the economic development, which can be regarded to represent the main aspects of economic development in developing countries, in particularly for these newly industrialized countries in Asian region. Compared with other studies, this thesis considers the distinctive merits and shortcomings of employing different financial indicators in the empirical regressions; this thesis is using three different indicators to measure the financial growth.

In terms of empirical results in Malaysia's long run equilibrium and short run dynamic process, it can be concluded some important ideas as followings: a) in the long run equilibriums, the significantly positive relationships are detected between financial growth and economic developments with each financial indicators. These significant long run interrelationships are supported by the existences of cointegration

vectors and significances of cointegrating coefficients. For the short run dynamic causations between economic development and financial growth, the most significant bi-direction causations are suggested between economic outputs and financial growth, and furthermore among all indicators for financial growth, the variable of non-financial private borrowings shows to exert the most significant roles in the process of economic development. These results are exactly the same as our expectations and very close to real life. The advanced level of development of Malaysia's financial systems can be attributed to explain these significant causations. The comparative studies across individual countries will be presented after the estimations with all newly industrialized countries in this thesis.

5.4.4 Empirical Estimations of Korea Models

5.4.4.1 Estimations and Results in Korea

In the light of the Korea's actual development, this basic form can be presented as a full version with four endogenous variables:

$$LPRGDPK_t = \gamma_1 + \sum_{k=1}^2 a_{1k} LPRGDPK_{t-k} + \sum_{k=1}^2 b_{1k} LFKR_{t-k} + \sum_{k=1}^2 c_{1k} LINVSRKR_{t-k} + \sum_{k=1}^2 d_{1k} LTROPNKR_{t-k} + u_{1t}$$

$$LFKR_t = \gamma_2 + \sum_{k=1}^2 a_{2k} LPRGDPK_{t-k} + \sum_{k=1}^2 b_{2k} LFKR_{t-k} + \sum_{k=1}^2 c_{2k} LINVSRKR_{t-k} + \sum_{k=1}^2 d_{2k} LTROPNKR_{t-k} + u_{2t}$$

$$LINVSRKR_t = \gamma_3 + \sum_{k=1}^2 a_{3k} LPRGDPK_{t-k} + \sum_{k=1}^2 b_{3k} LFKR_{t-k} + \sum_{k=1}^2 c_{3k} LINVSRKR_{t-k} + \sum_{k=1}^2 d_{3k} LTROPNKR_{t-k} + u_{3t}$$

$$LTROPNKR_t = \gamma_4 + \sum_{k=1}^2 a_{4k} LPRGDPK_{t-k} + \sum_{k=1}^2 b_{4k} LFKR_{t-k} + \sum_{k=1}^2 c_{4k} LINVSRKR_{t-k} + \sum_{k=1}^2 d_{4k} LTROPNKR_{t-k} + u_{4t}$$

where $LFKR_t = [LMONRTKR_t, LPRVNFKR_t, LLQLBRKR_t]$

This is the standard form, alternatively named as reduced form of VAR model for Korea empirical estimations. In order to use a stable VAR models, the next stage is to check and evaluate whether this VAR model is stable.

5.4.4.1.1 Stability of Korea VAR models

The empirical results of testing the mathematical stability for $VAR(2)$ models in Korea are shown in the following tables.

Table 25

Mathematical stability for unrestricted VAR models						
Systems with different financial Proxies	Systems with LMONRTRK		Systems with LPRVNFKR		Systems with LLQLBRKR	
	Root	Modulus	Root	Modulus	Root	Modulus
	0.983073	0.983073	0.983650	0.983650	0.985820	0.985820
	0.907313	0.907313	0.925943	0.925943	0.882831 - 0.318554i	0.938545
	0.822736 - 0.258510i	0.862393	0.677611 - 0.330207i	0.753786	0.882831 + 0.318554i	0.938545
	0.822736 + 0.258510i	0.862393	0.677611 + 0.330207i	0.753786	0.885271	0.885271
	0.295209 - 0.519508i	0.597526	0.581974	0.581974	0.295628 - 0.541392i	0.616848
	0.295209 + 0.519508i	0.597526	0.275562	0.275562	0.295628 + 0.541392i	0.616848
	-0.109772	0.109772	-0.059131 - 0.110032i	0.124914	-0.085310	0.085310
	0.067989	0.067989	-0.059131 + 0.110032i	0.124914	0.030448	0.030448
No root lies outside the unit circle in all models						
VAR satisfies the stability condition for all models						

The different regressions with three different types of financial proxies (LMONRTRK, LPRVNFKR, and LLQLBRKR) are identified to satisfy the mathematical stability conditions. There are not any roots lying outside the unit circle in all models for all regression models. The following figure includes the statistical stability checking in Korea economy.

Table 26

Statistical stability tests for VAR systems								
Financial Proxies	System Autocorrelation			System Normality			System Heteroscedasticity	
	Statistics	P-value	Statistics	P-value	Statistics	P-value		
Monetization Ratio (LMONRTKR)	LM(1)= 19.07924 LM(4)= 15.18979 LM(8)= 16.86229	0.2646 0.5108 0.3946	Jarque-Bera(8)= 21.54539 Kurtosis Chi^2= 11.81237 Skewness Chi^2= 9.733018	0.0058 0.0188 0.0452	Chi^2(160)= 99.7915			0.0578
Private Borrowings (LPRVNFKR)	LM(1)= 23.27541 LM(4)= 14.22522 LM(8)= 11.53284	0.1066 0.5819 0.7755	Jarque-Bera(8)= 10.76720 Kurtosis Chi^2= 4.753266 Skewness Chi^2= 6.013934	0.2152 0.3136 0.1981	Chi^2(160)= 186.3243			0.0757
Liquid Liabilities (LLQLBRKR)	LM(1)= 25.13102 LM(4)= 6.850369 LM(8)= 18.02782	0.0675 0.9760 0.3223	Jarque-Bera(8)= 18.85202 Kurtosis Chi^2= 9.964956 Skewness Chi^2= 8.887068	0.0157 0.0410 0.0640	Chi^2(160)= 79.5233			0.0656
Notes:								
All results here are based on the unrestricted VAR models								

For the autocorrelation and the heteroscedasticity tests for VAR systems, there are no problems of both autocorrelations and heteroscedasticity for all Korea's residuals. For the normality tests for VAR systems, the model for Korea's non-financial private borrowings (LPRVNFKR) does not suffer from the problems of normality in system residuals, whereas other two VAR models cannot pass the system normality for vector residuals. Now it is better to check the normality conditions for individual residuals within VAR model, shown in the following table.

Table 27
Normality tests for individual residuals in single-equations of VAR model

$ZKR_i = (LPRGDPKR_i, LMONRTKR_i, LINVSRKR_i, LTROPNKR_i)$, system with monetization ratio								
	Skewness	Chi-square	p-value	Kurtosis	Chi-square	p-value	Jarque-Bera	p-value
LPRGDPKR	-1.029562	9.009991	0.0027	4.187742	2.997802	0.0834	12.00779	0.0025
LMONRTKR	0.198930	0.336372	0.5619	1.735659	3.396936	0.0653	3.733308	0.1546
LINVSRKR	-0.053422	0.024258	0.8762	2.140728	1.568990	0.2104	1.593248	0.4508
LTROPNKR	0.206482	0.362397	0.5472	1.654219	3.848644	0.0498	4.211041	0.1218
$ZKR_i = (LPRGDPKR_i, LLQLBRKR_i, LINVSRKR_i, LTROPNKR_i)$ system with liquid liabilities								
	Skewness	Chi-square	p-value	Kurtosis	Chi-square	p-value	Jarque-Bera	p-value
LPRGDPKR	-1.04092	8.126353	0.0044	4.094251	2.245097	0.1340	10.37145	0.0056
LLQLBRKR	-0.07468	0.041838	0.8379	1.781634	2.783280	0.0953	2.825119	0.2435
LINVSRKR	0.04074	0.012453	0.9111	1.822744	2.598621	0.1070	2.611074	0.2710
LTROPNKR	0.30690	0.706423	0.4006	1.883348	2.337958	0.1263	3.044381	0.2182

The empirical results indicate most of individual tests pass the normality test, and therefore there are not normality problems for most of individual residual in this VAR(2) model. As most of residuals in VAR systems can pass the both mathematical

and statistical stability, it can be concluded here that lag=2 is an optimal lag length, which can provide a stable model to perform cointegration analysis with our endogenous variables in Korea.

5.4.4.1.2 Cointegration Tests and Explanations

The purpose of our estimations in this subchapter is to inspect both long- and short-run relationships in Korea. Following the previous subchapters of VAR, the models with Korea are can be reformulated into a VEC models as follows:

$$\Delta ZKR_t = \tilde{\Gamma}_1 \Delta ZKR_{t-1} + \tilde{\Gamma}_2 \Delta ZKR_{t-2} + \dots + \tilde{\Gamma}_{k-1} \Delta ZKR_{t-(k-1)} + \tilde{\Pi} ZKR_{t-1} + u_t,$$

where $ZKR_t = (LPRGDPKR_t, LFKR_t, LINVSRKR_t, LTROPNKR_t),$

$$LFKR_t = [LMONRTKR_t, LPRVNFKR_t, LLQLBRKR_t].$$

As the VAR model in Korea hereby is certified to be stable, the optimal lag length is k=2 in our models, and thus our VEC model can be specified as following:

$$\Delta ZKR_t = \tilde{\Gamma}_1 \Delta ZKR_{t-1} + \tilde{\Pi} ZKR_{t-1} + u_t,$$

where $ZKR_t = (LPRGDPKR_t, LFKR_t, LINVSRKR_t, LTROPNKR_t),$

$$LFKR_t = [LMONRTKR_t, LPRVNFKR_t, LLQLBRKR_t].$$

The next stage is to conduct the cointegration tests to investigate multivariate cointegrating relationships among the endogenous variables in Korea. With the empirical results from cointegration procedures, the VEC models for Korea case can be established with possible cointegration relationships, and then both of short- and long-run causations in Korea can be intercepted through these stable models. Based on our interpretations, the analysis of determining rank of cointegrating vectors can be described as follows:

Table 28

Cointegration Procedures for Korea models					
$\tilde{ZKR}_t = \tilde{A}_0 + \tilde{A}_1 \tilde{ZKR}_{t-1} + \tilde{A}_2 \tilde{ZKR}_{t-2} + \tilde{u}_t$ $ZKR_t = (LPRGDPKR_t, LFKR_t, LINVS RKR_t, LTROPNKR_t),$ where $LFKR_t = [LMONRTKR_t, LPRVNFKR_t, LLQLBRKR_t]$.					
LF-variables	Hypothesis	Eigenvalues	Statistics	Critical- value	Prob-value
Monetization Ratio (LMONRTKR)	$r = 0$	0.430035	57.39522	47.85613	0.0049*
	$r \leq 1$	0.291870	28.72404	29.79707	0.0661
	$r \leq 2$	0.164075	11.12250	15.49471	0.2041
Private Borrowings (LPRVNFKR)	$r = 0$	0.386300	48.70802	47.85613	0.0415*
	$r \leq 1$	0.263464	24.29559	29.79707	0.1882
	$r \leq 2$	0.141049	9.005700	15.49471	0.3648
Liquid Liabilities (LLQLBRKR)	$r = 0$	0.392069	51.88850	47.85613	0.0199*
	$r \leq 1$	0.357531	29.49224	29.79707	0.0542
	$r \leq 2$	0.126659	9.582578	15.49471	0.3142
Notes:					
1) MacKinnon-Haug-Michelis (1999) p-values is applied here;					
2) This result is based on unrestricted stable VAR models in Korea case.					

The above results demonstrate that there exists a unique cointegrating vector for Korea's models. The existence of cointegration relationship indicates that there is long run relationship among our variables, and therefore in the long run the economic growth and finance nexus can be verified to exist in the Korea economy. We applied three difference financial proxies to include various aspects of Korean financial systems, which are all used to test the empirical cointegration relationships with economic outputs of Korea. The above tables demonstrate that the cointegration vectors exist in each model with different financial indicators, and hence all financial indicators have the long run relationships with the economic outputs, investment ratio and trade openness.

5.4.4.1.3 The Stable VEC Models and Weak Exogeneity

In order to explore the details of the causations among variables in the Korea economy, the complex information of matrix Π in VEC models need to be specified here. The important terms of β' and α in the VEC model can be specified as following:

$$\Pi = \alpha * \beta', \text{ where } \alpha' = (\alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14}) \text{ and } \beta' = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14})$$

$$\text{And } EC_{KR} = \beta_{11}LPRGDPKR_{t-1} + \beta_{21}LFKR_{t-1} + \beta_{31}LINVSRRKR_{t-1} + \beta_{41}LTROPNKR_{t-1},$$

$$\text{where } LFKR_t = [LMONRTKR_t, LPRVNFKR_t, LLQLBRKR_t].$$

The individual equation for error-corrections system of Korea can be specified as followings:

$$LPRGDPKR_t = \gamma_1 + \sum_{k=1}^2 a_{1k}LPRGDPKR_{t-k} + \sum_{k=1}^2 b_{1k}LFKR_{t-k} + \sum_{k=1}^2 c_{1k}LINVSRRKR_{t-k} + \sum_{k=1}^2 d_{1k}LTROPNKR_{t-k} + u_{1t}$$

$$LFKR_t = \gamma_2 + \sum_{k=1}^2 a_{2k}LPRGDPKR_{t-k} + \sum_{k=1}^2 b_{2k}LFKR_{t-k} + \sum_{k=1}^2 c_{2k}LINVSRRKR_{t-k} + \sum_{k=1}^2 d_{2k}LTROPNKR_{t-k} + u_{2t}$$

$$LINVSRRKR_t = \gamma_3 + \sum_{k=1}^2 a_{3k}LPRGDPKR_{t-k} + \sum_{k=1}^2 b_{3k}LFKR_{t-k} + \sum_{k=1}^2 c_{3k}LINVSRRKR_{t-k} + \sum_{k=1}^2 d_{3k}LTROPNKR_{t-k} + u_{3t}$$

$$LTROPNKR_t = \gamma_4 + \sum_{k=1}^2 a_{4k}LPRGDPKR_{t-k} + \sum_{k=1}^2 b_{4k}LFKR_{t-k} + \sum_{k=1}^2 c_{4k}LINVSRRKR_{t-k} + \sum_{k=1}^2 d_{4k}LTROPNKR_{t-k} + u_{4t}$$

$$\text{where } LFKR_t = [LMONRTKR_t, LPRVNFKR_t, LLQLBRKR_t]$$

$$\Pi = \alpha * \beta', \alpha' = (\alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14}) \text{ and } \beta' = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}).$$

All of these information must be analyzed based on the stable VEC models of Korea, which means there should be not suffer from weak exogeneity problems, and thus it is important to delete some insignificant adjustment coefficients $\tilde{\alpha}$, which could cause some crucial weak exogeneity problems.

Table 29

Tests of adjustment coefficients($\tilde{\alpha}$) for Korea's VECM models					
$\tilde{ZKR}_t = \tilde{A}_0 + \tilde{A}_1 \tilde{ZKR}_{t-1} + \tilde{A}_2 \tilde{ZKR}_{t-2} + \tilde{u}_t$ $ZKR_t = (LPRGDPKR_t, LFKR_t, LINVSRKR_t, LTROPNKR_t), LFKR_t = [LMONRTKR_t, LPRVNFKR_t, LLQLBRKR_t]$.					
LF-variables	Parameter	Adjustment Coefficient			Restrictions for Adjustment coefficients
		statistics	S.D.	critical	
Monetization Ratio (LMONRTKR)	$\Delta LPRGDPKR$	0.006684	0.01011	0.66099	$\alpha_1 = 0$
	$\Delta LMONRTKR$	0.089224	0.02553	3.49460	
	$\Delta LINVSRKR$	0.081933	0.02086	3.92809	$\alpha_4 = 0$
	$\Delta LTROPNKR$	0.017010	0.02975	0.57167	
Private Borrowings (LPRVNFKR)	$\Delta LPRGDPKR$	0.007439	0.00420	1.77135	$\alpha_3 = 0$
	$\Delta LPRVNFKR$	0.027353	0.01111	2.46113	
	$\Delta LINVSRKR$	0.004091	0.01129	0.36218	$\alpha_4 = 0$
	$\Delta LTROPNKR$	0.003935	0.01268	0.31031	
Liquid Liabilities (LLQLBRKR)	$\Delta LPRGDPKR$	0.004981	0.01350	0.36904	$\alpha_1 = 0$
	$\Delta LLQLBRKR$	0.113334	0.03595	3.15289	
	$\Delta LINVSRKR$	0.127509	0.03237	3.93946	$\alpha_4 = 0$
	$\Delta LTROPNKR$	0.019076	0.03972	0.48021	
Notes:					
1) All critical values in this table are absolute values of real results.					
2) “*” means significant in 95% confidence level and “***” means significant in 90% confidence level.					
3) All results here are based on the stable unrestricted VAR and VECM models					

It is necessary to remove insignificant adjustment coefficients in the models for further economic analysis. In the case with LMONRTKR, the adjustment coefficients of $\Delta LPRGDPKR$ and $\Delta LTROPNKR$ are insignificant. In the case of regression with financial proxy of LPRVNFKR, the adjustment coefficients for $\Delta LINVSRKR$ and $\Delta LTROPNKR$ are insignificant, while with financial proxy of LLQLBRKR, the adjustment coefficients for $\Delta LPRGDPKR$ and $\Delta LTROPNKR$ are insignificant. In order to investigate whether our restrictions on adjustment coefficients can be accepted, the Likelihood Ratio (LR) tests are performed for restrictions, together with Chi-square statistical values. The results are presented as follows:

Table 30

Likelihood Ratio for Restrictions on adjustment coefficients
based on VECM analysis

Different Systems	Restrictions	Chi-square	Probability	Results
Monetization Ratio (LMONRTKR)	$\alpha_1 = 0$ & $\alpha_4 = 0$	0.295334	0.862718	Accept
Private Borrowings (LPRVNFKR)	$\alpha_3 = 0$ & $\alpha_4 = 0$	0.078695	0.779074	Accept
Liquid Liabilities (LLQLBRKR)	$\alpha_1 = 0$ & $\alpha_4 = 0$	0.362256	0.834328	Accept
Notes:				
1) The critical value of 0.05 for probability at 95% level is used here.				
2) All results here are based on the stable unrestricted VAR and VECM models				

The above tables indicate that all restrictions on adjustment coefficients cannot be rejected in 95% level, since p-values are greater than 0.05. Therefore, the

restrictions on adjustment coefficients in Korea's models can be accepted, and thus the following analyses should be based on these restricted VEC models without these insignificant adjustment coefficients.

The mathematical routes for checking VEC models stability is through the roots of autoregressive (AR) characteristic polynomial. The empirical results for mathematical stability for Korea's VEC models are shown as follows:

Table 31

Mathematical stability for vector error correction(VEC) models						
Systems with different financial proxies	LMONRTKR		LPRVNFKR		LLQLBRKR	
	Root	Modulus	Root	Modulus	Root	Modulus
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
	0.745745	0.745745	0.640503 - 0.249032i	0.687212	0.498878 - 0.226081i	0.547715
	0.328489 - 0.452281i	0.558984	0.640503 + 0.249032i	0.687212	0.498878 + 0.226081i	0.547715
	0.328489 + 0.452281i	0.558984	0.240556	0.240556	0.535515	0.535515
	0.202834	0.202834	-0.097864	0.097864	0.246447	0.246447
	-0.100320	0.100320	0.089890	0.089890	-0.134014	0.134014
All VEC models satisfied the stability through checking Roots of Characteristic Polynomial						

Those results show that all of these models satisfy the mathematical stability. The next step is the statistical stability. The empirical results for diagnostic tests are concluded as followings:

Table 32

Diagnostic tests for system/vector residuals of VEC models								
Three Systems with different Proxies	Vector Autocorrelation			Vector Normality		Vector Heteroscedasticity		
	Statistics	P-value		Statistics	P-value	Statistics	P-value	
Monetization Ratio (LMONRTKR)	LM(1)= 11.22249	0.7955	Jarque-Bera(8)= 15.41344	0.0516		Chi^2(160)= 160.6035	0.1201	
	LM(4)= 14.39336	0.5694	Kurtosis Chi^2= 5.140816	0.2732				
	LM(8)= 14.57693	0.5558	Skewness Chi^2= 10.27263	0.3611				
Private Borrowings (LPRVNFKR)	LM(1)= 20.13088	0.2144	Jarque-Bera(8)= 19.88782	0.0108		Chi^2(160)= 113.2541	0.1722	
	LM(4)= 10.49226	0.8397	Kurtosis Chi^2= 7.553849	0.1094				
	LM(8)= 17.32211	0.3651	Skewness Chi^2= 12.33397	0.0150				
Liquid Liabilities (LLQLBRKR)	LM(1)= 14.51687	0.5603	Jarque-Bera(8)= 15.48488	0.0101		Chi^2(160)= 58.7131	0.0521	
	LM(4)= 6.539011	0.9812	Kurtosis Chi^2= 18.88666	0.0080				
	LM(8)= 18.72342	0.2833	Skewness Chi^2= 16.59822	0.0023				
Notes:								
1) All critical values in this table are absolute values of real results.								
2) All results here are based on the stable unrestricted VAR and VEC models								

According to empirical tests, all have passed the autocorrelations and heteroscedasticity for vector residuals, while for the normality tests, most of them

passed it except when VEC model involves LPRVNFKR and LLQLBRKR. Now it is better to check the normality conditions for individual residuals within two VEC models, which can be shown as follows.

Table 33

Normality tests for individual residuals in single-equations of VEC models								
Model with LMONRTKR								
	Skewness	Chi-square	p-value	Kurtosis	Chi-square	p-value	Jarque-Bera	p-value
LPRGDPKR	-0.54574	2.481944	0.1152	3.195823	0.079889	0.7774	2.561833	0.2778
LMONRTKR	0.14939	0.185985	0.6663	2.142658	1.531324	0.2159	1.717310	0.4237
LINVSRR	1.00085	8.347499	0.0039	4.542902	4.959470	0.0259	13.30697	0.0013
LTROPNKR	0.39777	1.318542	0.2509	2.313036	0.983167	0.3214	2.301709	0.3164
Model with LLQLBRKR								
	Skewness	Chi-square	p-value	Kurtosis	Chi-square	p-value	Jarque-Bera	p-value
LPRGDPKR	-1.45054	15.78125	0.0001	5.850279	15.23267	0.0001	31.01392	0.0000
LLQLBRKR	-0.06923	0.035939	0.8496	2.181269	1.256850	0.2622	1.292789	0.5239
LINVSRR	0.25833	0.500404	0.4793	2.166867	1.301458	0.2539	1.801862	0.4062
LTROPNKR	0.19347	0.280634	0.5963	2.235564	1.095680	0.2952	1.376314	0.5025

The above empirical results indicate most of individual residual within the VEC model pass the normality test, as their p-values are bigger than 0.05, and therefore there are not normality problems for most of individual residual in these models involving LBCPKR and LLQKR in Korea.

5.4.4.2 Empirical analysis of Korea's long-run and dynamic models

The cointegrating coefficients ($\tilde{\beta}$) can be abstracted from empirical situations from Korea's economy within vector error-correction (VEC) models, which are normally addressed as the form of error correction (EC) equations:

$$EC_{KR} = \beta_1 LPRGDPKR_t - \beta_2 LFKR_t - \beta_3 LINVSRR_t - \beta_4 LTROPNKR_t - C,$$

where $\tilde{\beta} = (\beta_1, \beta_2, \beta_3, \beta_4)$, $LFKR_t = [LMONRTKR_t, LPRVNFKR_t, LLQLBRKR_t]$

The vector error correction (VEC) model for Korea's regressions can be

specified as follows:

$$LPRGDPK_t = \gamma_1 + \sum_{k=1}^2 a_{1k} LPRGDPK_{t-k} + \sum_{k=1}^2 b_{1k} LFKR_{t-k} + \sum_{k=1}^2 c_{1k} LINVSRKR_{t-k} + \sum_{k=1}^2 d_{1k} LTROPNKR_{t-k} + u_{1t}$$

$$LFKR_t = \gamma_2 + \sum_{k=1}^2 a_{2k} LPRGDPK_{t-k} + \sum_{k=1}^2 b_{2k} LFKR_{t-k} + \sum_{k=1}^2 c_{2k} LINVSRKR_{t-k} + \sum_{k=1}^2 d_{2k} LTROPNKR_{t-k} + u_{2t}$$

$$LINVSRKR_t = \gamma_3 + \sum_{k=1}^2 a_{3k} LPRGDPK_{t-k} + \sum_{k=1}^2 b_{3k} LFKR_{t-k} + \sum_{k=1}^2 c_{3k} LINVSRKR_{t-k} + \sum_{k=1}^2 d_{3k} LTROPNKR_{t-k} + u_{3t}$$

$$LTROPNKR_t = \gamma_4 + \sum_{k=1}^2 a_{4k} LPRGDPK_{t-k} + \sum_{k=1}^2 b_{4k} LFKR_{t-k} + \sum_{k=1}^2 c_{4k} LINVSRKR_{t-k} + \sum_{k=1}^2 d_{4k} LTROPNKR_{t-k} + u_{4t}$$

where $\Pi = \alpha * \beta'$, $\alpha' = (\alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14})$, $\beta' = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14})$,

$$LFKR_t = [LMONRTKR_t, LPRVNFKR_t, LLQLBRKR_t]$$

The detailed analysis of this information about long run and dynamic causations are explained in the following subsubchapters.

5.4.4.2.1 Analysis of Korea models in steady state

The error correction equations for Korea's frameworks can be represented as following table. As shown in the table, the long-run causations among economic outputs, financial growth, investment and trade are represented as the terms of cointegration coefficients, denoted as $\tilde{\beta}_{KR}$ in the VEC models.

Table 34

Cointegration coefficients ($\bar{\beta}$) with Error-Correction (EC) equations		
$\Delta ZKR_t = \tilde{\Gamma}_1 \Delta ZKR_{t-1} + \tilde{\Pi} ZKR_{t-1} + u_t$ where $ZKR_t = (LPRGDPKR_t, LFKR_t, LINVSRKR_t, LTROPNKR_t)$ and $\tilde{\Pi} = \bar{\alpha} \times \bar{\beta}'$		
Three Systems	Cointegration coefficients ($\bar{\beta}$) and long run causations	
Monetization Ratio (LMONRTMI)	EC equations	$EC = LPRGDPKR - 2.522 * LMONRTKR - 2.203 * LINVSRKR - 2.222 * LTROPNKR - C$
	With EC=0 (Long run causations)	$LPRGDPKR = 2.522 * LMONRTKR + 2.203 * LINVSRKR + 2.222 * LTROPNKR + C$
Private Borrowings (LPRVNFML)	EC equations	$EC = LPRGDPKR - 0.614 * LPRVNFKR - 0.560 * LINVSRKR - 0.187 * LTROPNKR - C$
	With EC=0 (Long run causations)	$LPRGDPKR = 0.614 * LPRVNFKR + 0.560 * LINVSRKR + 0.187 * LTROPNKR + C$
Liquid Liabilities (LLQLBRML)	EC equations	$EC = LPRGDPKR - 1.770 * LLQLBRKR - 0.368 * LINVSRKR - 0.536 * LTROPNKR - C$
	With EC=0 (Long run causations)	$LPRGDPKR = 1.770 * LLQLBRKR + 0.368 * LINVSRKR - 0.536 * LTROPNKR + C$
Notes:		
1) ** means significant in 95% confidence level and *** means significant in 90% confidence level.		
2) All coefficients on LPRGDP are normalized as the value of one.		

The error correction (EC) equations in these VEC models can be transformed to the long run equations as following:

$$LPRGDPKR = 2.522 * LMONRTKR + 2.203 * LINVSRKR + 2.222 * LTROPNKR + C$$

where financial growth is measured as aggregate monetization ratio

$$LPRGDPKR_t = 0.614 * LPRVNFKR_t + 0.560 * LINVSRKR_t + 0.187 * LTROPNKR_t + C,$$

where financial growth is measured as non-financial private borrowings

$$LPRGDPKR = 1.770 * LLQLBRKR + 0.368 * LINVSRKR - 0.536 * LTROPNKR + C,$$

where financial growth is measured as liquid liabilities ratio

For the first equation, the coefficients of [2.522], [2.203] and [2.222] are examined to be significant, as their t-statistics results are bigger than the t-critical value [1.96] and coefficients of investment ratio (LINVSRKR), financial growth (LMONRTKR) and trade openness (LTROPNKR) are positively inter-related with economic outputs (LPRGDPKR). The coefficient of financial proxy (LMONRTKR) is most significant among three significant proxies of finance, investment and trade. It

can be, therefore, summarized economic outputs in Korea significantly and positively depends on monetization ratio, investment ratio, and trade openness in this first system. Among these three significant factors, the coefficient of financial proxy, indicated as monetization ratio here, are most important, as coefficients of [2.522] is bigger than either [2.203] or [2.222]; accordingly, the financial proxy in the first system is more important for Korea economic outputs than investment ratio and trade openness based on long run endogenous growth analysis.

For the second equation, the coefficients of [0.614], [0.560] and [0.187] are examined to have the significance in this regression, and coefficients of investment ratio (LINVSRKR), financial growth (LPRVNFKR) and trade openness (LTROPNKR) are positively inter-related with economic outputs (LPRGDPKR) in Korea. Among these three significant factors, the coefficient of financial proxy, indicated as private borrowings here, are most important, as coefficients of [0.614] is bigger than either [0.560] or [0.187]; accordingly, the financial proxy for private borrowings in the first system is more important for Korea economic outputs than investment ratio and trade openness based on long run endogenous growth analysis.

For the third equation, the coefficients of [1.770], [0.368] and [0.536] are examined to have the significance in this regression, but trade openness is negative. The coefficient of financial proxy is more significant than investment ratio in the long run relationship. Among these three significant factors, the coefficient of financial proxy, indicated as liquid liabilities here, are most important, as coefficients of [1.770] is bigger than either [0.368]; accordingly, the financial proxy for liquid

liabilities in the first system is more important for Korea economic outputs than investment ratio based on long run endogenous growth analysis.

5.4.4.2.2 Analysis of Korea's Models in Dynamic Process

After discussing the long run equilibrium of economic development with financial growth in Korea, we will begin discussing the dynamic causations of financial growth and macroeconomic indicators to measure economic development in Korea, using economic outputs, investment and trade openness. In terms of vector error-correction models (VECM), the dynamic causations is represented as the term of $\tilde{\gamma}_{SG}$ in empirical regressions, whereas the terms of $\tilde{\beta}_{KR}$ tell us the information in long-term steady state equilibriums. The detailed information about dynamic causations will be shown in the following table, and the empirical results involve Korea's systems with three different financial indicators to analyse these dynamic causations.

Table 35

Dynamic coefficients (γ) in VEC models For dynamic interactions of endogenous variables									
Systems with Different Financial Proxies		$\Delta PRGDP_{Kt}$		$\Delta LFKR$		$\Delta INTSRK_t$		$\Delta TROP_{NKt}$	
		γ	S.D.	γ	S.D.	γ	S.D.	γ	S.D.
Monetization Ratio (LMONRTKR)	$\Delta LPRGDP_{Kt-1}$	0.231825	0.16804	1.153089	0.82448	0.691157*	0.34521	0.423355	0.49395
	$\Delta LMONRTKR_{-1}$	0.055576*	0.02344	0.625628*	0.13500	0.387442*	0.10979	0.097191	0.15710
	$\Delta INTSRK_{-1}$	0.048451	0.06475	0.547229*	0.16358	0.042670	0.13303	0.154522	0.19035
	$\Delta TROP_{NKt-1}$	0.023014	0.04791	0.166116	0.12103	0.020234	0.09843	0.008072	0.14083
Private Borrowings (LPRVNFKR)	$\Delta LPRGDP_{Kt-1}$	0.176748	0.18765	0.250324	0.29201	0.023896	0.50441	0.230459	0.56587
	$\Delta LPRVNFKR_{-1}$	0.113796*	0.03816	0.375390*	0.10005	0.147873*	0.07257	0.097016	0.11507
	$\Delta INTSRK_{-1}$	0.036139	0.06239	0.296784**	0.16359	0.234529	0.16771	0.080247	0.18814
	$\Delta TROP_{NKt-1}$	0.050227	0.05620	0.139661	0.14736	0.179949	0.15108	0.261269	0.16948
Liquid Liabilities (LLQLBRKR)	$\Delta LPRGDP_{Kt-1}$	0.004842	0.17390	1.321608	0.74676	0.599841	0.43359	0.222627	0.51167
	$\Delta LLQLBRKR_{-1}$	0.108470	0.08699	0.755316*	0.14642	0.431689*	0.14210	0.099733	0.16769
	$\Delta INTSRK_{-1}$	0.011961	0.06902	0.607719**	0.17732	0.062437	0.17209	0.159579	0.20308
	$\Delta TROP_{NKt-1}$	0.054814*	0.01161	0.064718	0.02982	0.033421	0.02894	0.22994**	0.17934

Notes: _____
 “*” means significant at 95% confident level;
 “**” means significant at 90% confident level

5.4.4.2.2.1 Dynamic Process with MONRT in Korea

In our first estimated system, the financial growth is measured as monetization ratio, each individual equation in this vector- error correction system with Korea's

monetization ratio can be empirically specified into following table as followings.

Table 36.1

Korea Economic Development with Monetization Ratio				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDPKR_{t-1}$	$MONRTKR_{t-1}$	$INVS RKR_{t-1}$	$TROPNKR_{t-1}$
$PRGDPKR_t$	0.231825	0.055576*	0.048451	0.023014
$MONRTKR_t$	1.153089	0.625628*	0.547229*	0.166116
$INVS RKR_t$	0.691157*	0.387442*	0.042670	0.020234
$TROPNKR_t$	0.423355	0.097191	0.154522	0.008072
Notes: ➤ The term of “*” means significant at 95% confident level; “***” means significant at 90% confident level				

These coefficients representing the individual equations in this VEC system demonstrate the dynamic causations among the variables of economic outputs, aggregate monetization ratio, investment ratio and trade openness in Korea economy . According to first and second lines, there are the one way link between economic outputs and the first financial proxy of monetization ratio, as the dynamic coefficient of [0.056] is significant, but another way coefficients of [1.153] are insignificant; accordingly, the interrelationship between economic outputs and financial proxy of monetization ratio can be regarded as the influences from financial growth to economic development in this dynamic system

According to the second and third lines in this system, there are bi-direction causations between monetization ratio and investment ratio significantly, as coefficient of [0.547] and [0.387] are proved to be significant in the second and the third equations of this VEC dynamic system. Thus, in the transitional stages of Korea economic development, the investment ratio is still playing an important impact on financial growth. But for influences about trade openness in this system, the results

show that a very weak link between trade and financial growth in Korea economy, as it is shown as two non-significant coefficients based on this VEC system: the coefficients of [0.166] and [0.197] are insignificant in the corresponding equations. Thus, when the VEC system is involved with monetization ratios as financial proxy, the trade openness can be regarded as much less important impacts compared with investment ratio and economic outputs in Korea transitional developing stages.

5.4.4.2.2.2 Dynamic Process with PRVNF in Korea

In our second estimated system, the financial growth is measured as private borrowings; the error correction (EC) models can be empirically specified due to Korea economy as following table involving the coefficients in dynamic process.

Table 36.2

Korea Economic Development with Private Borrowings				
dependent Variables	Coefficients in Dynamic Process			
	<i>PRGDPKR_{t-1}</i>	<i>PRVNFKR_{t-1}</i>	<i>INVSRRK_{t-1}</i>	<i>TROPNKR_{t-1}</i>
<i>PRGDPKR_t</i>	0.176748	0.113796*	0.036139	0.050227
<i>PRVNFKR_t</i>	0.250324	0.375390*	0.296784*	0.139661
<i>INVSRRK_t</i>	0.023896	0.147873*	0.234529	0.179949
<i>TROPNKR_t</i>	0.230459	0.097016	0.080247	0.261269
Notes:				
➤ The term of “*” means significant at 95% confident level; “***” means significant at 90% confident level				

These equations are the same as theoretical information about dynamic coefficients (γ). According to first and second equations, there are the bi-direction causations between economic outputs and financial proxy of private borrowings, as the dynamic coefficients of [0.114] is significant and [0.025] is insignificant where the Korea's financial proxy is measured by non-financial private sector borrowings in Korea

economy. According to the second and third equation in this system, there exit only one-way causation between variables of financial growth and investment ratio, as coefficient of [0.296] is significant in the second, but [0.147] is insignificant in the third equation of this VEC dynamic system. For influences about trade openness in this system, the second equation and fourth equation show that interrelationship between trade and financial growth in Korea economy is not significant based on this VEC system, as the coefficients of [0.020] and [0.097] are insignificant in the second and fourth equations.

5.4.4.2.2.3 Dynamic Process with LQLBR in Korea

In our third estimated system, the financial growth is measured as liquid liabilities; for each individual equation in this vector- error correction system with LLQLBRKR, the error correction (EC) models can be empirically specified due to Korea economy as followings table.

Table 36.3

Korea Economic Development with liquid liabilities				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDPKR_{t-1}$	$LQLBRKR_{t-1}$	$INVSRRK_{t-1}$	$TROPNKR_{t-1}$
$PRGDPKR_t$	0.004842	0.108470	0.011961	0.054814*
$LQLBRKR_t$	1.321608	0.755316	0.607719**	0.064718
$INVSRRK_t$	0.599841	0.431689*	0.062437	0.033421
$TROPNKR_t$	0.222627	0.099733	0.159579	0.22994**
Notes:				
➤ The term of “*” means significant at 95% confident level; “**” means significant at 90% confident level				

According to first and second equations, there are no causations between economic outputs (LPRGDPKR) and financial proxy (LLQLBRKR), as the dynamic coefficients of [0.108] and [1.322] are simultaneously insignificant; accordingly, the

interrelationship between economic outputs and financial proxy is insignificant in this dynamic system, where the Korea's financial proxy is measured by non-financial private sector borrowings in Korea. According to the second and third lines in this system, there exist bi-directional causations in transitional stages between variables of financial growth and investment ratio, as coefficients of [0.607] and [0.432] are significant in this VEC dynamic system. For influences about trade openness in this system, the second equation and fourth equation show that interrelationship between trade and financial growth in Korea economy is not significant based on this VEC system, as the coefficients of [0.064] and [0.099] are both insignificant in the second and fourth equations.

5.4.4.3 Comparative Studies inside Korea and Conclusions

These three different estimations, presented in the vector error-correction models in Korea, demonstrate the dynamic causations between the variables to measure economic development: economic outputs, investment ratio and trade openness in Korea and the variables to indicate three different systems of financial growth: Model I with MONRTKR, Model II with PRVNFKR, and Model III with LQLBRKR. These estimations are presented as the following table of Korea Dynamic Analysis. The individual analysis for estimations in terms of different financial growth variables has been studied in previous subchapter, and on top of that the comparative studies across these three estimation systems are presented in this subchapter.

Regarding the dynamics of economic outputs, i.e. the first indicator for economic development in Korea, with variables of financial growth, there is one-way relation between economic outputs and financial growth indicators in Korea, which indicate significantly positive influences from financial growth to economic development for two systems with both monetization ratio and non-financial private borrowings. For estimation with another financial variable of liquid liabilities, the links are not supported by our empirical results, as both directions are insignificant between financial growth variables and economic outputs. These results support the our hypothesis in Korea that economic development is crucially affected by financial growth, however the opposite influences are too weak.

Table 37

Korea Dynamic Analysis					
Based on stable Korea VEC Models					
Systems with different financial proxies	System I with MONRTKR		System II with PRVNFKR		System III with LQLBRKR
Economic Outputs & Financial Growth	LPRGDPKR \Rightarrow LMONRTKR	-	LPRGDPKR \Rightarrow LPRVNFKR	-	LPRGDPKR \Rightarrow LLQLBRKR
	LMONRTKR \Rightarrow LPRGDPKR	+	LPRVNFKR \Rightarrow LPRGDPKR	+	LLQLBRKR \Rightarrow LPRGDPKR
Investment Ratio & Financial Growth	LINVSRRKR \Rightarrow LMONRTKR	+	LINVSRRKR \Rightarrow LPRVNFKR	+	LINVSRRKR \Rightarrow LLQLBRKR
	LMONRTKR \Rightarrow LINVSRRKR	+	LPRVNFKR \Rightarrow LINVSRRKR	+	LLQLBRKR \Rightarrow LINVSRRKR
Trade Openness & Financial Growth	LTROPNKR \Rightarrow LMONRTKR	-	LTROPNKR \Rightarrow LPRVNFKR	-	LTROPNKR \Rightarrow LLQLBRKR
	LMONRTKR \Rightarrow LTROPNKR	-	LPRVNFKR \Rightarrow LTROPNKR	-	LLQLBRKR \Rightarrow LTROPNKR
Notes:					
1. "+" means the significant either 5% or 10% significant level, "-" means the insignificant either at 5% or 10% significant level.					

For the second indicator for economic development in Korea dynamic process—investment ratio, the bi-direction significant causations exist in both estimation systems with financial growth indicators of monetization ratio and non-financial private financial borrowings. But for other estimation systems involving financial growth indicator of liquid liabilities, the results show there are very weak

interrelationships between financial growth and economic development in either direction. Compared with the first variable for economic development, the investment ratio is much more significant linked with financial growth indicators. Furthermore, the influences from investment ratio are also significant for financial growth, i.e. monetization ratio and private borrowings, whereas there are insignificant roles from economic development to financial growth. But for the estimation with liquid liabilities, there are no causations to be significantly shown between investment ratio and financial growth in Korea.

For the last indicator for economic development-trading openness, the relations between economic development and financial growth are much less weak than other two estimations with either economic outputs or investment ratio. There are nothing of significant causations between trade openness and financial growth. The roles of Korea's trading sectors are not supported by our empirical results in the transitional stages in terms of VEC systems in Korea.

Overall, the ratio of significant dynamic causations over all relations is approximately 44.4%, and for the system with financial indicator of non-financial private borrowings, the significant dynamic causation is most significant among all systems with three different financial growth indicators. Furthermore, in empirical words for Korea economy, the influences from financial growth on economic development are more significant than influences from investment ratio and trading openness. In the meanwhile, these conclusions are in the line with Korea economic and financial development in real situations. In addition, the influences from

investment ratio on financial growth are more significant than links with trading openness. These influences are positively significant from both directions in the system with private borrowings.

The above interpretations reveal both long run relationships and short run causations of economic growth-finance models, involving the endogenous variables of economic outputs, three financial growth indicators, investment ratio and trade openness in Korea economy. Firstly, the existence of the cointegration relationships indicates the long-run relationships between indicators of economic development and proxies of financial growth. Moreover, the long-run interrelationships between three economic development indicators and three financial growth proxies are significant in long run equilibrium. In empirical words for Korea economy, the influences from financial growth on economic development are provide to be more significant than influences from investment ratio and trading openness.

In summary, the cointegration and vector error correction models are presented in this subchapter to investigate the long run relationships and short-run dynamic causations for the economic development with financial growth. The overall study is composed of three different variables to measure the economic development, which can be regarded to represent the main aspects of Korea's economic development.

In terms of empirical results in Korea's long run equilibrium and short run dynamic process, it can be concluded some important ideas as followings: a) in the long run equilibriums, the significantly positive relationships are detected between financial growth and economic developments with each financial indicators. These

significant long run interrelationships are supported by the existences of cointegration vectors and significances of cointegrating coefficients. For the short run dynamic causations between economic development and financial growth, the most significant bi-direction causations are suggested between economic outputs and financial growth, and furthermore among all indicators for financial growth, the variable of non-financial private borrowings shows to exert the most significant roles in the process of economic development. These results are exactly the same as our expectations and very close to real life. The advanced level of development of Korea's financial systems can be attributed to explain these significant causations. The comparative studies across individual countries will be presented after the estimations with all newly industrialized countries in this thesis.

5.4.5 Empirical Estimations of Thailand Models

5.4.5.1 Estimations and Results in Thailand

In light of Thailand's variables, this basic form can be presented as a full version with four endogenous variables:

$$\begin{aligned}
 LPRGDPTH_t &= \gamma_1 + \sum_{k=1}^2 a_{1k} LPRGDPTH_{t-k} + \sum_{k=1}^2 b_{1k} LFTH_{t-k} + \sum_{k=1}^2 c_{1K} LINVSRTH_{t-k} + \sum_{k=1}^2 d_{1k} LTROPNTH_{t-k} + u_{1t} \\
 LFTH_t &= \gamma_2 + \sum_{k=1}^2 a_{2k} LPRGDPTH_{t-k} + \sum_{k=1}^2 b_{2k} LFTH_{t-k} + \sum_{k=1}^2 c_{2k} LINVSRTH_{t-k} + \sum_{k=1}^2 d_{2k} LTROPNTH_{t-k} + u_{2t} \\
 LINVSRTH_t &= \gamma_3 + \sum_{k=1}^2 a_{3k} LPRGDPTH_{t-k} + \sum_{k=1}^2 b_{3k} LFTH_{t-k} + \sum_{k=1}^2 c_{3K} LINVSRTH_{t-k} + \sum_{k=1}^2 d_{3k} LTROPNTH_{t-k} + u_{3t} \\
 LTROPNTH_t &= \gamma_4 + \sum_{k=1}^2 a_{4k} LPRGDPTH_{t-k} + \sum_{k=1}^2 b_{4k} LFTH_{t-k} + \sum_{k=1}^2 c_{4K} LINVSRTH_{t-k} + \sum_{k=1}^2 d_{4k} LTROPNTH_{t-k} + u_{4t}
 \end{aligned}$$

where $LFTH_t = [LMONRTTH_t, LLQLBRTH_t, LPRVNFTH_t]$

This is the standard form, alternatively named as reduced form of $VAR(2)$ model for Thailand empirical estimations. The next stage is to check and evaluate whether this $VAR(2)$ model is stable.

5.4.5.1.1 Stability of Thailand VAR models

The empirical results of testing the mathematical stability for $VAR(2)$ models are described in the following tables.

Table 38

Mathematical stability for unrestricted VAR models						
Systems	LMONRTTH		LPRVNFTH		LLQLBRTH	
	Root	Modulus	Root	Modulus	Root	Modulus
with	0.963465-0.018143i	0.963636	0.982940 - 0.041268i	0.983806	0.945159 - 0.007781i	0.945191
	0.963465+0.018143i	0.963636	0.982940 + 0.041268i	0.983806	0.945159 + 0.007781i	0.945191
different	0.685973-0.398583i	0.793364	0.613945 - 0.382699i	0.723454	0.684215 - 0.439406i	0.813159
	0.685973+0.398583i	0.793364	0.613945 + 0.382699i	0.723454	0.684215 + 0.439406i	0.813159
financial	0.060059-0.413097i	0.417440	0.614989	0.614989	-0.111441 - 0.519252i	0.531075
	0.060059+0.413097i	0.417440	0.303404	0.303404	-0.111441 + 0.519252i	0.531075
proxies	0.186516-0.137042i	0.231449	-0.032588 - 0.101295i	0.106408	0.502376	0.502376
	0.186516+0.137042i	0.231449	-0.032588 + 0.101295i	0.106408	0.281227	0.281227
No root lies outside the unit circle in all models						
VAR satisfies the stability condition for all models						

The different regressions with different financial proxies are identified to satisfy the mathematical stability conditions. The following figure includes the statistical stability checking in the Thailand economy.

Table 39

Statistical stability tests for VAR systems							
Different Systems with Financial Proxies	System Autocorrelation		System Normality		System Heteroscedasticity		
	Statistics	P-value	Statistics	P-value	Statistics	P-value	
Monetization Ratio (LMONRTTH)	LM(1)= 14.77353	0.5413	Jarque-Bera(8)= 10.39350	0.2385	Chi^2(160)= 0.86371	0.8169	
	LM(4)= 6.014736	0.9879	Kurtosis Chi^2= 4.829874	0.3052			
	LM(8)= 11.79109	0.7582	Skewness Chi^2= 5.563623	0.2342			
Private Borrowings (LPRVNFTH)	LM(1)= 18.75667	0.2815	Jarque-Bera(8)= 20.17659	0.0097	Chi^2(160)= 162.973	0.0686	
	LM(4)= 18.63805	0.2879	Kurtosis Chi^2= 12.55208	0.0137			
	LM(8)= 10.48142	0.8403	Skewness Chi^2= 7.624504	0.1063			
Liquid Liabilities (LLQLBRTH)	LM(1)= 8.700305	0.9252	Jarque-Bera(8)= 11.78130	0.1612	Chi^2(160)= 139.443	0.0667	
	LM(4)= 19.62348	0.2377	Kurtosis Chi^2= 7.673030	0.1043			
	LM(8)= 10.42041	0.8438	Skewness Chi^2= 4.108268	0.3916			
<u>Notes:</u>							
All results here are based on the unrestricted VAR models							

There are not problems of both autocorrelations and heteroscedasticity for all

Thailand's VAR systems. For the normality tests for VAR systems, the VAR model for Thailand's private borrowings (LPRVNFTH) fails to satisfy the normality conditions in system residuals. Now it is better to check the normality conditions for individual residuals within this VAR model, which can be shown as following table.

Table 40

Normality tests for individual residuals in single-equations of VAR model								
	Skewness	Chi-square	p-value	Kurtosis	Chi-square	p-value	Jarque-Bera	p-value
LPRGDPTH	-0.85118	6.640188	0.0100	4.005527	2.317068	0.1280	8.957257	0.0113
LPRVNFTH	0.20730	0.394151	0.5301	1.611656	4.417183	0.0356	4.811334	0.0902
LINVSRTTH	-0.12158	0.135449	0.7128	2.116089	1.790478	0.1809	1.925927	0.3818
LTROPNTH	-0.22273	0.454716	0.5001	1.674334	4.027355	0.0448	4.482071	0.1063

There are not normality problems for most of individual residual in Thailand's VAR model. The stable VAR models are proved through above tests, and, thus, we can perform cointegration analysis with our endogenous variables.

5.4.5.1.2 Cointegration Tests and Explanations

The variables in Thailand are non-stationary series, all of which have the strong trends in their level and contains one unit root. The purpose of our estimations in this subchapter, based on stable VAR models, is to inspect both long run and short run relationships in Thailand. The stable VAR models in Thailand can be reformulated into a vector error-correction model (VEC) in Thailand, and our VEC model can be specified with k=2 as follows:

$$\Delta ZTH_t = \tilde{\Gamma}_1 \Delta ZTH_{t-1} + \tilde{\Gamma} ZTH_{t-1} + u_t, \quad ,$$

where $ZTH_t = (LPRGDPTH_t, LFTH_t, LINVSRTTH_t, LTROPNTH_t)$

Following the previous results for Thailand regressions, the next empirical

stage is to perform the cointegration tests to investigate cointegrating relationships among the endogenous variables in Thailand. The results of cointegration tests can be shown as follows:

Table 41

Cointegration Procedures for Malaysia models					
$\Delta ZTH_t = \tilde{\Gamma}_1 \Delta ZTH_{t-1} + \tilde{\Pi} ZTH_{t-1} + u_t$ where $ZTH_t = (LPRGDPTH_t, LFTH_t, LINVSRTH_t, LTROPNTH_t)$ and $\tilde{\Pi} = \tilde{\alpha} \times \tilde{\beta}'$					
Different Systems with Financial Proxies	Hypothesis	Eigenvalues	Statistics	Critical-value	Prob-value
Monetization Ratio (LMONRTTH)	$r = 0$	0.447834	63.63656	47.85613	0.0009
	$r \leq 1$	0.328800	28.34728	29.79707	0.0687
	$r \leq 2$	0.205207	13.01420	15.49471	0.1143
Private Borrowings (LPRVNFTH)	$r = 0$	0.485177	63.62832	47.85613	0.0009
	$r \leq 1$	0.222477	27.11202	29.79707	0.0989
	$r \leq 2$	0.185233	13.27174	15.49471	0.1052
Liquid Liabilities (LLQLBRTH)	$r = 0$	0.680349	82.86680	54.07904	0.0000
	$r \leq 1$	0.367937	34.96475	35.19275	0.0529
	$r \leq 2$	0.236512	15.69659	20.26184	0.1890
<u>Notes:</u>					
1) MacKinnon-Haug-Michelis (1999) p-values is applied here;					
2) This result is based on unrestricted stable VAR models in Malaysia case.					

The empirical results demonstrate that there exists a unique cointegrating vector in Thailand's models. The existence of cointegration relationship indicates that there is long run relationship in Thailand's models, and therefore in the long run the economic growth and finance nexus exist in Thailand economy. The results demonstrate that the cointegration vectors exist in each model with different financial proxies in Thailand, and hence all of financial proxies completely have the long run relationships with the economic outputs in Thailand.

5.4.5.1.3 The Stable VEC Models and Weak Exogeneity

The previous results have shown that each Thailand's model involves one cointegration vectors, indicating the single cointegration relationship among variables in Thailand. In order to explore the causations in Thailand, the complex information

of matrix Π in VEC models need to be specified here. The important terms of β' and α in the VEC model can be specified as following:

$$\Pi = \alpha * \beta', \text{ where } \alpha' = (\alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14}) \text{ and } \beta' = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14})$$

$$\text{And } EC_{TH} = \beta_{11}LPRGDPTH_{t-1} + \beta_{21}LFTH_{t-1} + \beta_{31}LINVSRTHT_{t-1} + \beta_{41}LTROPNTH_{t-1}$$

The individual equation for error-corrections system of Thailand can be specified as followings:

$$\Delta LPRGDPTH_t = \alpha_{11} + \gamma_{11}\Delta LPRGDPTH_{t-1} + \gamma_{12}\Delta LFTH_{t-1} + \gamma_{13}\Delta LINVSRTHT_{t-1} + \gamma_{14}\Delta LTROPNTH_{t-1} + c_1$$

$$\Delta LFTH_t = \alpha_{21} + \gamma_{21}\Delta LPRGDPTH_{t-1} + \gamma_{22}\Delta LFTH_{t-1} + \gamma_{23}\Delta LINVSRTHT_{t-1} + \gamma_{24}\Delta LTROPNTH_{t-1} + c_2$$

$$\Delta LINVSRTHT_t = \alpha_{31} + \gamma_{31}\Delta LPRGDPTH_{t-1} + \gamma_{32}\Delta LFTH_{t-1} + \gamma_{33}\Delta LINVSRTHT_{t-1} + \gamma_{34}\Delta LTROPNTH_{t-1} + c_3$$

$$\Delta LTROPNTH_t = \alpha_{41} + \gamma_{41}\Delta LPRGDPTH_{t-1} + \gamma_{42}\Delta LFTH_{t-1} + \gamma_{43}\Delta LINVSRTHT_{t-1} + \gamma_{44}\Delta LTROPNTH_{t-1} + c_4$$

$$\text{where } \Pi = \alpha * \beta', \text{ where } \alpha' = (\alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14}) \text{ and } \beta' = (\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14})$$

$$\text{where } LFTH_t = [LMONRTTH_t, LLQLBRTH_t, LPRVNFTH_t]$$

Here, the matrix of Π involves the significant information about the long-run and short-run relationships in Thailand economic performance. These information must be analyzed based on the stable VEC models, and thus it is important to remove some insignificant adjustment coefficients $\tilde{\alpha}$ that could cause some weak exogeneity. These insignificant adjustment coefficients can be shown on the unrestricted Thailand's VEC models shown as following:

Table 42

Tests of adjustment coefficients($\tilde{\alpha}$) for Thailand's VEC models						
$\Delta ZTH_t = \tilde{\Gamma}_1 \Delta ZTH_{t-1} + \tilde{\Pi} ZTH_{t-1} + u_t$, where $ZTH_t = (LPRGDP_{t-1}, LFT_{t-1}, LINVSRTH_{t-1}, LTROPNT_{t-1})$ and $\tilde{\Pi} = \tilde{\alpha} \times \tilde{\beta}'$						
Different Systems with Financial Proxies	Parameter	Adjustment Coefficient statistics	S.D.	critical	Restrictions for Adjustment coefficients	
Monetization Ratio (LMONRTTH)	$\Delta LYTH$	0.343549	0.08655	3.96921*	$\alpha_3 = 0$	
	$\Delta LMATH$	0.320918	0.13387	2.39722*		
	$\Delta LIRTH$	0.040571	0.20745	0.19557	$\alpha_4 = 0$	
	$\Delta LTRTH$	0.249598	0.19901	1.25419		
Private Borrowings (LPRVNFTH)	$\Delta LYTH$	0.037170	0.03010	1.23497	$\alpha_1 = 0$	
	$\Delta BCPH$	0.075166	0.05775	1.30151		
	$\Delta LIRTH$	0.240975	0.06050	3.98331*	$\alpha_2 = 0$	
	$\Delta LTRTH$	0.202726	0.05262	3.85256*		
Liquid Liabilities (LLQLBRTH)	$\Delta LYTH$	0.045913	0.06038	0.76034	$\alpha_2 = 0$	
	$\Delta LLQTH$	0.089591	0.03295	2.71899		
	$\Delta LIRTH$	0.322812	0.13323	2.42292*		
	$\Delta LTRTH$	0.326609	0.10435	3.12986*		
Notes:						
1) All critical values in this table are absolute values of real results.						
2) "*" means significant in 95% confidence level and "***" means significant in 90% confidence level.						
3) All results here are based on the stable unrestricted VAR and VECM models						

For the case with LMONRTTH, the adjustment coefficients for $\Delta LIRTH$ and $\Delta LTRTH$ are insignificant, while in the case with LPRVNFTH, the adjustment coefficients for $\Delta LYTH$ and $\Delta LFTH$ are insignificant. In the case with LLQLBRTH, the adjustment coefficient for $\Delta LFSG$ is insignificant. The Likelihood Ratio (LR) tests and Chi-square statistical values are presented as follows:

Table 43

Likelihood Ratio for Restrictions on adjustment coefficients based on VECM analysis					
Different Systems with Financial Proxies	Restrictions	Chi-square	Probability	Results	
Monetization Ratio (LMONRTTH)	$\alpha_3 = 0$ & $\alpha_4 = 0$	0.824033	0.364004	Accept	
Private Borrowings (LPRVNFTH)	$\alpha_1 = 0$ & $\alpha_2 = 0$	2.554029	0.278869	Accept	
Liquid Liabilities (LLQLBRTH)	$\alpha_2 = 0$	0.374779	0.540411	Accept	
Notes:					
1) The critical value of 0.05 for probability at 95% level is used here.					
2) All results here are based on the stable unrestricted VAR and VECM models					

The above tables indicate the restrictions on adjustment coefficients in the Thailand's VEC models can be accepted.

The next stage is to check the stability tests for Thailand's VEC models. The economic analyses require the stable VEC models. The empirical results for mathematical stability for VEC models are shown as following:

Table 44

Mathematical stability for vector error correction(VEC) models						
	LMONRTTH		LPRVNFTH		LLQLBRTH	
	Root	Modulus	Root	Modulus	Root	Modulus
Systems	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
with	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
different	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
financial	0.649836	0.649836	0.528090 - 0.419567i	0.674474	0.629123 - 0.116154i	0.639755
proxies	0.364817 - 0.124577i	0.385501	0.528090 + 0.419567i	0.674474	0.629123 + 0.116154i	0.639755
	0.364817 + 0.124577i	0.385501	0.640257	0.640257	-0.010576 - 0.451461i	0.451585
	-0.006958 - 0.360174i	0.360241	-0.020565 - 0.188190i	0.189311	-0.010576 + 0.451461i	0.451585
	-0.006958 + 0.360174i	0.360241	-0.020565 + 0.188190i	0.189311	0.256338	0.256338
All VEC models satisfied the stability through checking Roots of Characteristic Polynomial						

The above results show that all of these VEC models satisfy the mathematical stability. The empirical results of the statistical stability are concluded as followings:

Table 45

Diagnostic tests for system/vector residuals of VECM models								
Different Systems with Financial Proxies	Vector Autocorrelation			Vector Normality			Vector Heteroscedasticity	
	Statistics	P-value		Statistics	P-value		Statistics	P-value
Monetization Ratio (LMONRTTH)	LM(1)= 22.79717	0.1193	Jarque-Bera(8)= 37.27190	0.0070			Chi^2(160)= 121.5191	0.0707
	LM(4)= 10.90744	0.8152	Kurtosis Chi^2= 22.21554	0.0032				
	LM(8)= 13.35351	0.6468	Skewness Chi^2= 15.05636	0.0046				
Private Borrowings (LPRVNFTH)	LM(1)= 13.86755	0.6086	Jarque-Bera(8)= 13.85422	0.0657			Chi^2(160)= 149.8291	0.0607
	LM(4)= 19.50770	0.2432	Kurtosis Chi^2= 8.960433	0.0621				
	LM(8)= 12.08846	0.7379	Skewness Chi^2= 9.893791	0.0423				
Liquid Liabilities (LLQLBRTH)	LM(1)= 14.12835	0.5892	Jarque-Bera(8)= 23.86347	0.0240			Chi^2(160)= 114.7947	0.1480
	LM(4)= 16.00780	0.4524	Kurtosis Chi^2= 14.61562	0.0056				
	LM(8)= 12.30195	0.7229	Skewness Chi^2= 9.247859	0.0520				
Notes:								
1) All critical values in this table are absolute values of real results.								
2) All results here are based on the stable unrestricted VAR and VECM models								

According to above empirical tests, all of them have passed the autocorrelations and heteroscedasticity for system residuals; for the normality tests for system residuals, most of them passed it except when VEC model involves LMONRTTH and LLQLBRTH in the regression. Now it is better to check the normality conditions for individual residuals within two VEC models, which can be shown as following table.

Table 46

Normality tests for individual residuals in single-equations of VEC model								
	Skewness	Chi-square	p-value	Kurtosis	Chi-square	p-value	Jarque-Bera	p-value
LPRGDPTH	-1.183782	11.91139	0.0006	5.958473	18.59919	0.0000	30.51058	0.0000
LMONRTTH	0.586783	2.926667	0.0871	3.556386	0.657826	0.4173	3.584493	0.1666
LINVSRTTH	-0.122654	0.127875	0.7206	2.951066	0.005088	0.9431	0.132963	0.9357
LTROPNTTH	-0.103143	0.090427	0.7636	1.821080	2.953437	0.0857	3.043864	0.2183

Normality tests for individual residuals in single-equations of VEC models B								
	Skewness	Chi-square	p-value	Kurtosis	Chi-square	p-value	Jarque-Bera	p-value
LPRGDPTH	-1.12670	8.886276	0.0029	5.446432	10.47381	0.0012	19.36008	0.0001
LLQLBRTH	-0.17265	0.208663	0.6478	1.762271	2.680951	0.1016	2.889614	0.2358
LINVSRTTH	-0.14556	0.148318	0.7001	2.265640	0.943748	0.3313	1.092066	0.5792
LTROPNTTH	-0.02563	0.004601	0.9459	2.456408	0.517111	0.4721	0.521712	0.7704

The above empirical results indicate most of individual residual within the VEC model pass the normality test, as their p-values are bigger than 0.05, and therefore there are not normality problems for most of individual residual in this VEC models with LMONRTTH and LLQLBRTH in Thailand's regressions.

The above procedures have certified that our VEC models are stable. Now we can explain those results with accordance to the economic-finance theories. The cointegrating coefficients ($\tilde{\beta}$) imply the potential long-run causations among the variables. As it has been proved that there is only one cointegration vector for each case with Thailand data, these cointegration coefficients($\tilde{\beta}$) can be abstracted from empirical results within vector error-correction (VEC) models, which are normally addressed as the form of error correction (EC) equations:

$$EC_{TH} = \beta_1 LPRGDPTH_t - \beta_2 LFTH_t - \beta_3 LINVSRTTH_t - \beta_4 LTROPNTTH_t - C,$$

where $\tilde{\beta} = (\beta_1, \beta_2, \beta_3, \beta_4)$, and $LFTH_t = \{LMONRTTH_t, LPRVNFTH_t, LLQLBRTH_t\}$

In the empirical procedures of expressing the long-run relationships, the term of EC is assumed to be close to zero in long term. The coefficients of $\beta_1, \beta_2, \beta_3, \beta_4$ reveal the

long-run causations among economic outputs, proxies of financial growth, investment ratio and trade openness in Thailand.

The vector error correction (VEC) model can be theoretically described as $\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Pi Z_{t-1} + u_t$; as the coefficient vector is detected to be one, the VEC models can be specified as following:

$$\Delta LPRGDPTH_t = \alpha_{11} + \gamma_{11} \Delta LPRGDPTH_{t-1} + \gamma_{12} \Delta LFTH_{t-1} + \gamma_{13} \Delta LINVSRTHT_{t-1} + \gamma_{14} \Delta LTROPNTH_{t-1} + c_1$$

$$\Delta LFTH_t = \alpha_{21} + \gamma_{21} \Delta LPRGDPTH_{t-1} + \gamma_{22} \Delta LFTH_{t-1} + \gamma_{23} \Delta LINVSRTHT_{t-1} + \gamma_{24} \Delta LTROPNTH_{t-1} + c_2$$

$$\Delta LINVSRTHT_t = \alpha_{31} + \gamma_{31} \Delta LPRGDPTH_{t-1} + \gamma_{32} \Delta LFTH_{t-1} + \gamma_{33} \Delta LINVSRTHT_{t-1} + \gamma_{34} \Delta LTROPNTH_{t-1} + c_3$$

$$\Delta LTROPNTH_t = \alpha_{41} + \gamma_{41} \Delta LPRGDPTH_{t-1} + \gamma_{42} \Delta LFTH_{t-1} + \gamma_{43} \Delta LINVSRTHT_{t-1} + \gamma_{44} \Delta LTROPNTH_{t-1} + c_4$$

where $LFTH_t = [LMONRTTH_t, LLQLBRTH_t, LPRVNFTH_t]$

The matrix of $\tilde{\gamma}$ can reveal the information about the dynamic short-run causations among variables for each empirical case. Following the above theoretical interpretations about long-run ($\tilde{\beta}$) and dynamic causations ($\tilde{\gamma}$), the empirical results in Thailand's empirical regressions have been concluded as following tables. The detailed analysis of this information about long run and dynamic causations are explained in the following subchapters.

5.4.5.2 Empirical Analysis of Thailand's Long-run and Dynamic Models

5.4.5.2.1 Analysis of Thailand Models in Steady State

Now we are using the above empirical results to analyse the Thailand models, with the four endogenous variables to represent economic outputs, financial growth, investment ratio and trade openness in Thailand. The error correction equations for

Thailand's frameworks can be represented as following table. As suggestion from above tables, the long run interrelationships among economic outputs, financial growth, investment and trade are represented as the terms of cointegration coefficients, denoted as $\tilde{\beta}_{TH}$ in the VEC models.

Table 47

Long-run Causations in Thailand based on Error-Correction (EC) equations		
$\Delta ZTH_t = \tilde{\Gamma}_1 \Delta ZTH_{t-1} + \tilde{\Pi} ZTH_{t-1} + u_t$ where $ZTH_t = (LPRGDPTH_t, LFTH_t, LINVSRTH_t, LTROPNTH_t)$ and $\tilde{\Pi} = \tilde{\alpha} \times \tilde{\beta}'$		
Three Systems	Cointegration coefficients ($\tilde{\beta}$) and long run causations	
Monetization Ratio (LMONRTTH)	EC equations	$EC = LPRGDPTH - 0.588 * LMONRTTH - 0.459 * LINVSRTH - 0.758 * LTROPNTH - C$
	With EC=0 (Long run causations)	$LPRGDPTH = 0.588 * LMONRTTH + 0.459 * LINVSRTH + 0.758 * LTROPNTH + C$
Private Borrowings (LPRVNFTH)	EC equations	$EC = LPRGDPTH - 0.053 * LPRVNFTH - 1.205 * LINVSRTH - 0.978 * LTROPNTH - C$
	With EC=0 (Long run causations)	$LPRGDPTH = 0.053 * LPRVNFTH + 1.205 * LINVSRTH + 0.978 * LTROPNTH + C$
Liquid Liabilities (LLQLBRTH)	EC equations	$EC = LPRGDPTH - 0.562 * LLQLBRTH - 1.051 * LINVSRTH - 0.456 * LTROPNTH - C$
	With EC=0 (Long run causations)	$LPRGDPTH = 0.562 * LLQLBRTH + 1.051 * LINVSRTH + 0.456 * LTROPNTH + C$
Notes:		
1) "a" means significant in 95% confidence level.		
2) All coefficients on LY are normalized as the value of one.		

The error correction (EC) equations in these VEC models can be transformed to the long run equations to represent the long run relationships in steady state as following:

$$LPRGDPTH = 0.588 * LMONRTTH + 0.459 * LINVSRTH + 0.758 * LTROPNTH + C$$

where financial growth is measured as aggregate monetization ratio

$$LPRGDPTH = 0.053 * LPRVNFTH + 1.205 * LINVSRTH + 0.978 * LTROPNTH + C$$

where financial growth is measured as non-financial private borrowings

$$LPRGDPTH = 0.623 * LLQLBRTH + 1.051 * LINVSRTH + 0.456 * LTROPNTH + C$$

where financial growth is measured as liquid liabilities ratio

The coefficients of [0.588], [0.053] and [0.623] in all equations are examined to have the significance for each estimation system, as their t-statistics results are bigger than

the t-critical value [1.96] at 5% confident level. These coefficients ($\tilde{\beta}^1_{TH}$) reveal the significant effects of financial indicators on long-run economic outputs, and these effects are identified to be positive relationship. In our first system that monetary ratio is performed to measure financial growth, the coefficients of [0.588], [0.459] and [0.758] are examined to be significant in this regression, as their t-statistics results are bigger than the t-critical value [1.96] and coefficients of investment ratio (LINVSRTH), monetization ratio (LMONRTTH) and trade openness (LTROPNTH) are positively inter-related with economic outputs (LPRGDPTH) . It can be, therefore, summarized economic outputs in Thailand significantly and positively depends on monetization ratio, investment ratio, and trade openness in long run steady state.

In the second system that financial growth is measured as non-financial private borrowings in Thailand, the coefficients of [0.053], [1.205] and [0.978] are examined to be significant in this regression, as their t-statistics results are bigger than the t-critical value [1.96] and coefficients of investment ratio (LINVSRTH), private borrowings (LPRVNFTH) and trade openness (LTROPNTH) are positively inter-related with economic outputs (LPRGDPTH) in Thailand in long run steady state. In the third case that financial growth is measured as the ratio of liquid liabilities over nominal outputs, the coefficients of [0.623], [0.099] and [1.058] are examined to have the significance in this regression and coefficients of investment ratio (LINVSRTH), financial growth (LLQLBRTH) and trade openness (LTROPNTH) are positively inter-related with economic outputs (LPRGDPTH) in Thailand.

Accordingly, we can conclude that there exist definitely significant long-run relationships among the variables of economic outputs and financial growth in Thailand steady state equilibrium. This relationship between outputs and financial growth is identified to be much stronger than other two relationships between outputs and either investment and trade in long run steady state.

5.4.5.2.2 Analysis of Thailand's Models in Dynamic Process

After discussing the long run equilibrium of economic development with financial growth in Thailand, we will begin discussing the dynamic causations of financial growth and macroeconomic indicators to measure economic development in Thailand, using economic outputs, investment and trade openness. In terms of vector error-correction models (VECM), the dynamic causations is represented as the term of $\tilde{\gamma}_{SG}$ in empirical regressions, whereas the terms of $\tilde{\beta}_{TH}$ tell us the information in long-term steady state equilibriums. The detailed information about dynamic causations will be shown in the following table, and the empirical results involve Thailand's systems with three different financial indicators to analyse these dynamic causations.

Table 48

Dynamic coefficients (γ) in VEC models For dynamic interactions of endogenous variables									
Three Systems	$\Delta LPRGDPTH$		$\Delta LFTH$		$\Delta LINVSRTH$		$\Delta LTROPNTH$		
	γ	S.D.	γ	S.D.	γ	S.D.	γ	S.D.	
Monetization Ratio (LMONRTTH)	$\Delta LPRGDPTH_{-1}$	0.3524*	0.1505	0.1009*	0.0357	0.931374*	0.36324	1.147801*	0.34635
	$\Delta LMONRTTH_{-1}$	0.1770**	0.1001	0.3035**	0.1629	0.158776	0.15107	0.126311	0.13940
	$\Delta LINVSRTH_{-1}$	0.0087	0.0620	0.0257	0.0771	0.380610	0.14962	0.24711**	0.14267
	$\Delta LTROPNTH_{-1}$	0.0637	0.0592	0.0653	0.0927	0.003521*	0.14287	0.047615	0.13623
	$\Delta LPRGDPTH_{-1}$	0.29335**	0.15423	0.0743	0.0678	0.919599*	0.30883	1.155933*	0.27033
Private Borrowings (LPRVNFTH)	$\Delta LPRVNFTH_{-1}$	0.08765	0.08437	0.4372*	0.1243	0.21537**	0.12889	0.005156	0.11282
	$\Delta LINVSRTH_{-1}$	0.04606	0.06383	0.2995*	0.1232	0.409083*	0.12781	0.243443	0.11187
	$\Delta LTROPNTH_{-1}$	0.02108	0.07130	0.1463	0.1377	0.095136	0.14276	0.067084	0.12496
	$\Delta LPRGDPTH_{-1}$	0.33191	0.26216	0.1538	0.3552	1.539369*	0.56507	2.036553*	0.44965
	$\Delta LLQLBRTH_{-1}$	0.04313	0.13997	0.2010	0.1897	0.056810	0.30170	0.36796	0.22007
Liquid Liabilities (LLQLBRTH)	$\Delta LINVSRTH_{-1}$	0.04091	0.09477	0.0186	0.1284	0.110675	0.20426	0.571865	0.16254
	$\Delta LTROPNTH_{-1}$	0.01456	0.08328	0.2174	0.1829	0.156992	0.17950	0.27246**	0.14284

Notes:—

“**” means significant at 95% confident level;

“***” means significant at 90% confident level

5.4.5.2.2.1 Dynamic Process with MONRT in Thailand

In the first case that monetization ratio is performed to measure financial growth, the error correction (EC) equations based on vector error correction (VEC) models can be

specified as following table to present the dynamic coefficients between monetization ratio in Thailand and three different macroeconomic indicators of economic outputs, investment ratio and trade openness.

Table 49.1

Thailand Economic Development with Monetization Ratio				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDPTH_{t-1}$	$MONRTH_{t-1}$	$INVSRT_{t-1}$	$TROPNT_{t-1}$
$PRGDPTH_t$	0.3524*	0.1770**	0.0087	0.0637
$MONRTH_t$	0.1009*	0.3035**	0.0257	0.0653
$INVSRT_t$	0.9313*	0.1587	0.3806	0.0035*
$TROPNT_t$	1.1478*	0.1263	0.2471**	0.0476
Notes:				
➤ The term of “*” means significant at 95% confident level; “**” means significant at 90% confident level				

According to first and second lines in the system with financial growth indicator of monetization ratio, there are the bi-direction causations between economic outputs and aggregate monetization ratio (LMONRTTH) in Thailand, as the dynamic coefficients of [0.177] and [0.101] are simultaneously significant; accordingly, the interrelationship between outputs and monetization ratio is significant in Thailand’s dynamic process.

According to the second and third lines of coefficients, there exit no causation between variables of financial growth and investment ratio, as coefficients of [0.026] and [0.159] are insignificant, which indicates no significant links from financial growth and investment ratio based on the system with the first financial variable of monetization ratio in Thailand. For influences about trade openness in this system, the second equation and fourth equation show that interrelationship between trade and financial growth in Thailand economy is not significant due to insignificant

coefficients of [0.066] and [0.126]. Thus, when the VEC system is involved with aggregate monetization ratio as Thailand's first financial proxy, the bi-direction interrelationships between financial growth and economic outputs are strongly supported by our significant empirical coefficients in Thailand transitional developing stages. The investment ratio and trade openness can be regarded as much less important impacts compared with investment ratio and economic outputs

5.4.5.2.2.2 Dynamic Process with PRVNF in Thailand

For each individual equation in this vector- error correction system with another variable of financial growth, the dynamic coefficients to present the interrelationships can be empirically specified due to Thailand economy as followings table. These coefficients in this VEC system demonstrate the dynamic equations with different variables, which means causations among the variables of economic outputs, aggregate monetization ratio, investment ratio and trade openness in Thailand economy.

Table 49.2

Thailand Economic Development with Private Borrowings				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDPTH_{t-1}$	$PRVNFML_{t-1}$	$INVSRTHT_{t-1}$	$TROPNTH_{t-1}$
$PRGDPTH_t$	0.2933**	0.0877	0.0461	0.0211
$PRVNFTH_t$	0.0743	0.4372*	0.2995*	0.1463
$INVSRTHT_t$	0.9196*	0.2154**	0.4091*	0.0951
$TROPNTH_t$	1.1559*	0.0052	0.2434	0.0671
Notes:				
➤ The term of “*” means significant at 95% confident level; “**” means significant at 90% confident level				

According to the first and second equations in the system, a significant influence from financial proxy of private borrowings to economic outputs is empirically supported by the significant coefficients of [0.088], but the opposite way of influence is insignificant; accordingly, the interrelationship between outputs and finance is regarded as one-way significant causation between economic outputs and financial growth indicator of private borrowings in Thailand. For causations between financial growth indicator and investment ratio in this system, there exist strong bi-direction interrelationships, as coefficients of [0.300] and [0.215] are significant in either second or third equation. The causations between trade and other factors in Thailand economy are much less significant than other variable, as coefficients [0.146] and [0.005] are insignificant.

5.4.5.2.2.3 Dynamic Process with LQLBR in Thailand

These equations in this VEC system demonstrate the dynamic causations among the variables of economic outputs, financial proxy of liquid liabilities, investment ratio and trade openness in Thailand economy, which is represented in the following table involving the dynamic coefficients.

Table 49.3

Thailand Economic Development with liquid liabilities				
dependent Variables	Coefficients in Dynamic Process			
	$PRGDP_{t-1}$	$LQLBR_{t-1}$	$INVS_{t-1}$	$TROP_{t-1}$
$PRGDP_t$	0.3319	0.0431	0.0409	0.0146
$LQLBR_t$	0.1538	0.2010	0.0186	0.2174
$INVS_t$	1.5394*	0.0568	0.1107	0.1570
$TROP_t$	2.0366*	0.3680	0.5719	0.2725**
Notes:				
➤ The term of “*” means significant at 95% confident level; “**” means significant at 90% confident level				

According to first and second equations, the causations between economic outputs and financial proxy of liquid liabilities are very weak, as the dynamic coefficients of [0.248] and [0.207] are simultaneously insignificant in the system; accordingly, the interrelationship between outputs and finance is insignificant in this dynamic system. According to the second and third equation, there is no causation between variables of financial growth and investment ratio due to two insignificant coefficients of [0.019] and [0.057]. The second equation and fourth equation show that interrelationship between trade and financial growth in Thailand economy is insignificant, as the coefficients of [0.162] and [0.095] are insignificant. Thus, when the VEC system is involved with liquid liabilities as financial proxy, there are not significant dynamic coefficients to be supported by our empirical results, which mean the crucial links between the variables of economic development and liquid liabilities in Thailand transitional developing stages.

5.4.5.3 Comparative Studies inside Thailand and Conclusions

These three different estimations, involving three variables for financial growth, demonstrate the dynamic causations among the variables to measure economic development: economic outputs (LPRGDPTH), investment ratio (LINVSRTTH) and trade openness (LTROPNTH) with three different financial growth systems: Model I with MONRT, Model II with PRVNFTH, and Model III with LQLBR. These estimations are presented as the following table of Thailand Dynamic Analysis. The individual analysis for estimation has been studies in previous subchapter, and on top of that the comparative studies across these three estimation systems are presented in this subchapter.

Table 50

Thailand Dynamic Analysis					
Based on Stable Thailand VEC Models					
Systems with different financial proxies	System I with MONRTTH		System II with PRVNFTH		System III with LQLBRTH
Economic Outputs & Financial Growth	LPRGDPTH \Rightarrow LMONRTTH	+	LPRGDPTH \Rightarrow LPRVNFTH	-	LPRGDPTH \Rightarrow LLQLBRTH
	LMONRTTH \Rightarrow LPRGDPTH	+	LPRVNFTH \Rightarrow LPRGDPTH	+	LLQLBRTH \Rightarrow LPRGDPTH
Investment Ratio & Financial Growth	LINVSRTTH \Rightarrow LMONRTTH	-	LINVSRTTH \Rightarrow LPRVNFTH	+	LINVSRTTH \Rightarrow LLQLBRTH
	LMONRTTH \Rightarrow LINVSRTTH	-	LPRVNFTH \Rightarrow LINVSRTTH	+	LLQLBRTH \Rightarrow LINVSRTTH
Trade Openness & Financial Growth	LTROPNTH \Rightarrow LMONRTTH	-	LTROPNTH \Rightarrow LPRVNFTH	-	LTROPNTH \Rightarrow LLQLBRTH
	LMONRTTH \Rightarrow LTROPNTH	-	LPRVNFTH \Rightarrow LTROPNTH	-	LLQLBRTH \Rightarrow LTROPNTH
Notes:					
1. "+" means the significant either 5% or 10% significant level, "-" means the insignificant either at 5% or 10% significant level.					

Regarding the dynamics of economic outputs with variables of financial growth, the bi-direction dynamic relations between economic outputs and financial growth indicators in Thailand are showed to be significant in the system with the first variable of financial growth in Thailand. For another system with a different variable to

represent financial growth of private borrowings, there is a significant influence from financial growth to economic outputs. These results strongly support the null hypothesis that domestic outputs in Thailand can be crucially affected by financial growth.

For the second indicator for economic development in Thailand dynamic process—investment ratio, the bi-direction significant causations only exist in the estimation system with non-financial private financial borrowings. But for other estimation systems involving financial growth indicators of monetization ratio or liquid liabilities, the results show there are very weak interrelationships between financial growth and economic development in the system with either monetization ratio and liquid liabilities.

For the last indicator for economic development—trading openness, the relations between economic development and financial growth are much less weak than other two estimations with economic outputs or investment ratio, and there are not any significant links to be supported by our empirical results.

Overall, the ratio of significant dynamic causations over all relations is approximately 27.78%, and for the system with financial indicator of non-financial private borrowings, the significant dynamic causation is most significant among all systems with three different financial growth indicators; and for the system with liquid liabilities, no significant causations are supported by results. Furthermore, in empirical words for Thailand economy, the influences from financial growth on economic development are more significant than influences from investment ratio and

trading openness. In the meanwhile, these conclusions are in the line with Thailand economic and financial development in real situations. In addition, the influences from investment ratio on financial growth are more significant than links with trading openness. These influences are positively significant from both directions in the system with private borrowings.

The above interpretations reveal both long run and short run causations of economic growth-finance models, involving the endogenous variables of economic outputs, three financial growth indicators, investment ratio and trade openness in Thailand economy. Firstly, the existence of the cointegration relationships indicates the long-run relationships between indicators of economic development and proxies of financial growth. Moreover, the long-run interrelationships between three economic development indicators and three financial growth proxies are significant in long run equilibrium. In empirical words for Thailand economy, the influences from financial growth on economic development are provide to be more significant than influences from investment ratio and trading openness.

In summary, this subchapter uses the cointegration and vector error correction models to present the long run and short-run dynamic causations to investigate the economic development with financial growth.

In terms of empirical results in Thailand's long run equilibrium and short run dynamic process, it can be concluded some important ideas as followings: a) in the long run equilibriums, the significantly positive relationships are detected between financial growth and economic developments with each financial indicators. These

significant long run interrelationships are supported by the existences of cointegration vectors and significances of cointegrating coefficients; B) for the short run dynamic causations between economic development and financial growth, the most significant influences are suggested from financial growth and economic outputs and investment ratio, and furthermore among all indicators for financial growth, the variable of non-financial private borrowings shows to exert the most significant roles in the process of economic development. These results are the same as our expectations and very close to real situations of Thailand's economic development. The relatively lower development level of Thailand's financial systems can be attributed to explain these mixed causations. The comparative studies across individual countries will be presented after the estimations with all newly industrialized countries in this thesis.

5.5 Comparative Studies and Analysis with the Idea of Taxonomy

5.5.1 Specific Analysis with Financial Growth Variable of PRVNF

Thus far, this thesis has investigated how economic development is linked with financial growth in Singapore, Malaysia, Korea²¹ and Thailand. The empirical results are shown by three different systems in individual countries. Each is measured by different variables for financial growth as aggregate monetization ratio, non-financial borrowings to private sectors and liquid liabilities ratio. Although each subchapter for individual countries has involved the economic study across systems with three

²¹ The notion of Korea in this thesis means only South Korea (Republic of Korea).

financial measurements, the empirical results from four estimated countries show us the estimation system with non-financial borrowings to private sector can be acknowledged to be the most efficient system for our comparative studies, as well as analyses with a consideration of a taxonomy or typology of stages of economic development. Hence, this subchapter focuses specifically on analysing implications for the four countries' economic policies. The analysis is linked with a taxonomy of stage of economic development, and this subchapter also conducts comparative studies between the four countries.

First, it is necessary to explain why the estimation systems with a financial growth variable of non-financial borrowings to private sectors, denoted as PRVNF in this thesis, are regarded to be the most efficient approach. In LDC²²s, there are three special factors that influence the classical growth-finance-nexus as follows.

First, financial development is related to the growth and efficiency of the formal sector (such as commercial banking, development banks, and hedge funds) which is in competition with the informal sector (curb markets, family finance, illegal activities). Hence, indicators of financial development must reflect this. In particular, the ability of government to implement financial sector policy will be dependent of the size and function of the formal financial sector.

Secondly, growth and planning policy is often dependent on setting a target rate of long-run growth and estimating or calculating the ratio of investment /domestic outputs that can sustain that rate of growth. For example in the AK model of

²² LDCs: Less Developing Countries

endogenous rate of growth, $Y = AK$, without population or technical progress, the postulated rate of growth rate of Y is endogenously given by iA (where $i = I/Y$). If the savings rate $s < i$, then the financial sector must be able to raise s , through reducing cost of intermediation, providing higher return and reducing rate of risk, so that the investment ratio is attained.

Thirdly, since governments are in competition with the private or corporate sector, for funds from the financial sector, the amount of credit allocated to the private sector should not be 'crowded out' since the latter is assumed to have a higher productivity. The measure of financial development we use should be related to the three factors related above.

The financial growth variable of PRVNF is more relevant to this discussion than the degree of monetisation or total credit allocated to the economy by the financial sector. The former is a more suitable index for least developed economies while the latter is suitable for more advanced economies. In our economies of newly industrialized countries (NICs) in Asia, which are at an intermediate stage of development, it is better to concentrate on financial growth variable of PRVNF.

5.5.2 Comparative Studies across NICs

Consider the earlier discussion in the theoretical chapter of this thesis about exogenous and endogenous growth models. In the former case, a higher rate of growth exogenously determined by technical progress, can improve the productivity and efficiency of the financial system. On the other hand, it is still possible to

generate endogenous growth by increasing the productivity of capital through a better functioning financial system. The empirical surveys also demonstrate that an effective functioning financial system can increase the savings ratio and thereby increase the long-run steady state rate of economic growth. There are, however, arguments that express the growth-dampening effects. For instance, if the Lurssen-Metzler effect holds in an open economy, then higher domestic saving might cause a fall in the terms of trade and, thus, a reduction in competitiveness. As the early discussion about the empirical examples for economic-finance interrelationships show, the final outcomes about causations of finance and growth are not fixed and clear for all developing countries. The results for each country may be different from each other, therefore.

The table below demonstrates the comparative studies for four NICs in Asia. The results are based on the endogenous growth theories, with the econometrics determined by the empirical vector error correction routes. According to the previous studies, the cointegration relationships have been detected and certified already, and then all of these dynamic results are actually generated from the stable vector error correction models, with the conditions of autocorrelations, heteroscedasticity and normality in their system residuals fully satisfied. The above results proved directly the significant relationships among the financial indicators and economic growth indicators. These significant relationships exist in all of the four countries. Here the financial proxies are indicated with the private non-financial borrowings, for the productions of economic outputs, from the financial sectors given by the ratio of bank claims to non-financial private sectors to economic outputs. These results are

consistent with the positive causations from the growth theories: that it, the positive effects from financial indicators on economic outputs exist in the long run. Of the four countries studied, Malaysia's coefficients on economic outputs are the biggest, followed by Singapore, Korea and Thailand. For Thailand, the long run coefficients are very small, which can be explained by the problems of the country's financial system, especially in recent years.

Table 51

Long run coefficients of Economic-Financial Growth in steady state		
Nations	within endogenous growth models	
	EC equations	Long run causations
Thailand	$EC = LYTH - 0.053 * LBCPTH - 1.205 * LIRTH - 0.978 * LTRTH - C$	$LYTH = 0.053 * LBCPTH + 1.205 * LIRTH + 0.978 * LTRTH + C$
Singapore	$EC = LYSG - 0.798 * LBCPSG + 1.142 * LIRSG - 1.206 * LTRSG - C$	$LYSG = 0.798 * LBCPSG - 1.142 * LIRSG + 1.206 * LTRSG + C$
Korea	$EC = LYKR - 0.614 * LBCPKR - 0.560 * LIRKR - 0.187 * LTRKR - C$	$LYKR = 0.614 * LBCPKR + 0.560 * LIRKR + 0.187 * LTRKR + C$
Malaysia	$EC = LYML - 0.927 * LBCPML + 0.636 * LIRML - 0.407 * LTRML - C$	$LYML = 0.927 * LBCPML - 0.636 * LIRML + 0.407 * LTRML + C$

Here: LY~PCGDP; LBCP~PRIVY; LIR~INVSr; LTR~TROPN.

Notes:

- 1) *** means significant in 95% confidence level.
- 2) All coefficients on LY are normalized as the value of one.

Let us consider the analysis for each individual country. Singapore's finance-growth nexus in the endogenous models are observed to be the most significant among four countries. As Singapore's economic performance is generally acknowledged to be the most successful and remarkable in developing world, the causations between finance and other factors, economic outputs, investment ratio and trading openness, involve significant bi-direction causations in the dynamic process. For other three economies, the dynamic bi-direction causations exist significantly only in the links between investment and finance. There are no significant causations between factors of finance and trade openness. One-way dynamic causations of growth-finance nexus are detected for South Korea, Malaysia and Thailand, but the

directions vary from each country. For Korea, economic outputs (economic development) affect financial growth significantly, while for Malaysia and Thailand, financial development affects outputs. In light of the investigations for each country, the endogenous causations between financial growth and investment ratio are much more significant rather than the other two factors. These empirical findings support the explanations of endogenous growth models and link with Pagano (1993) models²³ that investment is more important than economic outputs for financial systems based on endogenous growth frameworks.

As discussed earlier, the main reasons for involving trading openness in our empirical estimations are because of the significant impacts of trading sectors in the economic development in most developing countries, especially among NICs in Asia. However, the empirical findings demonstrate the impacts of trading sectors on finance factors are less significant compared with investment and economic outputs. In the case of Singapore, however, the significant link between them is still shown in our frameworks, and is bi-direction endogenous causation. A key reasons for this is that major products of international trading in middle- and low-income developing nations are labour-intensive, and there are less advanced-levels of exporting and importing of technology, services, and high-tech products. As a result, these countries do not need too much finance services to support their importing and exporting business.

Table 52

²³ Please refer to the theoretical chapter of this thesis about Pagano Model (1993).

Dynamic endogenous causations for four countries with PRVNF

Nations		Aggregate Outputs(LY)		Financial indicators(LF)		Investment Ratio(LIR)		Trade Openness(LTR)	
		γ	S.D.	γ	S.D.	γ	S.D.	γ	S.D.
Singapore	ΔLYS_{G-1}	0.2271	0.1439	0.7448*	0.2657	0.7045*	0.2549	0.2079	0.3235
	ΔLFS_{G-1}	0.1323**	0.0734	-0.2289	0.1731	0.3866*	0.1661	0.5578*	0.2108
	$\Delta LIRS_{G-1}$	-0.0256	0.0758	0.1950**	0.1140	-0.0067	0.1346	-0.5275*	0.1708
	$\Delta LTRS_{G-1}$	-0.0511	0.0671	-0.1274	0.1234	-0.1330	0.1193	0.1431	0.1515
Korea	ΔLYK_{R-1}	0.1767	0.1876	0.2503	0.4920	0.0238	0.5044	0.2304	0.5658
	ΔLFK_{R-1}	0.1137*	0.0381	0.3754*	0.1001	0.1478	0.1025	0.0970	0.1150
	$\Delta LIRK_{R-1}$	0.0362	0.0624	0.2968**	0.1635	0.2345	0.1677	0.0802	0.1881
	$\Delta LTRK_{R-1}$	0.0503	0.0562	0.7397*	0.1473	0.1799	0.1510	0.2612	0.1694
Malaysia	ΔLYS_{G-1}	0.4057*	0.1535	0.1730*	0.0823	1.2341*	0.5333	0.2810	0.2873
	ΔLFS_{G-1}	0.0234	0.0527	0.0227*	0.1381	0.2240**	0.1330	0.2599	0.1986
	$\Delta LIRS_{G-1}$	0.0935**	0.0536	0.1972**	0.1104	0.2585	0.1861	0.1607**	0.1002
	$\Delta LTRS_{G-1}$	0.1462**	0.0892	0.0934	0.2337	0.3031	0.3097	0.1118	0.1668
Thailand	$\Delta LYTH_{-1}$	0.2934**	0.1542	0.2744**	0.1487	0.9195*	0.3088	1.1559*	0.2703
	$\Delta LFTH_{-1}$	0.0876	0.0644	0.4373*	0.1243	0.2153**	0.1289	0.0051	0.1128
	$\Delta LIRTH_{-1}$	0.0460	0.0638	0.2995*	0.1232	0.40908*	0.1278	0.2434	0.1118
	$\Delta LTRTH_{-1}$	0.0211	0.0713	0.1463	0.1377	0.0951	0.1428	0.0670	0.1249

Notes:

** means significant at 5% confident level;

*** means significant at 10% confident level

Table 53

Summarize Table of Dynamic Analysis

Countries	Dynamic Causations					
	LPRGDP \Rightarrow LPRIVY	LPRIVY \Rightarrow LPRGDP	LINVS \Rightarrow LPRIVY	LPRIVY \Rightarrow LINVS	LTROPN \Rightarrow LPRIVY	LPRIVY \Rightarrow LTROPN
Singapore	+	+	+	+	+	+
Korea	-	+	+	+	-	-
Malaysia	+	-	+	+	-	-
Thailand	+	-	+	+	-	-

Notes:

"+" means the significant either 5% or 10% significant level' "-" means the insignificant either at 5% or 10% significant level

5.5.3 Analyses with Taxonomy Stages of Development

On the basis of our empirical results, a taxonomy or typology of stages of economic development can be constructed, and related to the finance-growth nexus, as shown in the table below. In all types of developing countries capital investment and financial development are significantly related to each other and in terms of bi-directional causality. This is not surprising, since the core function of financial systems is to transform savings by households to capital formation by firms. Thus physical capital formation and financial intermediation are intimately related. This is observed for all four countries. However, significant differences emerge when other variables are

considered.

Table 54.A

Taxonomy explanations				
Stage of Development	Estimated Countries	Causations in empirical results for dynamic process	Author's Model	theoretical reflections from previous reviews
Advanced-level development	Singapore	Economic outputs \Leftrightarrow Finance Investment \Leftrightarrow Finance Trading \Leftrightarrow Finance	Theoretical Model II	Simultaneous contemporary Reinforcement
High-level development	Korea	Economic outputs \Leftrightarrow Finance Investment \Leftrightarrow Finance Trading \neq Finance	Theoretical Model III	Schumpeter, "the banker is not so much as middleman, He authorises people to innovate"
Middle-level development	Malaysia	Economic outputs \Rightarrow Finance Investment \Leftrightarrow Finance Trading \neq Finance	Theoretical Model I	Joan Robinson, "where enterprise leads, finance follows"
Early-level development	Thailand	Economic outputs \Rightarrow Finance Investment \Leftrightarrow Finance Trading \neq Finance		

Notes:
 \Rightarrow means one way direction of significant causations; \Leftrightarrow means bi-direction of significant causations; \neq means no significant causations

Let us now consider the four countries in terms of stages of development. Singapore is clearly at an advanced level developmental stage, with a very high per capita income and an exceptionally high growth rate by historical standards. In such a

country, financial development causes economic growth and vice versa. The relationship is one of bi-directional causality where each affects the other. This is similar to our Model II in the theoretical chapter of this thesis. In addition, the case of Singapore shows significant interrelationships between trade openness and financial development, partly because it has become a world financial centre.

Korea shows high levels of development, although in the period under consideration, it did not achieve the same degree of economic development as Singapore. The empirical results show that finance affects growth, as Schumpeter would have predicted. In relatively higher stages of development, similar to the Model III, financial sector productivity and efficient intermediation creates opportunities for growth and development.

For Malaysia and Thailand, at middle- and early- level development stages (essentially they being relatively prosperous developing countries), economic growth affects financial development similar to the prediction of Robinson. The causation is reversed for relatively poorer countries. The empirical analyses predict that their financial systems are still relatively underdeveloped, and hence, their financial systems are not sufficiently effective to promote economic growth as per Singapore and Korea. According to our Model III, lowering costs of intermediations by financial institutions can promote economic growth. The financial sectors in Malaysia and Thailand have relatively less able in this aspect, in that both financial systems have less ability to re-allocate the investment resources in either financial sectors or real sectors. Furthermore, both countries' financial systems are unable to reduce the cost

of financial intermediations. Thus, in either Malaysia or Thailand, there is only one-way causation from economic growth to financial sectors, which is the consistent with the Model I.

Table 54.B

Summary of Empirical Results and Economic Facts						
Systems	Singapore	Korea	Malaysia	Thailand	Results and Economic Facts	
Economic Outputs & Financial Growth	LPRGDPGSG ⇒	LPRGDPKR ⇒	LPRGDPML ⇒	LPRGDPPTH ⇒	1) The long run significant relationships exist between financial growth and outputs, investment and trade in all countries of NICs.	2) In the dynamic process, the significant causations between financial growth and outputs are different across countries of NICs. These causations are closely linked with the taxonomy stage of economic development
	LPRVNFSG	LPRVNFKR	LPRVNFML	LPRVNFTH		
Investment Ratio & Financial Growth	LPRVNFSG ⇒	LPRVNFKR ⇒	LPRVNFML ⇒	LPRVNFTH ⇒	3) The important roles of investment to link financial growth and economic development are the same as what we expected in terms of endogenous growth framework.	4) The relatively less significances of trading openness in NICs, except Singapore, tell us a fact that these countries' economic development involves more complex situations, such as exchange rate effects, in the process of finance and trade.
	LINVSRSRG	LINVSRRKR	LINVSRLML	LINVSRTTH		
Trade Openness & Financial Growth	LTROPNSG ⇒	LTROPNKR ⇒	LTROPNML ⇒	LTROPNPTH ⇒	4) The relatively less significances of trading openness in NICs, except Singapore, tell us a fact that these countries' economic development involves more complex situations, such as exchange rate effects, in the process of finance and trade.	
	LPRVNFSG	LPRVNFKR	LPRVNFML	LPRVNFTH		
Financial Growth	LPRVNFSG ⇒	LPRVNFKR ⇒	LPRVNFML ⇒	LPRVNFTH ⇒		
	LTROPNSG	LTROPNKR	LTROPNML	LTROPNPTH		

Notes:
 “+” means the significant causation in either 5% or 10% significant level; “-” means the insignificant causation in either at 5% or 10% significant level.

5.6 Conclusion and Remarks

This chapter provides the empirical investigations on the relationships between financial development and economic growth. It can be summarized that high-quality financial expansion and development is a critical input towards economic growth, and finance is no different from other forms of physical capital. Just as roads or infrastructures are good for growth, provided they are of high quality and not excessive in terms of needs, so also is financial expansion good for growth.

The empirical results from these countries, in different stages of economic development, can be compared with various ideas in the literature. Malaysia and Thailand, as middle- and early-level development economies, support Robinson's arguments that the economic growth induces financial development but not the hypothesis the financial system promotes economic growth. Korea, as high-level development economies, supports Schumpeter's arguments that financial development induces economic growth, while for Singapore, as advanced-level development economies, bi-direction hypotheses are strongly supported as simultaneous contemporary reinforcement. Despite the fact financial systems in these four nations were enlarged and developed in the similar period of 1980-1990, there does not appear to be the common causation direction between finance and economic growth across all them, as supported by different theoretical models in this thesis.

For economies at early stage of development, financial development is unlikely to lead to higher economic growth without an efficient and well-functioning financial

system. An improvement of the functioning of these countries' financial systems is critical for their financial development and reforms, therefore. For economies at a high development stage, financial systems play an important and positive role in promoting economic development, similar to other vital subchapters involved in overall production, such as manufactures and constructions. For economies at advanced development stages, the paces of both economic development and financial growth are going forward simultaneously and positive effects exist from each other. This positive bi-direction must depend on the well-functional financial systems, however.

Despite the results that the causations vary across different development stages, the empirical aspects of this thesis show the vital links between finance and economic development. For NICs in Asia, policymakers are advised that, while encouraging the growth of financial systems, less excessive inflation and sub-standards loans must be ensured to create, as they performs as negative externalities in the economic development. There are a number of other essential factors that can simulate financial growth and economic development:

- i) the more effective evaluation of credits for private enterprises; ii) an excellent legal economic framework; iii) a more stringent standards for national accountings and more efficient managements for current account; iv) further reduction in debits in private sector corporations due to hedged foreign currencies; and less-scale influences from political contamination of economic problems.

Chapter Six

Size Effects on the Relationship between Development and Finance: Case of BICS

6.1 Introduction

Large developing countries, and emerging economies, typically Brazil, China, India and South Africa, demonstrate a strong upward trend in many aspects of their macroeconomic performance in recent decades. This developmental surge has been sometimes attributed to ‘size effects’ whereby economies of scale and scope, and agglomeration impact, create productivity improvements. Most of the literature studying large developing countries emphasizes the real economy but says little about the comparison of interrelationship of real sectors and financial sectors on development in large developing economies. Although this chapter emphasizes the empirical and econometric estimations for BICSs, the empirical work is based on and closely linked with the conceptual ideas from the previous chapter on theoretical models, particularly using some implications from the model involving distinct real and financial sectors, since that two-sector model provides a conceptual framework for arguments about important contributions of real sectors and financial sectors to economic outputs.

The surprising speed of development of these large emerging economies has been observed for under fifteen years, but it is worth noting that their importance in the global economy has increased considerably in the last five years, particularly after

the economic recessions in the late 2000s, and this policy issue will be treated in detail. Furthermore, an important implication of this chapter is that we can suggest that the efficient approach to deal with economic recession of 2008-2009 for these large developing countries is to strengthen real sectors, such as an increase in investment spending and reforms of trade policies, instead of helping financial sectors directly.

This chapter analyses interconnections among outputs, investment, trades and finance for four specific large developing countries (BICS) – Brazil, India, China and South Africa – in terms of distinctive measurements for both the two real sectors and the financial sector. The real sectors of investment and trade are generally acknowledged as the vital factors for most developing countries in the process of economic development, and therefore the empirical part of this paper involves four factors in the econometric analysis: aggregate economic output, investment ratio, trade openness, and financial indicators. The conceptual analysis of benefits and costs of countries' size are a particular focus and are explained before the empirical analysis.

This chapter in this thesis concentrates on studying financial development, rather than monetary policy, and we present several explanations to justify this study is studying financial development. That means the growth of financial sectors in these empirical countries is regarded as endogenous factors inside the growth framework. The position and roles of the financial growth are the same as real sectors of investment and trade, based on the *two-sector model* mentioned in previous chapter of

this thesis. Moreover, the shocks from financial growth to economic outputs are regarded as demand-leading shocks, whereas the shocks from monetary policy to economic outputs are regarded as supply-leading shocks. On the other hand, monetary policy is normally acknowledged as an important exogenous factor involved inside both growth frameworks and empirical estimations. Thus, this is very different from what we studied in this thesis based on endogenous framework to investigate their endogenously relationships between financial growth and economic development, as well as comparison with real sectors. But the notion of monetary policy is normally regarded as an effective method to adjust macroeconomic stabilization by central government, in particularly for some developing countries in the middle-level or low-level development stages. Therefore, the monetary policy is restrictedly controlled by governments, whereas the financial development is regarded as self-raised factors in the process of economic development.

In terms of relatively short development processes, this paper uses structural VAR to build up an estimation framework to analyse these four countries' interrelationships in terms of various factors, real and financial, in economic development over the period from 1995 to 2007. Compared with the chapter on NICs in this thesis, this chapter on BICSs concentrates rather on dynamic analysis of a recent decade instead of long-term equilibrium analysis.

In recent decades, the financial markets in large emerging economies have been experiencing an extraordinary increase in their values: India by nearly 500%, China by nearly 200% and Brazil by nearly 370%, based on the A-share market. The

remarkable performance of equity markets in these large emerging economies can be regarded as one significant manifestation of the continuous increase of these economies' importance to international economic growth. In fact, the combined weight of BRIC economies totaled nearly 15% of world GDP by the end of 2007, which is actually much more than most economists expected.

Moreover, it is surprising that the Chinese economy, in terms of GDP, has overtaken Germany's economy to become the third-largest economy in the world. The report by Goldman Sachs in 2003 (see footnote) was the first to suggest that these large developing countries, especially BRICS, could overtake the combined GDP of the G7 by 2035. These outstanding performances in large emerging economies raise as many questions as answers. For example, will China grow at a sustainable rate in the next decades? Will India's growth be limited by its infrastructure challenges? Will the world economic turmoil in 2008 seriously affect these countries' growth?

The literature, on 'size' (see Alesina's survey paper (2007)) concentrates and emphasizes the real economy but says little on the impact of financial development on economic growth specifically for large developing economies. This chapter therefore investigates the interrelationships between some crucial factors of economic development and financial structures and growth for four large developing countries. The methodology is general but we concentrate on four macroeconomic variables indicating economic development (GDP), physical capital formation (investment), trade openness (exports plus imports) as well as broad indicators of financial development.

6.2 Benefits and Costs of Countries' Size: Conceptual Studies

6.2.1 Benefits and Costs of Countries' Size on Economic Development

Now let us turn to the equilibrium size of economies, which emerges from the trade-off between the costs of preference heterogeneity and benefits of size in the populations, an approach pioneered by Alesina and Wacziarg (1997, 2003). We are primarily talking here about the benefits of large countries in terms of aggregate national product, geographical size, complexity of institutions and population.

6.2.1.1 Benefits of Countries' Size on Economic Development

6.2.1.1.1 Benefits from Lower Costs of Public Goods

Economies can be scaled in terms of productions of public goods. In large developing countries, the per capita cost of public goods is lower than in relatively small countries, but there are more taxpayers in these large developing countries. These public goods can be understood as public health, financial reputation, infrastructures, national parks, national defence and so on. Empirically, the ratio of government expenditures over GDP decreases per number of population, which implies that the relatively small developing countries have larger governments and people have to bear a heavier burden.

The financial system benefits from the presence of intangible public goods such as reputation, confidence and economic stability. An economy which has a better public sector creating institutions which provide high quality public goods inspires the

financial system to function well. In addition, foreign capital is drawn to economies which are well supplied with these public goods. If the costs of provision are low, as in large economies, then the government has an incentive to produce more of these public goods with a corresponding rise in externalities for financial development. Most important, a high quality regulatory system is a sine qua non of financial development (as the recent example of the financial crisis shows) and government supply of 'regulation' is essential for generating confidence and lowering transaction costs. In a large country the per capita cost creating such a regulatory system and related institutions would be low and therefore cheaper to provide.

6.2.1.1.2 Benefits of Lower Risk of Foreign Aggression and National Security

As one of the most important public goods, national safety increases with country size. In the light of the above discussion about government expenditures, smaller economies have to spend more on national defence than large developing countries in terms of economies of scale. The fact is that small countries are willing to join military alliances, which also implies that size brings about greater safety. In that sense, it shows strong evidence of advantage as large economies, even with a consideration of military alliances.

As regards financial development, it relies on confidence very heavily. Hence, the lack of national security (both domestic conflict and foreign aggression) can be the biggest inhibitor of building a professional financial system. A cursory look at the Middle East for example shows how difficult it has been for countries like Israel and

Lebanon to relate high quality financial institutions to channel the vast sums of money generated in the region through oil wealth. Of course size alone does not provide security. Look at Switzerland which is a small country but has always remained neutral and therefore guaranteed its security. However, among developing countries large countries are less prone to foreign attacks and can instill confidence among its own people and among foreign investors to save, invest and allocate funds for domestic projects. China has been able to build up a financial sector much faster than Taiwan principally because it has less fear about foreign aggression. The same holds for India as compared to Pakistan.

6.2.1.1.3 Benefits of Providing Better Insurance to Regions

On the assumption of imperfect international capital markets, independent economies or countries cannot fully self-insure, especially in a period of economic recession. Think, for example, of the East China²⁴ Region. If this region has a worse economic recession than the Chinese average, it receives help from other regions of China through fiscal policies and other transfers. On the other hand, when this region develops better than other regions, it becomes a provider to help other Chinese regions. If this region was independent from China, it is distinctly possible it would experience a significant business cycle as it would not be able to receive help from other regions.

²⁴ The East China Region is the richest region in China, and counts as a middle-income developed economy in terms of per capita income. It is composed of Shanghai, Jiangsu, Shandong, Jiangxi, Zhejiang, and Fujian.

6.2.1.1.4 Benefits of Better Distribution Systems

Inequality problems are always pronounced issues for developing countries. For large developing countries, it is easier to establish distribution systems from richer to poorer regions. These schemes can be achieved through taxation systems, fiscal policies, and other such measures. This is one approach to explain why poorer regions want to form larger countries inclusive of some richer regions; richer regions, however, normally prefer independence.

6.2.1.1.5 Benefits of Scale in Terms of Market Size

The final benefit for large developing countries relates to market size and its role in large countries, and it is based on the normal assumption that large countries have a relatively large size of market. First, the extent of the market might lead to a limitation of specialisation. (Adam Smith 1776). The recent literature studies the benefits of country's size in terms of positive externalities in the accumulation of human capital, as well as transmission of advanced knowledge (Romer 1986, Lucas 1988, Helpman 1991). Consider instead of another model of 'big push' or 'take-off' of industrialisation, a situation where the phase of 'big push' can be characterised by transition from a slow growth to endogenous growth, where the former is constant returns to scale and the latter is increasing returns to scale technology (Shleifer and Vishny 1989). Moreover, pro-competitive effects can be employed to explain the effects of large market size, because size can enhance economic growth through an

increase in the intensity of product market competition.

In fact, theoretical explanations have shown that country size is, at least through the market size approach, irrelevant to economic success. Supported by a free-trade world, economic productivity or efficiency cannot be influenced by redrafting borders. Much of the literature, however, has indicated that in the absence of explicit trade barriers, it is very costly to cross borders, so economic interactions within one country should be much easier than in countries cross-border. This, therefore, is true for financial markets, good markets or even investment opportunities, as large countries are able to enjoy vast benefits from their large markets. Furthermore, this is more important for large developing countries than developed countries. The benefits described by the above theoretical explanations are more significant for large developing countries.

6.2.1.2 Costs of Countries' Size on Economic Development

Support a country can become larger and larger without any restrictions, the costs of administration and congestion could overcome the benefits of size mentioned in previous section. Thus the costs of countries' size merit our attention together with the benefits of size. The costs in this study only refer to very large developing countries, and they are not relevant determinants for most existing economies, which are normally those of small and medium countries.

6.2.1.2.1 The Costs of the Heterogeneity of Preferences

The first important restraint on the size of countries relates to the heterogeneity of

individuals' preferences in large countries. Every household must share the same public resources, public goods, and national policies, but these cannot satisfy every individual's preferences. Think, for instance, of taxation policy. The government is willing to make taxation policies to suit everybody; however, it is obviously difficult to satisfy everybody owing to the heterogeneity of preferences.

Some literature argues that certain policy prerogatives can be delegated to sub-national levels through the approach of decentralisation, but these measures must rely on sound administration of national departments and sound legal systems. Thus this approach of decentralisation is very difficult to implement in the developing world, and most policies are compulsory to be nationalized (Bardhan 2002), especially for developing countries. It is not difficult to think of examples of defence systems, foreign policies, and legal systems.

6.2.1.2.2 The Costs of the Heterogeneity of Population

The second most important costs relate to the heterogeneity of the population in large countries, especially for studies using ethnolinguistic fragmentation to measure heterogeneity in national populations. Levine and Easterly (1997) showed that ethnolinguistic fractionalisation can be inversely linked with economic success and several indicators of quality of government, social democracy and freedom. Moreover, the ethnic fractionalisation in South Asia and Africa is particularly induced by inappropriate borders left by former colonisers, which largely contributes to responsibility for economic failure.



The costs of countries' size result in many specific characteristics of problems involved in the process of economic development in large developing countries. Think, for instance, of enormous populations, various ethnic groups and serious inequality among different groups of peoples and regions and so on. Industrialised large countries in terms of population, such as US and Japan, have specific problems because of their size but these have been well offset by positive effects from sound national systems of welfare and services. The above explanations of both benefits and costs of countries' size provide us with a good theoretical framework for thinking of large developing countries as a special group, and a particular approach is needed to research the interrelationships between domestic incomes, investment, trade and finance, based on the specific characteristics of economic development as the large developing countries.

6.2.2 Specifications of Financial Growth with Ideas of Countries' Size

The previous section explained the conceptual issues of size effects on economic development, involving benefits and costs, in large developing countries. But there is a crucial question now: 1) how these general specifications of sizes' effects influence the growth of financial systems in large developing countries? What are the specific features of financial growth linked with size effects in these economies? This section links the general specifications of size effects on economic development to financial growth in large developing countries. The core ideas of these discussions can be represented in the following table:

Table 6.1

Specific Features of Financial Growth with Large Developing Countries

Factors as	1) Large numbers of population
Large	2) Dispersion of controlling powers
Developing	3) Diversified economic policies and regulations
Countries	
	
General Specification from Size	Benefits
	1) Lower costs of public goods and national resources
	2) Lower dangers of foreign aggressions
	3) Relative broad scale in terms of market size
	4) Stronger demand of domestic consumptions
	5) More dependent system of economic development
	Costs
	1) More heterogeneity of preferences across nationals
	2) More heterogeneity of demands by populations
	3) Higher possibility of existences of inequality
	4) Relatively unbalanced industrial structures
	
Specification of Financial Growth from Size	1) Higher possibility to provide a relative safe financial systems, as well as safety investments of financial products
	2) Stronger demand of various financial products due to huge domestic consumptions
	3) More barriers to implement deeper reforms of financial regulations and capital flows
	4) More diversifications of financial services due to more heterogeneity of nationals
	5) Highly possible to involve informal financial markets
	6) Less powers to implement unique regulations of financial systems

6.2.2.1 A Relative Safe Financial Systems and Products

According to studies of size benefits as large developing countries, the benefits of lower dangers of foreign aggressions and more dependent economic growth can be implied to support the hypothesis that large developing countries are highly possible to build up a safe financial systems, as well as to sustain the development of financial institutions.

The economic development in large developing countries should be different from other developing countries, in particularly the NICs being studies in early

chapter, because of both benefits and costs of countries' size. Following that arguments, this section use the ideas regarding countries' size on these large emerging nations to study the further specifications of financial growth linked with size effects, being considered as both positive and negative features.

First, the large emerging economies must involve the relatively safer financial systems for either domestic nationals or foreign investors. For the domestic markets, these effects of the safer financial systems are not only related to safe financial institutions for domestic consumers, savers and investors, but it also means to provide safe financial services for the whole economic systems, like manufactures and trades. Every household is willing to use the convenient and safe means to finance their life, as well as some investments for their further. As knows, the society security in most developing countries is under less-development, the problems of healthy, education, and pension require a safe mode of financial systems. As large developing countries, its development basic in terms of large amount of reserves and abundant resources are more likely to set forth a relatively safety financial systems.

The foreign investments, including foreign direct investment (FDI) and foreign equity investments (FEI) are being one of the most important factors to boost economic growth of developing nations in recent decades. There is another requirement of safe financial systems to abstract more foreign investments, as well as to sustain the stable growth rate of these investments. It is easy to understand that FEI relies on the development of financial systems, as nobody is willing to invest equity products in a unsafe systems. But for most developing economies, the investments

from overseas are mainly about FDI. The successful example to absorb more FDI is of China in recent fifteen years, as China's government provides more safe investment environments. One of these safe settings is of providing a safe financial system. In fact, these current FDI in China were in some other developing countries, like Indonesia and Thailand.

6.2.2.2 Large Demands of Financial Services and More Diversifications

Another important feature, that is, a large number of nationals and a huge demand of domestic consumptions, has been mentioned in the early section as one of the most important specification in these large developing nations. These can result in another specification of financial growth in these countries: stronger demand of various financial services and products.

In large developing countries, the financial demands must be stronger than others, because of its heterogeneity of demands from different nationals. These diversified financial services and products not only refer to saving services, but also to some investment products for households. Being different from industrialized countries, most of households' investments in developing nations work through financial institutions instead of investment in financial markets by themselves. These facts result in a rapid expansion of financial institutions in large developing nations, whereas small- or medium-size developing countries are lack of these stimulations to boost financial growth.

Another idea from large financial demands in large developing nations is to reduce the transaction costs in the process of financial development. In large developing nations, the per capita cost of financial products and services should be lower than in relatively small economies, however, the taxpayers becomes relatively more in these countries. In fact, the financial system in these countries could benefit from the existence of intangible public goods, that is, reputation, confidence and economic stability. Furthermore, when the costs of provision become low, then the financial institutions in large developing countries must have an incentive to produce more of these financial products and services in order to sustain the growth rate. In summary, the per capita cost leading a regulatory financial system and linked financial institutions should be lower and thus cheaper to provide.

The above study talked about the benefits of more demands of products and services to the development of financial sectors, while these relatively more financial demands could lead to another negative specification of financial growth in large developing nations: that is more diversifications of financial services and products across all nationals.

As earlier discussion, the financial demands in large developing countries must be larger than others, which could boost financial growth. But a large number of demands of financial products and services must result in an increase of costs to support these financial demands, as well as to satisfy various corresponding customers. These costs are also linked with size effects. First, the more financial demands must involve higher training costs for financial systems. As the financial systems require a

high level of professional knowledge, the training costs must be increased as more financial demands are required. Second, the security costs are more likely to increase as more financial products are introduced by financial institutions. Thirdly, as financial demands are more required, the more investments are necessarily spend in the Research and Development (R&D) sectors in order to develop better financial services and products.

6.2.2.3 More Informal Financial Markets and Barriers for Financial Reforms

The economies of developing countries have a large sector where money is not used as the primary means of exchange, as well as involving a large informal financial sectors or unorganised money markets. This problem of informal financial markets is more significant in large countries. It is believed that these countries' financial systems cannot satisfy all requirements at all, because of a fact that the preferences are too much diversified across the nationals, and therefore those unsatisfied persons have to use informal financial markets. Secondly, more serious problems of inequality result in the existences of larger informal markets. The unbalanced social development should lead to a larger gap of capitals in either consumption or industrial fields, and thus informal financial markets work to reduce these gaps.

The implements of financial reforms require government to have a big power for each individual provinces or states inside the countries. However, in large developing countries, regional protectionism is a crucial problem in the process of economic development. These problems of regional protectionism are acknowledged



to be more serious in large developing countries, because of the large scale of countries' sizes and huge amount of populations. In some large developed countries, such as US or Australia, the well-developed legal systems could prevent the negative effects of regional protectionism, while in small- or medium-size developing countries the negative effects of regional protectionism are much less serious. Thus, the serious problems of regional protectionism must lead to a number of tough barriers to implement the financial reforms

6.2.3 Specifications of Transmission Channels in Large Emerging Economies

The specific features of financial growth in these economies have been explained in above section. Furthermore, the transmission channels from finance to economic development are believed to involve some specifications because of specific facts and features of financial systems in large developing countries. The general features of transmission channels were theoretical explained the first chapter of this thesis, and this chapter is only concentrating on specific features in terms of size effects linked with large developing countries. First, these specifications can be shown as following table:

Table 6.2
Specifications of Transmission Channels in Large Developing Countries

General Specification of Transmission Channels	Financial Functions	1) Facilitating risk management
		2) Allocating of resources
		3) Mobilization of savings
		4) Facilitating exchange
		5) Payment systems
	Channels to development	1) Capital accumulation
		2) Technological innovation
		3) Encouraging obsolescence

	
Specification of Transmission Channels to Economic Development	<p>1) More Complicated Transmission Process The transmission channels become more complicated by the facts of the diversified financial systems, like branches of financial institutions, in large developing countries</p>
	<p>2) Delayed Transmission Time The time of transmission channels will be delayed because of the facts that massive inefficiency of the overstaffing administration inside financial systems in large developing countries</p>
	<p>3) Less Powerful into Macroeconomy The roles to these economies of financial systems are less due to the simplicity of financial products and services. The domestic consumers have relatively less confidences in financial services.</p>
	<p>4) Indirect Channels to Development The transmission channels are indirect as the less development level of financial systems and more barriers to implement further financial reforms in large developing countries.</p>
	<p>5) More Reliance (Indirect) on Real Sectors The reliance of financial systems on important real sectors are more significant in large developing countries, as most of transmission channels must use investments or trades to link financial growth to economic development.</p>
	
In summary, the channels from finance to development in large developing countries are more complicated, delayed, less powerful and more dependences.	

6.2.3.1 More Complicated Transmission Process and Delayed Time

The transmission channels could become more complicated because of the facts of more diversified financial systems, like branches of financial institutions, in large developing countries. The simpler the process of transmission channels linking finance and economic development is, the more effective financial growth can exert crucial roles in economic development. Thinking of, for example, some physics theories to analyse this idea. In large developing countries, there are so many unexpected situations existing in the process of transmission channels, such as administration problems, regional professionalism, even problems of communications in these countries.

The time of transmission channels will be delayed because of the facts that massive inefficiency of the overstaffing administration inside financial systems in large developing countries. The administration sectors in these large developing countries must be more overstaffing, which will in fact result in the delayed in the process of these transmissions. The efficiency is one of the most standards to measure the growth of financial systems. The lower efficiency of financial services will definitely result in an increase in the costs inside the financial systems. The final effects from finance to economic development must be decreasing as an increase in the transmission periods.

6.2.3.2 Less Powerful into Macroeconomy

The roles to these economies of financial systems are less due to the simplicity of financial products and services. The less development level of financial systems in these countries means that the financial products and services cannot be as many as in industrialized countries. As discussion earlier, if large developing economies increase as many financial services as possible, the costs of developing these services might be higher that could have negative effects on financial systems, even on whole economic development.

6.2.3.3 Indirect Channels and More Reliance on Real Sectors

The reliance of financial systems on important real sectors are more significant in large developing countries, as most of transmission channels must use investments or

trades to link financial growth to economic development. One of the main functions of financial systems is to provide a service for investments and trades, and this function is more significant in developing countries. As the financial systems in developing countries are still in the low- or middle-level of development compared with industrialized countries, the financial sectors can not be major powers to boost the economic growth.

6.3 Reviews of BICS: Brazil, India, China and South Africa

6.3.1 Introduction of BICS

The current economic recession stemmed from the financial crisis in the US, and nearly all members of OECD members and all countries in the G7 Group have been affected. It is worth noting that the quick responses to the US financial crisis are almost all those of developed or industrialised countries. Jointly with considerations of previous explanations about benefits for large developing countries, an interesting problem is whether the predictions of Goldman Sachs regarding the growing-up of BRICs is coming true in the light of the current economic crisis. This subsection explains the notion of a special group for large developing countries, including Brazil, India, China and South Africa, as well as detailed understanding of some characteristics of their economic development.

6.3.2 Absence of Russia and Inclusion of South Africa

The important differences between the ideas about BRIC expressed by Goldman Sachs

and BICS in this thesis are the absence of Russia and the inclusion of South Africa. As this thesis concentrates on the studies of developing countries' economic development and financial growth, Russia is still a bone of contention as to whether it can be acknowledged as a developing country. The common perception of Russia is that its economic development is a special case, and there are many articles explaining the special characteristics of Russia's economic development. This section only considers some ideas linked with this thesis: (1) Russia has many industrial bases, built up in the period of the Soviet Union, and most of these industrial bases are still playing an important role in economic development, especially the excellent national defence industry. Most other developing countries lack industrial bases in the economic take-off stages; (2) Russia experienced an amazing structural non-economic 'big push', a remarkable political shock in 1991. Although most developing countries experience more and less structural changes in either society or economy, Russia's changes have been acknowledged as the biggest shocks in the international world after World War II; (3) In the period of the Soviet Union, Russia was acknowledged as an open economy, but its major trading-partners were countries in Eastern Europe. For other developing countries, the notion of trade openness normally refers to the global trading-partners or regional trading-partners. (4) Russia is a transitional economy, moving from communism to capitalism and the core problems of development are not present in the current economy. (5) Russia has a more homogeneous economy while developing countries face dualistic development i.e. the presence of a dual economy. (6) Russia has many characteristics of an endogenous growth economy, such as

human capital and advanced technology, but fails to develop due to institutional backwardness. Russia, therefore, should be distinguished from other large developing countries and is therefore omitted from the discussion here.

With two economies in Asia, one in Europe and one in Latin America represented in the studies of BRICs profiles, it is not difficult to notice the absence of an African economy. When the BRICs were first proposed by Goldman Sachs in 2003, the four countries were chosen because they are the largest developing economies.²⁵ In fact, it is still interesting and useful to extend our studies to some potential economies in Africa. The biggest economy in Africa is broadly acknowledged as South Africa, and it should play the same role in world economy as the other four countries. Thus, the group of large developing countries in this study is actually composed of four developing economies, i.e. BRIC+ South Africa - Russia, henceforth referred to as BICS.

According to pioneering forecasts by Goldman Sachs, the projected GDP²⁶ in South Africa could reach 1174 billion by 2010, ranked fifth after the other four countries, but it is still quite a high level compared with other developing economies. The GDP of South Africa in 2003 was 83 billion US dollars, so the projected GDP for 2050 in South Africa will be more than ten times the current level. South Africa could achieve approximately 5% growth over the next decade if the government implements good economic policies to sustain economic development. The average growth rate in South Africa is around 3.5% over the next 50 years. As the population growth rate could decline, the per capita domestic income should rise more rapidly. The economic

²⁵ Goldman Sachs, 2003

²⁶ GDP based on 2003 US dollar

growth in South Africa by 2050 is normally acknowledged to be significantly smaller than in the other countries, though per capita value would be higher.

South Africa replaces Russia in this thesis to join Brazil, India and China as a specific group of large developing countries, denoted as BICS. This group shares common characteristics of economic development, in particular benefits and costs of countries' sizes and effects on issues linked with growth patterns.

6.3.3 General Overviews of BICS's Development

6.3.2.1 Overview of Brazil

The Brazil economic development can be characterized by large scale and well-developed agricultural sectors, manufacture industries, mining industries and services industries, Brazil's economy outweighs that of other nations in South America. Now Brazil is expanding its presence in the global markets. From 2002 until now, Brazil ran record its first current account surpluses since 1992. Productivity gains coupled with high commodity prices contributed to the surge in exports. Brazil improved debt profile in 2006-2007 through changing country's debt burden toward into real denominated and domestically held instruments. LULA DA SILVA presented his commitment of fiscal responsibility by keeping the Brazil's primary surplus during the 2006 election. Following his inauguration in October 2006, LULA DA SILVA announced further economic reforms of reducing taxes and increasing investment in infrastructure. Brazil's debt achieved investment grade status early in 2008, but the government's try to boost the growth while decreasing the debt burden resulted by

inflationary pressures. In 2008, the Central Bank of Brazil implemented a restrictive monetary policy to stem these pressures. In terms of the global financial crisis beginning in the second half of 2008, Brazil's currency and its stock market - Bovespa - have significantly lost value, -41% for Bovespa for the year ending 30 December 2008. Brazil incurred another current account deficit in 2008, as world demand and prices for commodities dropped in the second-half of the year.

6.3.2.2 Overview of China

China's economy has changed from a control-planning growth strategy that was closed to international trade to a more market-oriented economy involving large numbers of rapidly growing private sectors. Now China is a major player in the global economy. China's economic reforms expanded to include the gradual liberalization of prices, the opening to foreign trade and investment. the foundation of a diversified banking system, fiscal decentralization, and the rapid growth of the non-state sector.

In recent years, China has re-invigorated its support for leading state-owned enterprises in sectors it considers important to "economic security," explicitly looking to foster international competitive national champions. The restructuring of the economy and resulting efficiency gains have contributed to a more than tenfold increase in GDP since 1978. Measured on purchasing power parity (PPP) basis that adjusts for price differences, China in 2008 stood as the second-largest economy in the world after the US. The Chinese government faces numerous economic development challenges, including: (a) strengthening its social safety net, including pension and health system reform, to counteract a high domestic savings rate and

correspondingly low domestic demand; (b) sustaining adequate job growth for tens of millions of migrants, new entrants to the work force, and workers laid off from state-owned enterprises deemed not worth saving. One demographic consequence of the "one child" policy is that China is now one of the most rapidly aging countries in the world. China continues to lose arable land because of erosion and economic development. In 2007 China intensified government efforts to improve environmental conditions, tying the evaluation of local officials to environmental targets, publishing a national climate change policy, and establishing a high level leading group on climate change, headed by Premier WEN Jiabao. The Chinese government attempts to seek to add energy production capacity from sources. In late 2008, while China commemorated the 30th anniversary of its historic economic reforms, the global economic downturn began to slow foreign demand for Chinese exports that is the first time in recent decades. The China's government promised to continue reforming the economy and emphasized the need of increasing domestic consumption in order to make China less dependent on foreign exports for GDP growth in the future.

6.3.2.3 Overview of India

India's economy encompasses traditional village farming, modern agriculture, a multitude of services, and a wide range of modern industries. Service industries are the main source of economic growth, accounting for more than half of outputs with less than one third of employment. Slightly more than half of employment is in agriculture, leading the United Progressive Alliance (UPA) government to articulate a development program of rural economies, which involves creating basic infrastructure

to improve the lives of the rural poor. The India government has reduced restrictions and administration controls on foreign trade and investment. Higher level of limitations on FDI exists in a few key sectors, such as telecommunications. However, tariff spikes in sensitive sectors, including agriculture, and incremental progress on economic reforms still hinder foreign access to India's vast and growing market. Privatization of government-owned industries remains stalled and continues to generate political debate; populist pressure from within the UPA government had restrained needed initiatives. The economy has posted an average growth rate of more than 7% in the decade since 1997, reducing poverty by about 10 percentage points. India achieved 8.5% GDP growth in 2006, 9.0% in 2007, and 7.3% in 2008, significantly expanding manufactures through late 2008. India also is capitalizing on its large numbers of well-educated people skilled in the English language to become a major exporter of software services and software workers. Strong growth combined with easy consumer credit, a real estate boom, and fast-rising commodity prices fueled inflation concerns from mid-2006 to August 2008. Rising tax revenues from better tax administration and economic expansion helped New Delhi make progress in reducing its fiscal deficit for three straight years before skyrocketing global commodity prices more than doubled the cost of government energy and fertilizer subsidies. The ballooning subsidies, amidst slowing growth, brought the return of a large fiscal deficit in 2008. In the long run, the huge and growing population is the fundamental social, economic, and environmental problem.

6.3.2.4 Overview of South Africa

South Africa is a middle-income, emerging market with an abundant supply of natural resources; well-developed financial, legal, communications, energy, and transport sectors; a stock exchange that is 17th largest in the world; and modern infrastructure supporting an efficient distribution of goods to major urban centers throughout the region. Growth was robust from 2004 to 2008 as South Africa reaped the benefits of macroeconomic stability and a global commodities boom, but began to slow in the second half of 2008 due to the global financial crisis' impact on commodity prices and demand. However, unemployment remains high and outdated infrastructure has constrained growth. At the end of 2007, South Africa began to experience an electricity crisis because state power supplier Eskom suffered supply problems with aged plants, necessitating "load-shedding" cuts to residents and businesses in the major cities. Daunting economic problems remain from the apartheid era - especially poverty, lack of economic empowerment among the disadvantaged groups, and a shortage of public transportation. South African economic policy is fiscally conservative but pragmatic, focusing on controlling inflation, maintaining a budget surplus, and using state-owned enterprises to deliver basic services to low-income areas as a means to increase job growth and household income.

Table 6.3
Factbook of BICS

Countries	Brazil	China	India	South Africa
GDP (PPP) 2008	\$1.99 trillion (2008 est.)	\$7.8 trillion (2008 est.)	\$3.267 trillion (2008 est.)	\$489.7 billion (2008 est.)
GDP (official exchange rate)	\$1.665 trillion (2008 est.)	\$4.222 trillion (2008 est.)	\$1.237 trillion (2008 est.)	\$300.4 billion (2008 est.)
Labor force	100.9 million (2008 est.)	807.7 million (2008 est.)	523.5 million (2008 est.)	18.22 million (2008 est.)
Investment (gross fixed)	18.6% of GDP (2008 est.)	40.2% of GDP (2008 est.)	39% of GDP (2008 est.)	20.1% of GDP (2008 est.)
Public debt	40.7% of GDP (2008 est.)	15.7% of GDP (2008 est.)	78% of GDP (2008 est.)	29.9% of GDP (2008 est.)
Commercial bank lending rate	43.72% (Dec 2007)	5.58% (Dec 2007)	8.5% (Jan 2009)	13.17% (Dec 2007)
Inflation rate (consumer prices)	5.8% (2008 est.)	6% (2008 est.)	7.8% (2008 est.)	11.3% (2008 est.)
Stock of money	\$131.1 billion (Dec 2007)	\$2.3 trillion (Oct 2008)	\$250.9 billion (Dec 2007)	\$58.49 billion (Dec 2007)
Stock of domestic credit	\$1.377 trillion (Dec 2007)	\$5.316 trillion (Oct 2008)	\$769.3 billion (Dec 2007)	\$254.9 billion (Dec 2007)
Current account balance	-\$27.33 billion (2008 est.)	\$368.2 billion (2008 est.)	-\$38.39 billion (2008 est.)	-\$21.67 billion (2008 est.)
FDI - at home	\$280.9 billion (2008 est.)	\$758.9 billion (2007 est.)	\$142.9 billion (2008 est.)	\$99.61 billion (2008 est.)
FDI - overseas	\$119.1 billion (2008 est.)	\$139.3 billion (2008 est.)	\$54.21 billion (2008 est.)	\$57.08 billion (2008 est.)

Source:

Factbook, CIA; International Financial reports, IMF; Chinese Year Statistics, PBOC

6.3.4 Importance of BICS in the Global Economy

When the notion of BRICs was presented by Goldman Sachs in 2003, the importance of large developing countries came to development economists' minds immediately. In fact, there are many other evidences to support the significance of these large developing countries on the stage of global economy. The G20 Group of Developing Nations, established on 20 August 2003, has become a pioneering organisation, and its major members are Brazil, India, China and South Africa.

In fact, the G4 bloc, consisting of China, India, Brazil, and South Africa, is the

core leadership of the larger G20 trade bloc within the World Trade Organization. In 2003, Brazil, India and South Africa signed the Brasilia Declaration that would lead to the founding of the G20 Developing Countries Group. The Group of 20 Developing Nations accounts for 60% of the world's population and 26% of the world's agricultural exports.

Economic comparisons between BICS and G8 show economic developments in these countries, as well as members of G8. The total volumes of GDP level, based on the US dollar, put China in fourth place, Brazil tenth, India twelfth and South Africa twenty-eighth. All members of G8 are in the first fifteen ranks, Brazil and India just behind them, and China has overcome the UK, France, Italy and Russia already, becoming the fourth biggest economy in the world. Moreover, it is amazing that the gap between Italy (eleventh) and India (twelfth) is so small: Italy has 2,107,481 million USD and India has 1,170,968 million USD. Regarding the real growth rate of GDP, Brazil, China, India and South Africa are all above the industrialised countries in G8: Brazil in thirty-fifth place, China eighth, India seventeenth and South Africa fiftieth. The sharp growth rates for China and India provide the best reason for the importance of large developing countries. The data for exports, imports and FDI reveal significance of these large developing countries in international trading markets and global capital markets.

Another interesting fact is the frequent representation of these large developing countries at global economic summits, especially that on the late 2000s economic recessions. The following table 'Major Summits about Late 2000s Economic

Recessions' certifies their attendances, and in the meanwhile it is believed that industrialised countries are willing to discuss economic problems with developing countries. Even at the Thirty-Fourth G8 Summit in Tokyo in July 2008, the BICS were invited to jointly discuss the economic problems, and that summit is also known as the G8+G5 Summit in much of the economic literature. The latest summit for the current global economic recession is the London G20 Summit. The developing countries, in particular China, India and Brazil, are expected to wield more power in discussing the global economic development. In other words, the importance of large developing countries, typically represented by Brazil, China, India and South Africa, has been noticed and accepted in the fields of development economics. Nobody knows whether the predictions of Goldman Sachs that BRICS will surpass the G7 in the next fifty years are correct or not, but most development economists believe the emergence of BICS will surprise us all.

Table 6.4 Economic Comparisons of BICS and G8

	BRICS					G8						
	Brazil	China	India	S. Africa	US	UK	Japan	Germany	France	Italy	Russia	Canada
2007 GDP Millions of USD	1,314,170	3,280,053	1,170,968	277,581	13,811,200	2,727,806	4,376,705	3,297,233	2,562,288	2,107,481	1,291,011	1,326,376
2008 GDP growth rates	10 th	4 th	12 th	28 th	1 st	5 th	2 nd	3 rd	6 th	7 th	11 th	9 th
	5.2%	9.8%	7.3%	3.7%	1.4%	1.1%	0.7%	1.7%	0.9%	0.0%	6.0%	0.7%
2008 Exports Million of USD	35 th	8 th	17 th	50 th	67 th	69 th	73 rd	65 th	71 st	77 th	27 th	73 rd
	200,000	1,465,000	175,700	59,150	1,377,000	468,700	776,800	1,530,000	629,700	566,100	476,000	461,800
2007 FDI Millions of USD	20 th	2 nd	26 th	41 st	3 rd	9 th	4 th	1 st	5 th	6 th	8 th	10 th
	248,900	758,900	95,960	93,510	2,093,000	1,288,000	110,800	855,800	942,300	364,800,	271,600	527,400
2007 Imports Million of USD	16 th	6 th	27 th	28 th	1 st	2 nd	24 th	5 th	4 th	11 th	14 th	10 th
	120,600	904,600	230,200	61,530	1,968,000	621,400	573,300	1,075,000	600,900	498,600	260,400	386,900
2007 Imports Million of USD	26 th	3 rd	16 th	36 th	1 st	4 th	6 th	2 nd	5 th	7 th	15 th	11 th

Notes:

1) GDP: total GDP based on US dollar; GDP Growth rate: real growth rate of GDP;

2) Data sources: IMF, World Bank and CIA.

Table 6.5

Major Summits about late 2000s global economic recession

Summits after 2008 economic crisis	Attendances, including invited countries	intergovernmental organizations	Time	location
Washington G20 Summits	Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Korea, Russia, Saudi Arabia, South Africa, Turkey, UK, US, Nederland, and others	World Bank, IMF, UN and others	November 14 th -15 th , 2008	Washington, USA
34 th G8 Summits (G8+G5)	Australia, Brazil, Canada, China, France, Ghana, Germany, India, Indonesia, Italy, Japan, Mexico, Nigeria, South Korea, Russia, South Africa, UK, US, and others	WTO, IMF and others	July 7 th -9 th , 2008	Tokyo, Japan
APEC 2008 summit	Australia, Brunei, Canada, Chile, China, Chinese Taipei, Hong Kong, Indonesia, Japan, Korea, Malaysia, New Zealand, Peru, Philippines, Russia, Singapore, Thailand, United States, Vietnam	UN, WTO, IMF and others	November 22 nd -23 rd , 2008	Lima, Peru
London G20 Summits	Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, South Korea, Russia, Saudi Arabia, South Africa, Turkey, UK, US, Nederland, and others	World Bank, IMF, UN and others	April 2 nd 2009	London, UK

Notes:

1) This conclusion ends by the 30th May 2009.

2) IMF: International Monetary Funds; UN: Union Nations; China: P.R.China; Korea: South Korea; Hong Kong: Hong Kong Special Administrative Region

Table 6.6													
Projected ¹ US\$GDP Billions for BRICS and G6 ²													
2003 US\$ Billions	BRICS					G6					Total		
	Brazil	China	India	Russia	South Africa	US	UK	Japan	Germany	France	Italy	BRICS	G6
2000	762	1078	469	391	83	9825	1437	4176	1875	1311	1078	2783	19702
2010	668	2998	929	847	147	13271	1876	4601	2212	1622	1377	5589	24959
2020	1333	7070	2104	1741	267	16415	2285	5221	2524	1930	1553	12515	29928
2030	2189	14312	4935	2980	447	20833	2649	5810	2697	2267	1671	24863	35927
2040	3740	26439	12367	4467	739	27229	3201	6039	3147	2668	1788	47752	44072
2050	6074	44453	27083	5870	1174	35165	3603	6673	3603	3147	2061	84654	54252
Average	2953.2	19270	9577.4	3259.2	571.4	24547.6	3010.2	6504	3211.6	2589	1905.6	35631.2	41768
Notes:													
¹ Goldman Sachs, 2003 Report													
² BRICS: Brazil, Russia, India, China and South Africa; G6 does not include Canada.													

6.4 SVAR²⁷ Models for BICS's Empirical Analysis

6.4.1 Basic Explanation of SVAR Model

This section describes an empirical strategy to investigate dynamic structures and compare the impacts of shocks from two real sectors, investment and trade, on economic outputs with the impacts from financial shocks. The empirical estimation framework employs the structure vector autoregressive (SVAR) model. The SVAR models were first proposed by Shapiro and Watson (1998) from an idea of Quah and Blanchard (1989). It is to be expected that these four countries (BICS) have many of their own specialisations in economic development, and in order to suit our SVAR model and estimations, there are four main indicators and three control variables to be incorporated into each country's empirical estimations. The main variables are composed of economic outputs, investment ratio, trade openness and financial

²⁷ SVAR: Structural Vector Autoregressive Models. The SVAR is developed by Bernanke (1986), Blanchard and Watson (1986) and Sims (1986) and more recently by Clarida and Gali (1994) and Astley and Garratt (1996), who considered a priori restrictions on contemporaneous effects of shocks in dynamic process or long run term.

indicators those can be broadly acknowledged as important measurements for emerging economies. The control variables include government expenditures, education expenditures and military expenditures, which can be regarded.

The SVAR model is acknowledged as an efficient econometric framework to investigate the shocks and impacts among several important indicators, and it is quite broadly used in developing economies as it normally does not require a long time series, which is a compulsory condition for other time series models, like vector error-correction models. Since SVAR normally uses fairly short periods in the empirical regressions, the efficient analysis for SVAR generally includes dynamic analysis, forecasting and other topics for economic growth or evaluations of fiscal or monetary policies.

In addition, in terms of our theoretical models for finance and growth, all variables involved in our empirical estimations including investment, trade, finance, and economic outputs are simultaneously regarded as endogenously correlated in terms of our theoretical models in previous chapters. In view of the endogenous interrelationships among variables, the SVAR models are also one of the suitable models for empirical regressions.

This paper uses a four-variable SVAR as the basic framework for analyses and comparisons of these shocks of investment and trade and their effect on economic outputs in these large developing countries, and procedures to identify this model are explained in the following sections.

The four-variable SVAR model can be derived from the following

reduced-form vector autoregressive (VAR) models:

$$\tilde{X}_t = a_0 + \sum_{i=1}^k a_i X_{t-i} + e_t$$

Here \tilde{X}_t is a 4×1 matrix to involve our four variables, and these variables are acknowledged as endogenous variables in the model: $\tilde{X}_t = [x_{1t}, x_{2t}, x_{3t}, x_{4t}]$. The term of a_0 is still a matrix to be composed of autoregressive coefficients. The residual matrix of e_t is white noise. The term of $\sum_{i=1}^k a_i X_{t-i}$ can be transformed to $A_L X_{t-1}$, where A_L is a 4×1 matrix of lag polynomials and $A_{L,MN} = \sum_{i=1}^k a_{MN}(i) L^{i-1}$.

The reduced-form vector autoregressive (VAR) model can be represented in terms of moving average (MA) expression as follows:

$$\tilde{X}_t = (I - A_L L)^{-1} a_0 + (I - A_L L)^{-1} e_t,$$

where \tilde{X}_t = the convergent sum of the current and previous residuals

Let the term of $(I - A_L L)^{-1} a_0$ be σ and $(I - A_L L)^{-1}$ be B_L . And the B_L is the 4×1 matrix of lag polynomials and $B_{L,MN} = \sum_{i=1}^k b_{MN}(i) L^i$. The VAR model can be represented as follows:

$$\tilde{X}_t = \sigma + B_L e_t = \sigma + \sum_{i=0}^{\infty} b_i e_{t-i},$$

where b_i is a 4×4 matrix of coefficients for $i=0,1,2,\dots,k$ and $b_0 = I$.

The residuals involved in the reduced-form VAR model are assumed to be a linear combination of four structural innovations of interest of four endogenous variables involved in the empirical estimations. Furthermore, there is a 4×4 non-singular matrix C_0 and $e_t = C_0 \varepsilon_t$ where $\varepsilon_t = [\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}, \varepsilon_{4t}]'$. So far the expression for VAR can be rearranged as follows:

$$\tilde{X}_t = \sigma + \sum_{i=0}^{\infty} b_i C_0 \varepsilon_{t-i} = \sigma + \sum_{i=0}^{\infty} c_i \varepsilon_{t-i}, \text{ where } c_i = b_i c_0$$

This new expression for VAR model is the structural VAR (SVAR) model based on the moving average (MA) expression, and here \tilde{X}_t can be regarded as a function of history of innovations. It is important to understand the structural innovations involved in the SVAR framework, since the structural innovations play a key role of driving forces behind the stochastic process of the variables in the system. In the above equation, the term of c_i is actually a function to involve impulse responses. The elements of matrix in c_0 represent a contemporaneous effect from one-unit change in structural innovations on the macroeconomic variables.

In terms of theoretical understanding, the basic problem to estimate the SVAR models is that it is highly impossible to estimate and derive directly the “real true” values of the elements of matrix c_i . According to study by Gottschalk (2001), the information of sample based on the data is insufficient to estimate since there could be an infinite set of different values for matrix c_i . Accordingly, it is not enough to infer c_i only based on the data alone; and the SVAR with only data information is still “unidentified”. In order to achieve the full conditions of identification, the SVAR model must involve some additional restrictions.

6.4.2 The Set-up of Econometric Models for Empirical Estimations

6.4.2.1 Testable Models, Variables and Data in Empirical Estimations

Based on the basic ideas of vector autoregressive models above, this thesis employ the structural vector autoregressive models, denoted as SVAR, to investigate the dynamic shocks with several important macroeconomic variables in the process of the estimations in Brazil, India, China and South Africa. The reduced-form VAR approach is popular due to its ease of use and success in investigating the empirical regularities of economic development. But its simplicity are from the expense of imposing some stringent restrictions in the process of empirical estimations, and thus, this important feature make it unsuitable for our purposes. For one the contemporaneous economic outputs' innovations are assumed to originate from all shocks simultaneously in normal reduced-form VAR models. The theoretical sections have shown us that the specifications of transmission channels in large emerging economies result in delayed responses from financial systems to economic outputs. Likewise, because the standard VAR model does not explicitly consider the delayed responses, it is not possible to help us investigate the economic development with finance in terms of large size effects on BICSs.

Firstly we can consider our testable model as the traditional reduced-form VAR model as follows:

$\Gamma(L)Z_t = u_t$, where Z_t is a vector of macroeconomic variables in our estimations

Thus, the vector of variables in the process of BICSs' estimations can be presented as

follows: $Z_{i,t}^{BICS} = [REY_{i,t}^{BICS}, INR_{i,t}^{BICS}, TRP_{i,t}^{BICS}, FSG_{i,t}^{BICS}, GVE_{i,t}^{BICS}, EUE_{i,t}^{BICS}, MIE_{i,t}^{BICS}, RFI_{i,t}^{BICS}]$,

where *BICS* means Brazil, India, China and South Africa. Here, all variables except the term of $RFI_{i,t}^{BICS}$ are regarded as endogenous variables in the estimation. In each economy of BICS, the $Z_{i,t}^{BICS}$ can be specified as $Z_{i,t}^{BR}$, $Z_{i,t}^{CN}$, $Z_{i,t}^{ID}$ and $Z_{i,t}^{SA}$ to represent the estimated SVAR models in Brazil, China, India and South Africa respectively.

The term of $REY_{i,t}^{BICS}$ means the domestic economic outputs, measured by real term of gross national incomes in BICSs; $INR_{i,t}^{BICS}$ is a variable of measuring investment sectors, indicated by investment ratio over the outputs; $TRP_{i,t}^{BICS}$ means the trading openness to measure the trading sectors; $FSG_{i,t}^{BICS}$ ²⁸ is the variables of financial systems in BICSs, which are measured by monetary aggregates or domestic credits ratio in each country. The terms of $GVE_{i,t}^{BICS}$, $EUE_{i,t}^{BICS}$, $MIE_{i,t}^{BICS}$ and $RFI_{i,t}^{BICS}$ are regarded as control variables in the estimations: $GVE_{i,t}^{BICS}$ is the per capita real government expenditures in BICS; $EUE_{i,t}^{BICS}$ measures education expenditures in BICS; $MIE_{i,t}^{BICS}$ measures the military expenditures in BICS; $RFI_{i,t}^{BICS}$ is the real term of foreign domestic investments in BICS. The control variables of $GVE_{i,t}^{BICS}$ and $MIE_{i,t}^{BICS}$ exert a crucial role in linking the effects of large size in large developing countries with the specific features of estimations. Furthermore, the ideas of government expenditures and military expenditures show the specific features as large scale of economies²⁹ in BICS, which make the estimations of BICSs' to be significantly different other developing countries.

In order to transform the traditional reduced-form of VAR model to a

²⁸ The detailed definitions of these variables will be explained in the following section of this chapter.

²⁹ The specific features of estimations in BICS are linked with specifications of economic development, financial systems and transmission channels in terms of large sizes' effects.

structural form of model in which disturbances are orthogonal, the SVAR approach proposes to begin from the true structural form model³⁰. The SVAR model suggest to impose restrictions on the contemporaneous structural parameters only, so that reasonable economic structures might be derived³¹. The fact is that only cotemporaneous restrictions are imposed however does not imply that there is no feedback among variables in the model. In the SVAR model, the lagged values enter each equation and therefore variables are interrelated for each other.

Estimations of BICS are based on quarterly data over the period from 1st quarter in 1995 (1995:Q1) to the 4th quarter in 2007³². All of data in BICS are presented in logarithmic form. The primary data sources are from the International Financial Statistics, IMF and World Development Indicator, World Bank. However, as these four economies of BICS are still in the relatively low level of economic development compared with other semi-industrialized countries³³, we have to use other data sources for our estimations, in particularly from central banks and statistics departments such as People's Bank of China (PBOC), Central Banks of Brazil, Asian Development Banks (ADB) and so on.

For the variables of $REY_{i,t}^{BICS}$, $INR_{i,t}^{BICS}$, $TRP_{i,t}^{BICS}$, $GVE_{i,t}^{BICS}$, $EUE_{i,t}^{BICS}$, $MIE_{i,t}^{BICS}$, $RFI_{i,t}^{BICS}$, their definitions of the variables are used in terms of specific economic development of four emerging economics of BICS. The detailed definitions of these variables are

³⁰ Sims (1980) suggested replying on the Cholesky decomposition of the variance-covariance matrix, through a lower-triangular matrix P such. However, the Cholesky decomposition is not an a-theoretical approach. The lower triangularity of P implies a recursive scheme among the variables that has clear economic implications and has to be test as other relationships

³¹ This specification scheme is the most used in the financial system analysis: see among others Gordon and Leeper (1994), Sims and Zha (1998), Leeper and Roush (2003) and Kim (2000), Mojon and Peersman (2003), Dedola and Lippi (2005).

³² As the data in BICS is very limited, the source of data from 1995:Q1 to 2007:Q4 is not sole.

³³ Semi-industrialized countries typically involve some middle- and high-level income emerging economies, such as Korea, Taiwan, Malaysia and others.

concluded based on several important sources, involving United Nations Data, World Banks, PBOC, Central Banks of Brazil, ADB and IMF. These definitions are listed in appendix³⁴.

The problems of stationarity and VAR models are still being hotly debated. Unit root tests suggest that most, if not all, of the variables involved in the model are non-stationary, that is, $I(1)$, process. These tests are available as an unpublished appendix upon request in this thesis. According to Blanchard and Quah (1989), the reduced form of VAR models required all variables to be stationary. But recent studies are still arguing that the estimation of structural VAR models with non-stationary variables are still able to be accepted, if these structural VAR models do not involve the problems of autocorrelations, normality and heteroscedasticity. The preferences for VARs with $I(1)$ series can be explained, at least in part, by a reluctance to impose possible incorrect restrictions on the model³⁵ (Hamilton 1994). In order to guarantee the mathematical stability of VAR models, we still estimate the reduced form VAR model firstly based on the traditional approach in variables' first differences to make sure the stationarity³⁶. Importantly, the tests for misspecification are compulsory for detecting the stability of the VAR model. The estimation with stationarity first differences substantially improves system performance in misspecification tests.

6.4.2.2 Control Variables Linking Size Effects with Empirical Estimations

According to theoretical studies of size effects' on financial systems and transmission

³⁴ Please refer to the tables in the appendix of this chapter.

³⁵ Please refer to the literature by Hamilton (1994), page 652.

³⁶ ADF test formally confirm stationarity of the first-differenced time series, as the null hypothesis of unit root is rejected at 5% or 1% level. Majority of variables are shown to be stationary in their first differences.

channels, the control variables are necessary to be involved in the process of the estimations in order to link the size effects with the empirical estimations. In the econometric models for BICSs' regression with SVAR, there are totally three control variables of size effects involving into the estimation processes in BICSs: government expenditures, education expenditures and military expenditures. These control variables are denoted as "the indicators of size effects" in the econometric models of this thesis. In the process of empirical estimations, these indicators of size effects are measured by the ratio over the economic outputs, and the per capita level of three variables are used instead of aggregate values. Therefore, the three indicators of size effects within empirical regressions for BICSs study can be presented as follows: per capita level of the ratio of government expenditures over GDP, per capita level of the ratio of education expenditures over GDP, per capita level of the ratio of military expenditures over GDP. This section provides some of the most important reasons to answer why our study use these three control variables and why the per capita levels of variables are better than aggregate levels.

Firstly, in order to keep consistency in the regression, all of three variables are used with the ratio over economic outputs³⁷. Moreover, in empirical regressions the ratio-values are much better than level-values in the comparative studies across countries. For one, government expenditures, the level-differences between China and Brazil are significantly large, and these large differences are not real meanings, but due to some externalities like exchange rate, growth strategies and other reasons.

³⁷ The ratio over the economic outputs means the ratio of GDP. This definition is in terms of World Bank Development Index.

Hence, the ratio of government expenditures over economic can better measure the real situations of government expenditures. Our study of BICSs includes four countries with both individual and comparative studies; therefore, the ratio-values should work more efficiently in this chapter.

Secondly, the population should exert an important role in explaining the size effects and economic development. As what we studies in previous section³⁸, large emerging economies should share the relatively less costs to use public resources and goods, such as defence expenditures. In the meanwhile, more peoples can be beneficial from public benefits and goods in the large emerging economies. Therefore, it is compulsory to involve the factors of population into our empirical estimations. But the growth trend of data of population varies from each country of BICSs, in particularly, there are highly possible to involve some unexpected exogenous shocks in our SVAR models. The per capita level for each variable is, therefore, a suitable approach to involve the factors of populations inside our estimations without considerations of exogenous shocks.

Thirdly, these three variables can be acknowledged as three of most suitable and efficient variables to represent public goods and resources in developing countries. These three variables are actually the indicators of size effects. Because of the involvements of these indicators of size effects in our regressions, the shocks between real sectors and financial systems to economic outputs become more attractive, more specific and more interrelated with the specifications of large emerging economies.

³⁸ Please refer to the section of theoretical discussion about size effects and economic development in this chapter

The relatively lower costs to share public goods and resources can be efficiently shown by these three indicators of size effects. In other hand, the population is an important factor to measure the size effects, and it is impossible to ignore that.

Fourthly, some economist argues the infrastructure investment is a good variable for public goods as well, but several reasons support us not to use it in our study of BICSs. Firstly, the aggregate government expenditures in BICSs involves majority of infrastructure investment. Although some infrastructure investments are operated by private sectors or international assistances like IMF Programs, the proportion of government expenditures for infrastructure are taking the dominated positions in BICSs. Secondly, the fluctuations of data for infrastructure investments must result in some misspecifications in the regression process. So far most of official statistic departments can not use single variable to measure infrastructure investments in developing countries, since the statistical approaches are technically difficult to implement in developing countries. Therefore, the government expenditures are the first indicator of size effects in our regression.

Finally, the military expenditures are always one of the important public goods and resources in every country. The large number of population and sizes in BICSs make the military expenditures to be more important than other developing countries. As one kind of public resources, every national can share the costs and benefits of military expenditures. The same ideas can be used to use the education expenditures as well.

6.4.2.3 Financial Variables in Large Emerging Economies

Compared with comprehensive and diversified indicators for financial growth in Newly Industrialized Countries, the measurement for another group of large developing countries is more centralized and only involves one financial growth indicator for each individual country. There are several realistic reasons to employ a single financial growth indicator for the countries of Brazil, India, China and South Africa (BICS).

Firstly, it is not surprising that the development of financial systems in these BICS countries is at a relatively early stage. The traditional approach for measurements still dominates the process of investigating financial systems in these large countries and, accordingly, the monetization ratio is broadly used in economic life and is acknowledged to represent the functions of financial systems for economic development. Think of, for example, China and India still controlling the amount of aggregate money supplied to affect financial policies in the period of recent global financial crisis.

Secondly, the functions of borrowing and lending within financial systems are not broadly used in these large countries. The existence of a *Black Market* in credit markets results in the inefficient use of measurements of borrowing and lending. In other words, it could result in a large scale of errors in empirical regressions with measurements of credit markets.

Thirdly, the development of private enterprise in these large developing countries is too diversified: India and South Africa have a large amount of private

enterprise, but the big enterprises in China and Brazil are nearly all nationalized companies, particularly for important sectors like the energy, railway and telecommunications industries. Thus, the variable rates of borrowings and credits to private sectors are not suitable for group estimations of BICS.

On top of the above reasons, the monetization ratio is used in the group and comparative estimations of large developing countries, except in the estimation for Brazil. The financial systems in Brazil have their own specific characteristics, and the money supply can not efficiently measure financial growth. Hence, financial growth is measured by the aggregate domestic credits ratio in Brazil's empirical estimations.

6.4.2.4 Basic Descriptions of Main Variables in Empirical Estimations

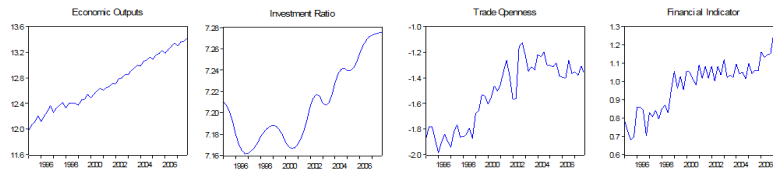
This section reports the graphs and correlation matrix with zero-order route for REY_t^{BICS} , INR_t^{BICS} , TRP_t^{BICS} and FSG_t^{BICS} in BICSs in this thesis. It is worth to recalling that the economic output is denoted as REY_t^{BICS} , and proxies for two real sectors are shown as INR_t^{BICS} and TRP_t^{BICS} for investment ratio and trading openness respectively. The financial growth is represented as FSG_t^{BICS} . According to previous discussion, our testable model for BICS not only involves these four main variables, but it also includes several control variables linked with large size effects, however, the empirical purpose of the BICS's study is to investigate how real sectors and financial systems help economic development with effects of large size in emerging economies. Therefore, this section is only concentrating on the graph descriptions and

correlation matrix for aggregate economic incomes, investment ratio, trading openness and financial growth as REY_t^{BICS} , INR_t^{BICS} , TRP_t^{BICS} and FSG_t^{BICS} in Brazil, China, India and South Africa.

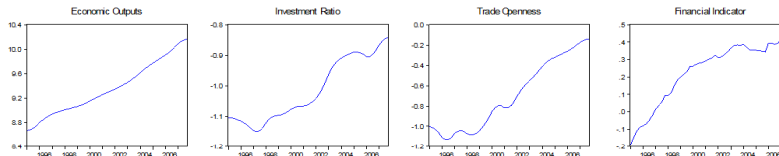
The basic information from graph descriptions and correlation matrix might not show the exact meanings among these variables, however, these fundamental ideas could firstly provide some useful information and help us investigate our data and variables involved in the following estimations of BICS's study. Let's begin these basic investigation from the a comparative graph-descriptions of REY_t^{BICS} , INR_t^{BICS} , TRP_t^{BICS} and FSG_t^{BICS} in Brazil, China, India and South Africa respectively in the period of 1995:1st Quarter to 2007: 4th Quarter.

Graphs Descriptions (Level) in BICSs
For REY_t^{BICS} , INR_t^{BICS} , TRP_t^{BICS} , FSG_t^{BICS}

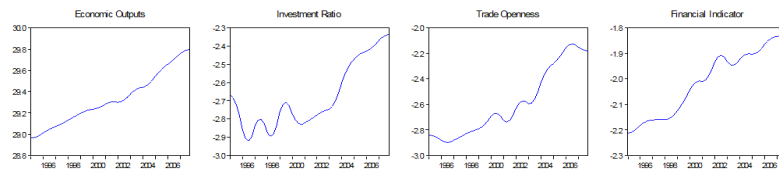
Brazil



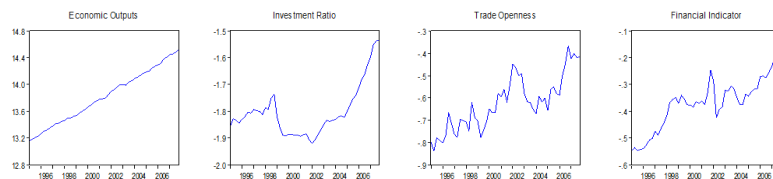
China



India



South Africa



In terms of the above graph-description in BICSs, the economic aggregate incomes in all countries of BICS are shown as the stable up-trend line, which means the general notion of macroeconomic development in these large emerging economies in the period of 1995 to 2007 always remain the sustainable growth level. The growth patterns of investment ratio in India and China are very similar, but Brazil and South Africa's data obviously involve some fluctuations because a few of breaks, but these breaks are still small. Even with some breaks in investments, four countries' lines are shown to be up-trend lines significantly. In particularly, the significant up-trend pattern of investment ratio becomes more stable in recent five years, while BICSs'

economies exert a dramatically important role in global economic development only after 2002. The growth patterns of trading openness have similarities as investment's graphs in BICSs: India and China's trading growth is always up-trend with less fluctuation points in all quarter periods until the end. But either Brazil or South Africa's trading growth involves many fluctuations.

Refer to financial graphs, the most stable growth pattern for financial indicator is either China's or India's financial growth, whereas the Brazil's graph shows as similar pattern as graphs of trading openness. In summary, the most stable graphs for four main variables of REY_t^{BICS} , INR_t^{BICS} , TRP_t^{BICS} and FSG_t^{BICS} among BICSs are shown in either China or India; Brazil involves more fluctuations, and South Africa shows less growing patterns.

After investigating the basic information from graphs, correlation matrix with zero-order route for REY_t^{BICS} , INR_t^{BICS} , TRP_t^{BICS} and FSG_t^{BICS} are reported in the following table for Brazil, China, India and South Africa respectively.

Correlations Matrix for BICSs for REY_t^{BICS} , INR_t^{BICS} , TRP_t^{BICS} , FSG_t^{BICS}				
Brazil				
REY_t^{BR}	INR_t^{BR}	TRP_t^{BR}	FSG_t^{BR}	
REY_t^{BR}	1.000000	-0.270323	0.832785	0.841978
INR_t^{BR}	-0.270323	1.000000	-0.313228	-0.156892
TRP_t^{BR}	0.832785	-0.313228	1.000000	0.786897
FSG_t^{BR}	0.841978	-0.156892	0.786897	1.000000
China				
REY_t^{CN}	INR_t^{CN}	TRP_t^{CN}	FSG_t^{CN}	
REY_t^{CN}	1.000000	0.953149	0.971402	0.883823
INR_t^{CN}	0.953149	1.000000	0.985114	0.811399
TRP_t^{CN}	0.971402	0.985114	1.000000	0.835544
FSG_t^{CN}	0.883823	0.811399	0.835544	1.000000
India				
REY_t^{IN}	INR_t^{IN}	TRP_t^{IN}	FSG_t^{IN}	
REY_t^{IN}	1.000000	0.881759	0.969534	0.944340
INR_t^{IN}	0.881759	1.000000	0.938014	0.772851
TRP_t^{IN}	0.969534	0.938014	1.000000	0.919046
FSG_t^{IN}	0.944340	0.772851	0.919046	1.000000
South Africa				
REY_t^{SA}	INR_t^{SA}	TRP_t^{SA}	FSG_t^{SA}	
REY_t^{SA}	1.000000	0.548706	0.851816	0.872617
INR_t^{SA}	0.548706	1.000000	0.490813	0.509277
TRP_t^{SA}	0.851816	0.490813	1.000000	0.788488
FSG_t^{SA}	0.872617	0.509277	0.788488	1.000000

As suggested in the previous graphs, India and China might involve many similarities in the correlation matrix, and thus India and China is studied jointly. Among all correlations between financial growth indicators and other variables, both India and China's investment ratios are the less significantly correlated with financial growth compared with economic outputs and trading openness. But the overall correlations among four variables are very dramatically significant in either India or China. These correlations are less important in South Africa and Brazil. It is surprising that Brazil's investment ratios are negatively correlated with other three variables. In terms of real stories in Brazil's development, the less proportion of investment in Brazil's economy can explain these interesting results well. In summary the set-up of following empirical models should learn some important points from these basic points. In the meanwhile, this basic information provides us a technical overview of BICSS' economic development statistically.

6.4.3 Identifications for SVA models: Theoretical and Empirical Routes

6.4.3.1 Theoretical Ideas for Identifications

The general form of our structural model can be represented as follows:

$$Ax_t = A_1^*x_{t-1} + \dots + A_p^*x_{t-p} + B\varepsilon_t, \text{ where } \varepsilon_t \sim (0, I_k)$$

In empirical modelling, the matrix A indicates the estimations of the contemporaneous relationships among endogenous variables. The structural shocks can be expressed by terms of ε_t , which can be related to the system residuals in the model through linear regressions. It is assumed that the structural shocks are orthogonal. The

interconnections among these structural shocks by the reduced form disturbance can be obtained through multiplying above equation, and thus $A_j = A^{-1}A_j^*$. The relationships between errors from reduced and structural forms are formulated as $u_t = A^{-1}B\varepsilon_t$.

According to Amisano and Giannini (1997), the restrictions for elements of A and B can be combined and thus the SVAR model for innovations can be shown as $Au_t = B\varepsilon_t$. Here the metrics of u_t and ε_t are vectors of length k . The matrix of u_t presents the residuals in the reduced form SVAR model, and the matrix of ε_t show the structural innovations. The residuals in reduced form system are observed and structural innovations are unobserved. As the structural innovations ε_t are orthonormal set, i.e. its covariance is an identity matrix as $E[\varepsilon_t \varepsilon_t'] = I$. In empirical estimations, the orthonormal innovations include the following restrictions on A and B as $A \sum A' = B B'$. Since the above expressions of restrictions are symmetric, we need $k(k+1)/2$ restrictions on the $2k^2$ unobserved elements for matrix A and B. In order to identify A and B fully, we need to supply at least $2k^2 - k(k+1)/2$ additional restrictions in the theoretical model.

6.4.3.2 Empirical Identifications³⁹ for BICS's Models

The structural shocks among endogenous variables in a SVAR model are normally able to be identified by use of some conditions to restrict the contemporaneous interconnections among these endogenous variables. This is one of the most important features of SVAR, which cannot be achieved with normal VAR models and VECM

³⁹ Notes: the empirical identifications only refer to the four main variables, so there is no discussion for control variables about empirical identifications

models with current econometric methods, but some restrictions of contemporaneous relationships are compulsory for our empirical analysis. According to previous explanations of sophisticated economic situations in BICS, the complex transmission channels in these economies should result in some non-contemporaneous interrelationships among factors in economic development stages. The conditions of non-contemporaneous interrelationships require us to place some restrictions in an econometric model. Therefore, SVAR becomes a suitable econometric framework for our empirical investigations of comparisons for different shocks and effects on outputs in these large developing economies.

In fact, our models involve only four endogenous variables in the process of estimation to be the analysed variables in the following explanation. Although there are total seven variables inside the econometric models, other three control variables are regarded as “exogenous factors” to link the size effects on the process of estimation⁴⁰. Therefore, this section concentrates on four endogenous variables’ technical discussion of empirical identification in the SVAR models⁴¹.

The restrictions for the contemporaneous relationships among our endogenous variables can be expressed as the following equation, and this equation is actually the left-hand side of a unrestricted Structural VAR model.

⁴⁰ The detailed explanation about control variables are shown in the previous sections of this chapter.

⁴¹ The other three control variables are employed as “exogenous factors” to link size effects and the estimations.

$$BX_t = \begin{bmatrix} b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & b_{16} & b_{17} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{25} & b_{26} & b_{27} \\ b_{31} & b_{32} & b_{33} & b_{34} & b_{35} & b_{36} & b_{37} \\ b_{41} & b_{42} & b_{43} & b_{44} & b_{45} & b_{46} & b_{47} \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} & b_{56} & b_{57} \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & b_{66} & b_{67} \\ b_{71} & b_{72} & b_{73} & b_{74} & b_{75} & b_{76} & b_{77} \end{bmatrix} \begin{bmatrix} X_t^1 \\ X_t^2 \\ X_t^3 \\ X_t^4 \\ X_t^5 \\ X_t^6 \\ X_t^7 \end{bmatrix}, \text{ where } \begin{bmatrix} X_t^1 \\ X_t^2 \\ X_t^3 \\ X_t^4 \\ X_t^5 \\ X_t^6 \\ X_t^7 \end{bmatrix} \text{ represents seven}$$

endogenous variables in Brazil, India, China and South Africa

The non-zero coefficients b_{ij} in equation indicate that variables of j have contemporaneous relationships with variables of i . For example, b_{21} show the instantaneous influences of X_t^1 on X_t^2 immediately, and their effects will take place in the same period without any delays.

The coefficients on the diagonal are normalised to one. In our study, the blank entries show that those entries in the matrix are restricted to zero. For example, if b_{21} is set to zero, there is no instantaneous influence of X_t^1 on X_t^2 , which indicates that these impacts are highly unlikely to take place immediately without any delays. In fact, the instantaneous relationships in economic development are not realistic, especially for large developing countries. Compared with new industrialised economies and developed countries, i.e. ASEAN and OECD members, the large developing countries involve over-complex transitional channels from investment, trade and services to economic outputs; second, these large developing countries' economic structure is still in the process of development, whereas developed and new industrialised countries have a relatively advanced level of these economic transitional channels. Therefore, this study establishes some necessary and realistic conditions to restrict the contemporaneous relationships and instantaneous shocks,

while it is allowed to place some realistic contemporaneous shocks among the endogenous variables in the framework.

The transmission of investment and trade to outputs can be very rapid. This transmission channel can be understood as a straight way, since investment and trade are two major factors in economic activities that result in structural shocks to domestic incomes immediately. The responses from shocks in financial sectors cannot, however, be regarded as an instantaneous response to domestic incomes, as financial sectors are classically acknowledged as services; even in terms of our theoretical model, where financial capitals are going to development as a real sector as productions, the responses from financial sectors to domestic incomes need a relatively complex channel via investment, foreign exchange rate or trade. Therefore, apart from one exception, financial shock effect on domestic income, it is assumed that investment and trade have instantaneous impacts on domestic incomes, which means the structural shocks from investment (X_t^2) or trade (X_t^3) affect domestic incomes immediately. In our SVAR model, these can be represented as $b_{12} \neq 0$ and $b_{13} \neq 0$ but $b_{14} = 0$.

For responses to investment and trade sectors from domestic incomes, it is assumed that there is a one-period delay response in our SVAR model except for responses from financial sectors. According to the New Keynesian School, there is one transmission channel from money to outputs, simply described as

Shocks of Financial Markets \Rightarrow Total Investment \Rightarrow Economic Outputs

Support and positive shocks in financial markets, such as expansion in money supply,

should result in a fall in real interest rates, and then financing costs can be reduced so that investment spending will be increased, and finally the economic outputs increase owing to an increase in domestic supply. It is easy to verify an immediate effect of financial shocks on domestic incomes.

For the relationships between trade and outputs, the foreign-exchange model is used here as follows:

Shocks of Financial Markets \Rightarrow Changes in Exchange Rate Market \Rightarrow Exports and Imports \Rightarrow Economic Outputs

Here an increase in money supply means deposits are less attractive since real interest is lower, and then exchange rates will depreciate, and net exports will increase. Finally, the economic outputs will be higher. It should be noted here that the expansions or shocks in financial markets are generally represented as changes in money supply or changes in domestic credits. The transmission of financial shocks at macroeconomic level, such as money supply or domestic credits shocks can be very rapid responses to domestic incomes.

According to the above explanations, there is a series of assumptions about restrictions for contemporary relationships as follows:

$$b_{21} = 0, b_{23} = 0 \text{ and } b_{24} \neq 0; b_{31} = 0, b_{32} = 0 \text{ and } b_{34} \neq 0; b_{41} = 0, b_{42} \neq 0 \text{ and } b_{43} \neq 0.$$

The SVAR model with our restrictions in terms of real situations of BICSs' economic development can be restructured as follows:

$$BX_t = \begin{bmatrix} 1 & b_{12} & b_{13} & 0 & b_{15} & b_{16} & b_{17} \\ 0 & 1 & 0 & b_{24} & 0 & 0 & 0 \\ 0 & 0 & 1 & b_{34} & 0 & 0 & 0 \\ 0 & b_{42} & b_{43} & 1 & 0 & 0 & 0 \\ b_{51} & b_{52} & 0 & 0 & 1 & 0 & b_{57} \\ b_{61} & b_{62} & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & b_{75} & 0 & 1 \end{bmatrix} \begin{bmatrix} X_t^1 \\ X_t^2 \\ X_t^3 \\ X_t^4 \\ X_t^5 \\ X_t^6 \\ X_t^7 \end{bmatrix}, \text{ where } \begin{bmatrix} X_t^1 \\ X_t^2 \\ X_t^3 \\ X_t^4 \\ X_t^5 \\ X_t^6 \\ X_t^7 \end{bmatrix} \text{ represents seven}$$

endogenous variables in Brazil, India, China and South Africa

Given the above structural factors involved in our model, it is still important to verify that each SVAR model is satisfied with both mathematical and statistical stability for each country's estimation. Only if the SVAR models are stable frameworks, can the empirical regressions be used for further economic explanations. This study uses both mathematical and statistical approaches to detect whether our SVAR models in each country are stable, which will result in final SVAR models with a suitable number of lags.

6.4.4 Stable SVAR Models for Empirical Analysis in BICS

The necessary step for conducting the empirical estimations of SVAR is to verify the stability conditions of our SVAR models, which means it is compulsory to establish the appropriate lag length for our SVAR models in four empirical countries. The procedures to verify the stabilities are composed of two pronounced approaches: mathematical and statistical approaches. The first step is actually the evaluation of eigenvalues of the companion matrix for SVAR models, and the second is conducted through a variety of diagnostic tests for system residuals.

According to the results for checking mathematical stabilities, all of our SVAR

specifications in all countries of BICS satisfy the mathematical stability conditions, because our tables indicate that all eigenvalues of the companion matrix for VAR models lie inside the unit cycle. Therefore, in terms of mathematical stability, all of our models pass these tests and can proceed to the following diagnostic tests to investigate statistical stability. The examinations of statistical stability include three important tests for system residuals: tests for system residual serial correlations, tests for system residual normal distributions, and for system residual heteroscedasticity. The following table presents the three different diagnostic tests for each country to investigate autocorrelations, normality and heteroscedasticity. In summary, each model for BICS's empirical estimations has satisfied the compulsory conditions of stabilities, and thus these SVAR models can be used to conduct the investigations and analysis in the following sections.

6.5 Explanations and Analysis of Dynamic Shocks in BICSs

6.5.1 Dynamic Analyses of Structural Shocks and Fluctuations in BICS

On the basis of the stable SVAR models verified by the above steps, the dynamic interrelationships can be analysed through the matrix of impulse responses inside our SVAR models of large economies of Brazil, China, India and South Africa. The dynamic interrelationships are investigated by the responses of domestic incomes to various structural shocks from two real sectors, i.e. investment shocks and trade shocks, and shocks from financial growth. The structural shocks are based on the

specifications of SVAR models linked with large size effects that is indicated as several important control variables within our models, that is, $GVE_{i,t}^{BICS}$, $EUE_{i,t}^{BICS}$, $MIE_{i,t}^{BICS}$ and $RFI_{i,t}^{BICS}$. As the purpose of this thesis is to investigate shocks from investment, trade and financial systems to domestic outputs, the following presentation will ignore the description and explanation of shocks from these control variables. However, these control variables exert a significant role in linking our estimations to the specifications of large size effects on economic development with finance in these large emerging economies.

These structural shocks to domestic incomes are denoted by $ISKY_t^i, TSKY_t^i, FSKY_t^i$, where the $i = [Brazil, India, China, South Africa]$, so the three different dynamics responses to macroeconomic aggregates can be concluded as a matrix:

Responses from Structural Shocks of Investment:

$$ISKY_t^{total} = [ISKY_t^{BRL}, ISKY_t^{IND}, ISKY_t^{CHN}, ISKY_t^{SAF}]$$

Responses from Structural Shocks of Trade:

$$TSKY_t^{total} = [TSKY_t^{BRL}, TSKY_t^{IND}, TSKY_t^{CHN}, TSKY_t^{SAF}]$$

Responses from Structural Shocks of Finance:

$$FSKY_t^{total} = [FSKY_t^{BRL}, FSKY_t^{IND}, FSKY_t^{CHN}, FSKY_t^{SAF}]$$

The representation of BRL, IND, CHN and SAF represents the different shocks in Brazil, India, China and South Africa respectively.

All of these shocks, $ISKY_t^i, TSKY_t^i, FSKY_t^i$, are presented in the following tables and figures. In detail, they indicate the short-run transitional shocks in

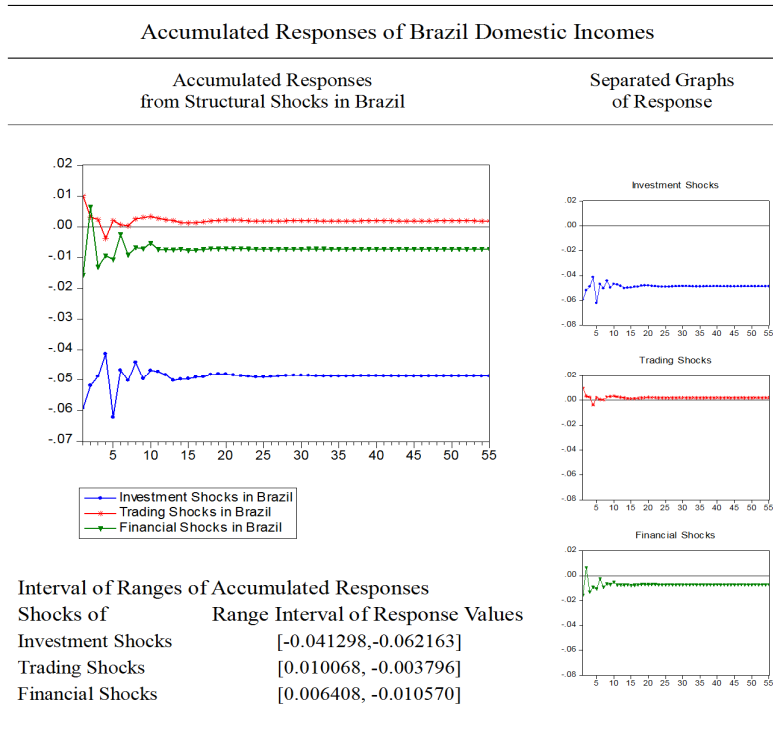
responses to three comparative sectors: investment, trade and finance. The average relative importance of each structural shock in these fluctuations is evaluated and presented in terms of the analyses of variance decompositions based on SVAR framework, all of which are in turn presented as the following tables and figures.

The analyses of dynamic shocks will be presented by each country of Brazil, China, India and South Africa. The dynamic shocks are shown through the presentation of accumulated responses and responses⁴² graphs and tables based on the structural factorizations⁴³ in each country's SVAR models. The first tables of structural shocks shows the responses of Brazil's domestic incomes to three different shocks of investment shocks, trading shocks and shocks from financial systems, represented as $ISKY_t^{BRL}$, $TSKY_t^{BRL}$, and $FSKY_t^{BRL}$ respectively.

[Table 6.5.1]

⁴² The analysis of BICS is based on both results from accumulated responses and stepped responses. The tables inside the chapter of BICS are only of accumulated responses in Brazil, India, China and South Africa.

⁴³ The impulse response functions are based on the confidence level for all responses of 90% or 95% significant level.

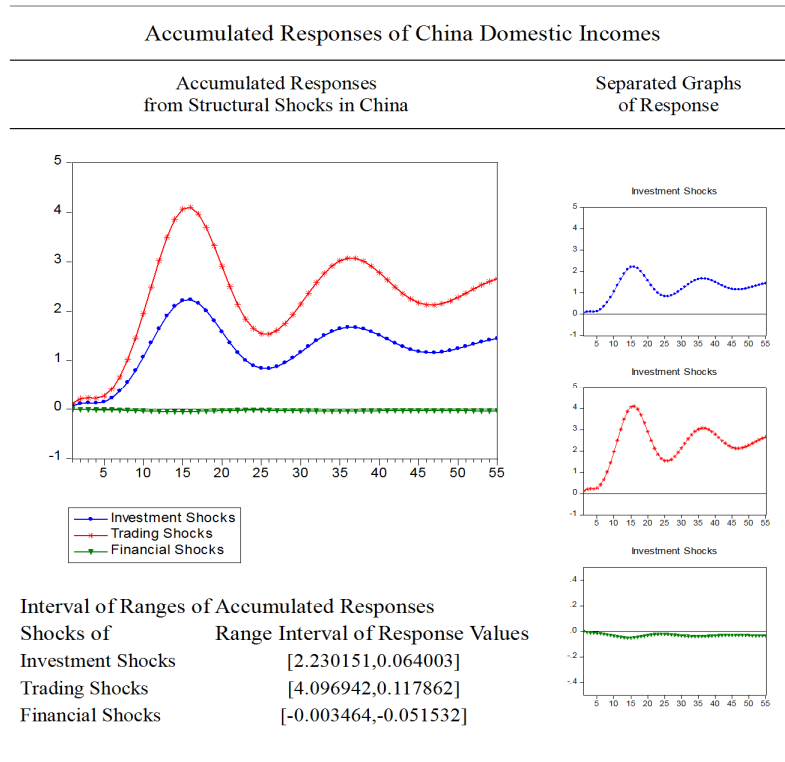


The figures for Brazil involve results of three different shocks to domestic income, i.e. $ISKY_t^{BRL}$, $TSKY_t^{BRL}$, and $FSKY_t^{BRL}$ by 55 basis points. The dashed lines are 90 per cent confidence intervals derived by means of Kilian's (1998) technique. The dynamic shocks of trading sectors ($TSKY_t^{BRL}$) appear strongest among all shocks of $ISKY_t^{BRL}$, $TSKY_t^{BRL}$, and $FSKY_t^{BRL}$. Among three different shocks, the vast majority of trading shocks are positive, whereas the other two shocks of investment and financial systems are almost negative in the whole period. If all of three responses are calculated as absolute values, the biggest responses are from investment shocks, that is $ISKY_t^{BRL}$. In the first ten periods roughly, the accumulated responses from three shocks are shown as very fluctuation lines. After that, three shocks grow at a sustained rate. The more interesting shocks are from the financial growth ($FSKY_t^{BRL}$) in terms of Brazil's domestic incomes. The $FSKY_t^{BRL}$ is always between the shocks of $ISKY_t^{BRL}$ and $TSKY_t^{BRL}$, in particularly after the fluctuation periods (10th basic points).

In summary, the empirical results from Brazil shock's responses imply that the roles from financial systems into domestic incomes are lower than trading influences, and financial shocks to domestic incomes are negative; in the meanwhile, these financial shocks are higher than responses from investment shocks, but absolute values of shocks are still lower than investment shocks.

China's dynamic shocks are much more surprising than what happened in Brazil. The China's results reveal the dynamics of China's domestic income in response to structural shocks of investment, trade and finance, represented by $ISKY_t^{CHN}$, $TSKY_t^{CHN}$, and $FSKY_t^{CHN}$. In terms of accumulated responses of domestic incomes in China, the positive shocks always remain for both investment and trading sectors of $ISKY_t^{BRL}$, $TSKY_t^{BRL}$, but financial shocks of $FSKY_t^{BRL}$ are always negative in the whole investigation period. The dynamics of trade shocks ($TSKY_t^{BRL}$) are the strongest to economic domestic incomes in China's economy, which is the same as results in Brazil, and the highest points of $TSKY_t^{BRL}$ reach 409.7%. The investment shock in China is another more amazing result, since the highest point of $ISKY_t^{CHN}$ is 223.0%. However, the responses from financial systems are extremely weak in the whole investigation period: the highest points in only -0.003%. The financial shocks of $FSKY_t^{CHN}$ in China are relatively more stationary than other shocks of $ISKY_t^{CHN}$ and $TSKY_t^{CHN}$, since the range interval for $FSKY_t^{CHN}$ is the smallest, and graphs of changes are flatter dramatically.

[Table 6.5.2]



It is, in fact, not very difficult to imagine how much Chinese trading influences macroeconomic development, especially in the last fifteen years. In the first ten periods of the empirical investigations, the shocks from investment and trade do not display such large differences as in the following periods. China's investment volumes are always acknowledged to account for the over-proportion of the macroeconomic aggregates, which lays heavy burdens on economic growth for a large developing country.

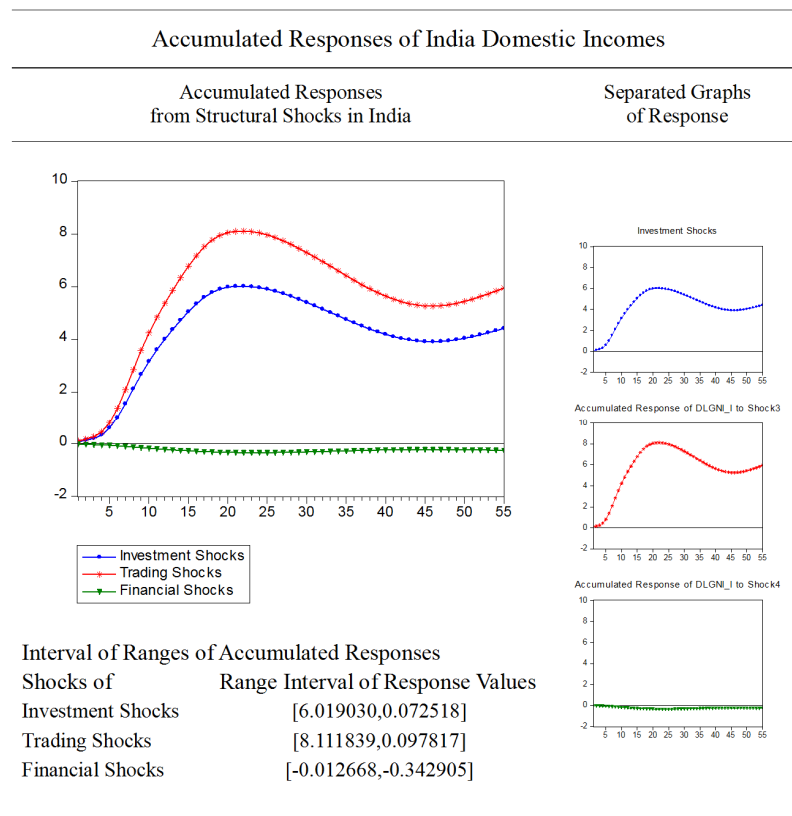
Therefore the central government has attempted to take the initiative to reduce the proportion of investment in the domestic outputs. In the meantime, more beneficial policies are made for trading sectors, by encouraging more exports and reducing the trading barriers, so China has become a world factory today. Thus the shock-gap between $ISKY_t^{CHN}$ and $TSKY_t^{CHN}$ is going to be larger in the peak point.

The structure shocks from financial sectors are still very attractive for our

studies, as the dynamics are nearly around the zero responses while the peak value is only -0.05%. Compared with shocks from two real sectors, the fluctuations from China's financial shocks are insignificant in terms of domestic inputs, as well negative effects on economic incomes in the whole period. In empirical words, China's government has announced lots of packages of financial reforms in recent decades, such as liberalization of foreign capitals, reducing barriers for foreign banks' entry, and privatization of financial institutions. However, the pace of reforms is still acknowledged to be slower than other middle-income emerging economies in Asia, like Korea and Taiwan. Thus, the reforms of financial systems are broadly regarded as relatively less significant to boost the economic growth in China. Furthermore, most of China's financial reforms are introduced in order to enhance the development in real sectors like trading business or social welfare.

After China's investigation, the next large concentration is India, as in the comparisons of Crouching Tiger and Lumbering Elephant for China and India respectively (Pranab 2007). The results for India's dynamics of $ISKY_t^{IND}$, $TSKY_t^{IND}$, and $FSKY_t^{IND}$ are reported in the following table:

[Table 6.5.3]



Those studies of three different shocks to domestic incomes in India have some crucial similarities as China's dynamics. Firstly, the financial shocks are almost not worth monitoring, as the trend line is always around the zero-shocks line, while the values are all negative with low peak value of -0.34%, whereas the investment shocks of 601.9% and trade shocks of 811.1% have strong responses to domestic incomes. Secondly, trade is a little more significant than shocks of investment. The differences between investments and trades become more significant from the 10th basic points. Moreover, in India these differences between shocks of investment and trade and shocks of financial systems are much remarkable than China's results. In the meanwhile, the interval ranges in India are bigger than China, which shows more significance of responses from investment and trades in India's domestic economic

incomes compared with China.

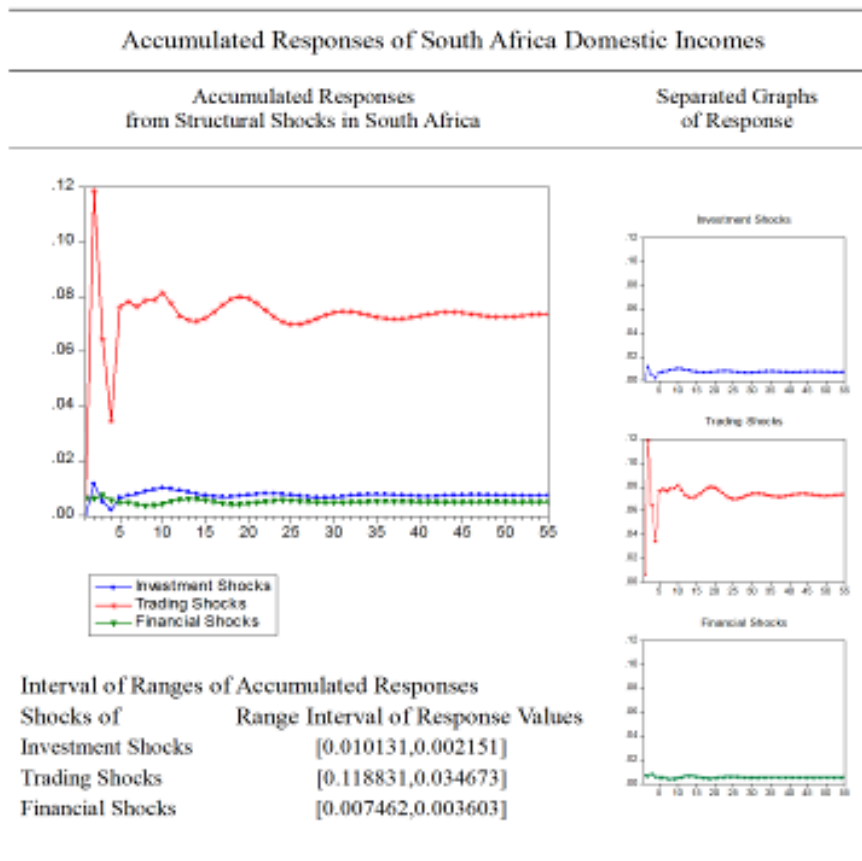
The most attractive point in either India or China's figures is some evidence for possible business-cycles⁴⁴ for investment and trade, but none of evidences for financial systems. It is not difficult to understand the business cycle for investment in terms of new ideas of Gaps Model⁴⁵ or Ceiling Theory for Growth. It is still a puzzle, however, why the cycle appears in trade shocks, and the possible explanations relate to the fairly close trading policies or single trading partners. The absence of business cycle for financial growth to economic incomes can show the insignificance of financial growth in the proportion of economic aggregates in India.

South Africa is the last country in this thesis to be investigated in terms of financial shocks and economic domestic incomes. As an African country, South Africa and its economic growth have their own characteristics for complex reasons beyond the scope of this thesis, like demography and anthropology. The dynamics in South Africa in response to three shocks are shown in the following figure.

[Table 6.5.4]

⁴⁴ Basic ideas of business cycle are shown with a graph as the appendix of this chapter.

⁴⁵ The Three Gaps Model for macroeconomic stabilization and growth is presented as the appendix of this chapter.



The trading shocks are still the most significant among three shocks in South Africa, while its peak value is 11.8%. The differences between peak values among three shocks are relatively small. The investment shocks in South Africa are relatively smooth and less powerful compared with India and China, which involves the peak value of 1.01%, and the range intervals for investment shocks are small as well. The most significant influences of trading sectors to aggregate economic development in South Africa is the same as in Brazil, India and China.

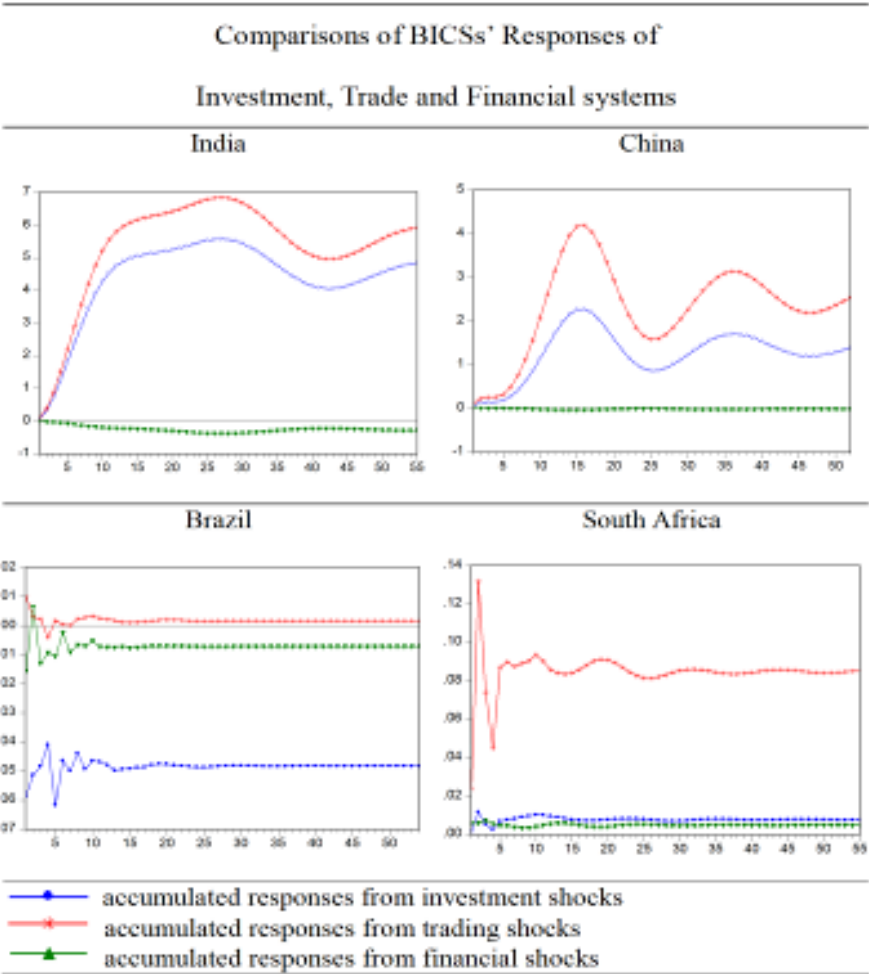
The shocks from finance in South Africa are still the lowest values compared with investment and trade, but its trends are close to the shocks of investment, while the peak value for financial shocks is only 0.75%. But there is a very special feature of financial shocks in South Africa compared with other countries: the financial

shocks in the whole period are positive, so that all of three sectors to South Africa’s domestic incomes are positive dynamic shocks.

6.5.2 Comparative Studies across Countries of BICSs

All four large emerging economies show some common significant characteristics of reactions of macroeconomic aggregates in response to two important real sectors in developing countries: investment and trade, and one special aspect: financial growth. The comparative analyses are illustrated as comparisons of graphs and numbers in the following figure and table.

[Table 6.5.5]



[Table 6.5.6]

Horizons (quarters)	Dynamics of Shocks ¹ to Domestic Income in Brazil, India, China and South Africa											
	Brazil			India			China			South Africa		
	$ISKY_{i,t}^{BRL}$	$TSKY_{i,t}^{BRL}$	$FSKY_{i,t}^{BRL}$	$ISKY_{i,t}^{IND}$	$TSKY_{i,t}^{IND}$	$FSKY_{i,t}^{IND}$	$ISKY_{i,t}^{CHN}$	$TSKY_{i,t}^{CHN}$	$FSKY_{i,t}^{CHN}$	$ISKY_{i,t}^{SNA}$	$TSKY_{i,t}^{SNA}$	$FSKY_{i,t}^{SNA}$
4	-0.04093	0.00398	-0.00938	0.13820	0.25552	-0.00964	1.24060	1.50710	-0.05780	0.00259	0.04495	0.00548
8	-0.04394	0.00236	-0.00668	0.60726	1.11287	-0.02102	3.44610	4.21018	-0.16733	0.00902	0.08905	0.00329
12	-0.04802	0.00213	-0.00748	1.70244	3.13966	-0.00424	4.74999	5.80018	-0.22691	0.00902	0.08905	0.00551
16	-0.04879	0.00113	-0.00758	2.26572	4.18695	-0.04656	5.09592	6.22567	-0.26059	0.00733	0.08583	0.00482
20	-0.04772	0.00203	-0.00706	1.58296	2.92216	-0.02866	5.24022	6.41681	-0.31266	0.00767	0.09093	0.00407
24	-0.04871	0.00163	-0.00725	0.89819	1.65503	-0.01951	5.47766	6.72649	-0.37189	0.00819	0.08273	0.00521
28	-0.04830	0.00172	-0.00726	0.99991	1.84313	-0.02621	5.55205	6.82508	-0.38972	0.00701	0.08314	0.00466
32	-0.04835	0.00174	-0.00720	1.45620	2.68616	-0.03649	5.21990	6.41198	-0.35098	0.00750	0.08314	0.00466
36	-0.04843	-0.00168	-0.00722	1.69602	3.13066	-0.03145	4.61127	5.65449	0.28615	0.00807	0.08394	0.00489
40	-0.04834	0.00176	-0.00726	1.52724	2.81920	-0.03145	4.13932	5.06901	-0.24359	0.00741	0.08449	0.00479
44	-0.04842	0.00170	-0.00723	1.24404	2.29483	-0.02689	4.08292	5.00179	-0.24387	0.00763	0.08593	0.00612
48	-0.04836	0.00173	-0.00722	1.20566	2.22355	-0.02803	4.37388	5.36128	-0.27062	0.00787	0.08465	0.00481
52	-0.04839	0.00172	-0.00722	1.37345	2.53385	-0.03171	4.70146	5.76492	-0.29344	0.00752	0.08444	0.00476

Notes:

1. These dynamic shocks are responses of three sectors of investment, trade and finance to domestic incomes, based on the SVAR frameworks

First, each member of BICS, i.e. Brazil, India, China and South Africa, shows the relative insignificance of dynamic responses of domestic incomes in response to financial growth, compared with two real sector shocks of investment and trade. According to accumulated responses in the above tables, financial shocks to domestic incomes in Brazil, India and China are mostly negative values in the whole period,

even the response values in India and China are around zero lines. The financial shocks in South African result in the positive responses of domestic incomes, however, these positive responses in South Africa is too much weak as the peak value is only 1.17%. The small range intervals for financial shocks in Brazil, India, China and South Africa suggest that the variations of financial shocks to domestic incomes are so smalls, and thus, the BICSs' economic development is weakly intensive with shocks in these countries' financial systems. Think of, for examples, the reforms in financial systems might have limited influences on these large emerging economies' development in their transitional stages. In terms of conceptual understanding, these weak influences can be explained with the specifications of transmission channels⁴⁶, that is, these channels from finance to development in large developing countries are more complicated, delayed, less powerful and more dependence because of large sizes' effects.

Another important idea from comparative studies of BICSs highlights the trading sectors' prominent positions in the process of economic development, in particularly for recent taking-off periods in these large emerging economies. Furthermore, the endogenous growth theories⁴⁷ implies the roles of trading sectors exert a crucial roles in linking the development of financial systems with aggregate development, and these roles are of special importance in transitional economies. The above comparison graphs and tables demonstrate that the most significant accumulated responses of domestic incomes are all from trading shocks in Brazil,

⁴⁶ The specifications of transmission channels was studied and explained in previous sections of this chapter

⁴⁷ Please refer to Pagano's literatures (1993, 1996)

China, India and South Africa. The vast majority of responses from trading shocks in BICSs are positive value. The peak values from different shocks in BICSs are all values from trading shocks, that is, 601.90% in India, 409.69% in China, 11.89% in South Africa and 1.01% in Brazil. From this point, the processes of economic development in India and China are very similar, as their trading responses play a dominated role in the accumulated responses of economic incomes.

The most attractive point in this chapter is still about the responses from financial systems' shocks in the process of economic development. Among all countries of BICS, the positive shocks from financial systems only exist in South Africa. In other countries of Brazil, India and China, the financial systems contribute the negative responses of these economies' domestic incomes. Even for South Africa, the values of positive responses are always in the low level at all basic points, and the peak value is only 0.746%. In all countries of BICS, the responses from financial shocks are the most stable, which implies that BICSs' economies have a common characteristic of weak sensitivity to financial systems. This characteristic can be explained by several facts in these large countries. First, these large developing countries are still in the beginning stage of economic development, so their financial systems are relatively less-developed.

Secondly, the transmission channels from finance to growth are more complicated and time delayed in BICSs because of large sizes' effects. Think of, for example in physics, the resistance will affect the process of power transmission. In empirical explanation, the remarkable reforms in financial systems of BICSs normally

are announced together with other reforms and innovations in other sectors, as the isolated financial reforms is highly possible to fall flat. In the period of late 2000s global economic recessions, both India and China announced package plans of financial reforms to stimulate the economy. In the meanwhile India introduced the strategies in trading sectors, such as the further reductions of taxations in importing business, and China had the plans in the investment. such as a huge amount of investments in infrastructure construction.

The gaps between financial shocks $FSKY_t^i$ and shocks of investment $ISKY_t^i$ and trade $TSKY_t^i$ are much more significant in both China and India. Without considerations of serious business cycles in India, these gaps in India and China between $FSKY_t^i$ and $ISKY_t^i$ or $TSKY_t^i$ are extremely surprising: the peak-gap between $FSKY_t^{CHN}$ and $ISKY_t^{CHN}$ in China is nearly 220%, peak-gaps between $FSKY_t^{CHN}$ and $TSKY_t^{CHN}$ are nearly 420%; India is approximately 500% and 600%. These remarkable differences show that both India and China's national economies relies heavily on contributions from trading sectors or investments, which definitely includes varies of trades and investments, such as trades of services, foreign direct investment, foreign equity investment and so on.

Brazil and South Africa have similar properties: their peak-gaps between $FSKY_t^i$ and $ISKY_t^i$ or $TSKY_t^i$ are not so big as India or China. The peak-gaps between $FSKY_t^i$ and $ISKY_t^i$ are only 4.65% and 0.46% for Brazil and South Africa respectively, and the peak-gaps between $FSKY_t^i$ and $TSKY_t^i$ are only 0.47% and 12.5% for Brazil and South Africa respectively. It is not difficult to understand those

relatively small gaps in Brazil and South Africa compared with India and China for the following reasons: (a) the financial systems grow well in Brazil and South Africa, as well as being more advanced than India and China; thus the contributions from financial growth to economic development in Brazil and South Africa are much more important than India and China; (b) the levels of investments and trades in Brazil and South Africa are always criticised by development economists as being too low to support high-speed growth rate of macroeconomic aggregates, therefore their shocks to domestic incomes are not so strong in terms of our models.

If we analyse these results from another perspective, however, Brazil and China's situations can be, to a certain extent, concluded as the similar group to study here: (1) as regards the proportion of trade shocks, both Brazil and China show the most significant dynamic influences from trading shocks, compared with financial and investment shocks. In the beginning periods of Brazil, the investment shocks are a little more significant than trading shocks, but these advantages are only kept for roughly two years, so in most periods of Brazil the trading shocks can be regarded as the absolute advantage proportions among all shocks. For China, the influences from trading shocks are always more important than the other two shocks, and even the gap between investment and trades is not as big as in other countries. China's investment influence on macroeconomic aggregates is still the important factor in terms of huge amounts of physical investments from central government, especially given that China was a closed economy before the 1980s.

Summarize Table of Dynamic Analysis

	Important Points of Conclusion of Results	Comparative Facts
China	1) financial shocks to domestic incomes in China and India are around zero lines, so China's and India's economic development is weakly intensive with shocks in these countries' financial systems	The processes of economic development in India and China are very similar, as their financial contributions to economic growth are too much weak, while the trading responses play a dominated role in the accumulated responses of economic incomes,
	2) vast majority of responses from trading shocks in China and India are positive value	
India	3) gaps between financial shocks and shocks of investment and trade are much more significant in China and India	
Brazil	1) financial shocks to domestic incomes in Brazil are mostly negative values in the whole period 2) the contributions from financial growth to economic development in Brazil are much more important than India and China	The financial systems grow well in Brazil as well as being more advanced than others; thus the contributions from financial growth in Brazil are much more important than others
South Africa	1) financial shocks are positive, but in South African is too much weak 2) the levels of investments and trades South Africa are always criticised by development economists as being too low to support high-speed growth rate of macroeconomic aggregates	The public investments South Africa are always criticised by economists as being too low to support high-speed growth rate of macroeconomic aggregates, therefore their shocks to domestic incomes are not so strong in terms of our models.

6.5.3 Structural Shocks with Business Cycle in BICS

Among our empirical results, there is always some significant evidence of business cycles of structural shocks for all countries. These cycles not only exist in the structural shocks of investments and trade, but are also actually involved in the

shocks from financial growth; however, the evidence is much more significant in investment and trade, whereas the cycles in financial growth are nearly unnoticeable owing to its flatter lines. If we extend the observation scopes in graphs, the business cycles in the financial shocks to a certain extent do show a similar trend to shocks of investment and trade.

The shock cycles are most significant in India and South Africa. We make use of Hick's Ceiling Theory to explain these interesting problems. The growth of investment and trade in India and South Africa is very rapid, and these growths will definitely hit government constraints or gaps like Ping-Pong hits the ceilings, so these growths should go down quickly. In order to classify these ideas, the three-gap model is used to illustrate the meaning of ceiling constraint for growth, and this three-gap model is theoretically presented in the appendix. Among all four countries, China's shock-cycles are most insignificant, while Brazil has only little evidence for shock-cycles in the beginning periods. In terms of joint consideration of Hick's theory and the three-gaps model, the shock-cycles in these countries indicate that the development levels of government or roles of government might significantly affect the shock-cycles through the transmission channels of infrastructures investment, which should mainly be conducted by governments in these large developing countries.

Compared with industrialised countries like the UK, Japan and the US, governments in developing countries should play much more significant roles in terms of both physical and human capital investments, while in developed countries

these investments could be well accomplished through a sound market system with relatively perfect competition. Among these four countries, China's government is normally acknowledged to play a relatively key role in economic development, as China's economic policies work through a combination of market-friendly approaches and central-planning approaches. India, Brazil and South Africa's governments' roles in servicing macroeconomic development are, however, less weak. In fact, the shock cycles in India are much more serious because of the lack of sound infrastructure investments. In the meantime, India's government puts less effort into encouraging trade and financial sectors.

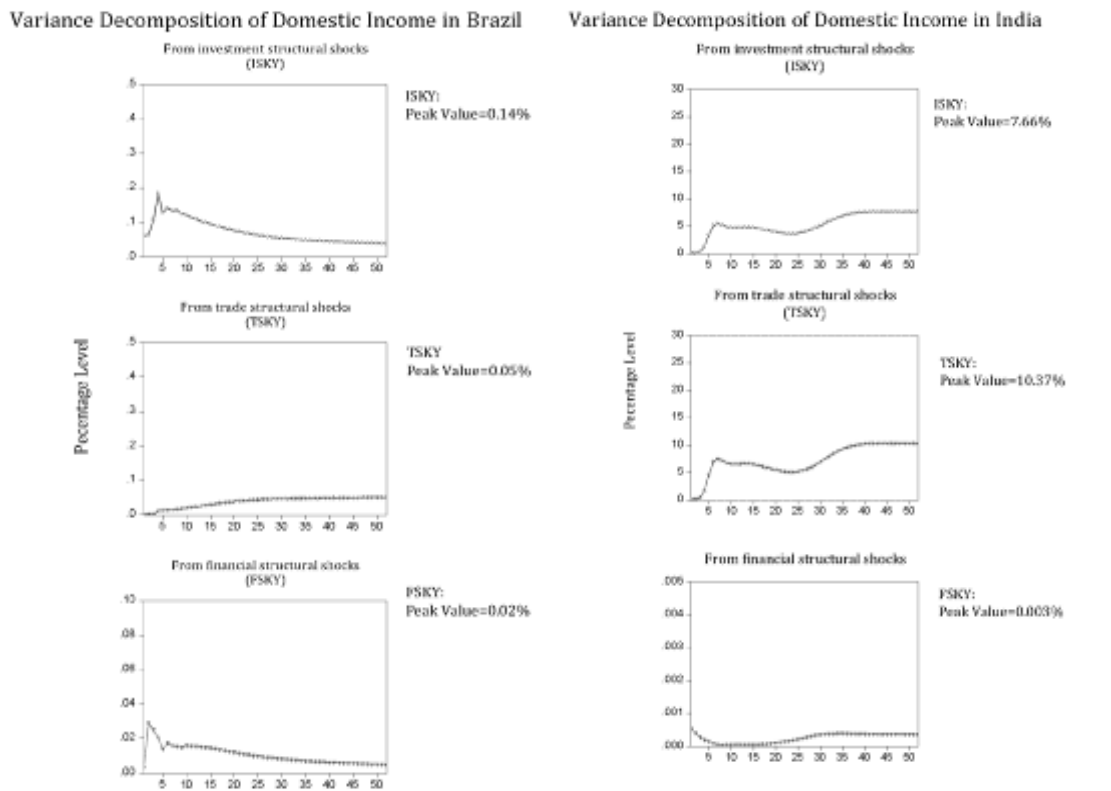
6.5.4 Relative Variance Contributions (RVC) and Further Analyses

Another important analysis of the properties of the model concerns relative variance decomposition. The previous explanations of dynamic shocks are based on impulse response functions, which in fact trace the impacts of individual shock from one endogenous variable on the other variables inside our SVAR model; this approach of variance decomposition is used to separate the variations in endogenous variables into the shocks of components in the SVAR framework. Therefore, the studies from variance decomposition with SVAR models can provide important information regarding the relative importance of each innovation in affecting the other variables inside our SVAR, which is called relative variance contribution in this thesis.

The following table shows the separate variance decomposition for domestic incomes for all four BICS countries, i.e. Brazil, India, China and South Africa. The

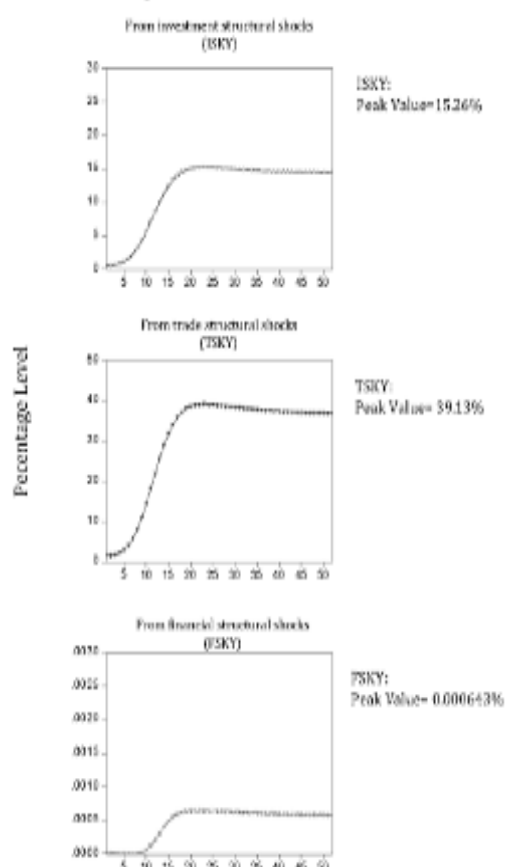
percentages of forecast error of domestic incomes owing to three other innovations are reported at the given forecast horizons, while the quarters are used as the forecast horizons and every four quarters equal one year. The three different innovations are actually the same as the dynamic shocks in the previous studies of impulse responses, i.e. innovations of total investment ratio, innovations of trade openness, and innovations of financial growth. In other words, the following table and figure report the proportions of the error of forecast, generated by SVAR models, which are attributable to other shocks to domestic incomes in the model. The proportions of the forecast errors in this thesis are based on the structural orthogonalisation which is available from the estimations of structural factorisation matrices, whereas the normal approach is based on the Cholesky Factor.

[Table 6.5.7]

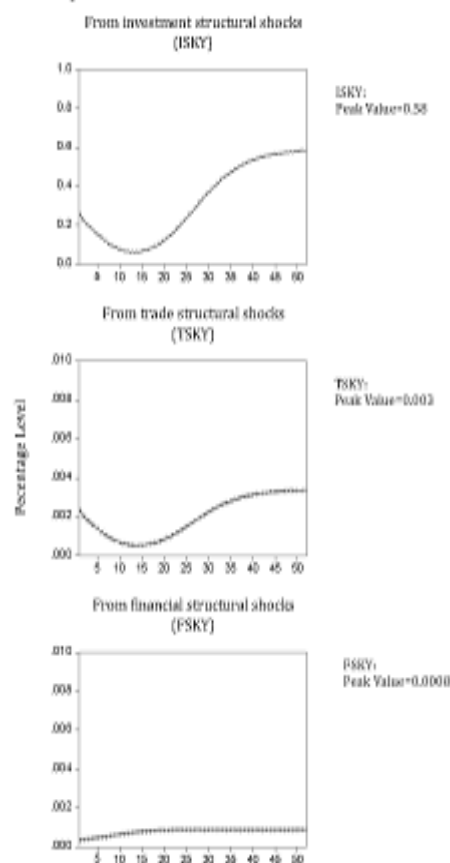


[Table 6.5.8]

Variance Decomposition of Domestic Income in China



Variance Decomposition of Domestic Income in South Africa



The strongest implication of the relative variance contributions (RVC) to domestic incomes in BICSs is that the innovations from financial growth are the most significant contributions to domestic incomes in all countries, which is consistent with our expectations and analyses of previous impulse responses. The weakest contribution from financial growth to domestic income is that of China and India in the first few periods: India is only (2.91E-05) % at the eighth quarter and China is only (5.37E-06)% at the fourth quarter; even in the latter periods, the contributions from financial growth to domestic incomes in either India or China generally show increases in percentage levels, but the peak value is only 0.0003% and 0.0006% in India and China respectively.

During the same periods, however, the trade shocks have an excessively high level of contributions to domestic incomes: India is 10.33% in the fifty-second quarter and China is 39% in the twenty-fourth quarter; the investment shocks have similarly high contributions as trade: India is 7.66% in the forty-fourth quarter and China is 15.24% in the twenty-fourth quarter. Moreover, over longer horizons, the relative variance contributions (RVC) from two real sectors of trade and investment must be much more important than RVC from financial growth, as the shocks of financial growths have been shown to be a very small part of domestic incomes.

[Table 6.5.9]

Horizons (quarters)	Brazil			India			China			South Africa		
	$ISKY_{i}^{BRL}$	$TSKY_{i}^{BRL}$	$FSKY_{i}^{BRL}$	$ISKY_{i}^{IND}$	$TSKY_{i}^{IND}$	$FSKY_{i}^{IND}$	$ISKY_{i}^{CHN}$	$TSKY_{i}^{CHN}$	$FSKY_{i}^{CHN}$	$ISKY_{i}^{SAP}$	$TSKY_{i}^{SAP}$	$FSKY_{i}^{SAP}$
4	0.1844	0.0118	0.0204	1.3113	1.7701	0.00018	0.8384	2.1438	5.37E-06	0.1766	0.0015	0.0004
8	0.1359	0.0171	0.0155	5.1960	7.1363	2.91E-05	3.1589	8.0897	6.22E-06	0.0999	0.0008	0.0005
12	0.1098	0.0241	0.0154	4.7912	6.5970	4.16E-05	8.5614	21.9611	0.00021	0.0637	0.0005	0.0006
16	0.0907	0.0320	0.0140	4.6191	6.3732	3.75E-05	13.2814	34.0852	0.00055	0.0710	0.0005	0.0007
20	0.0761	0.0388	0.0118	3.9636	5.4936	9.39E-05	15.0567	38.6262	0.00064	0.1193	0.0008	0.0008
24	0.0648	0.0434	0.0100	3.6600	5.0677	0.00017	15.2495	39.0921	0.00064	0.2077	0.0013	0.0008
28	0.0569	0.0460	0.0086	4.3979	6.0172	0.00029	15.0921	38.6642	0.00063	0.3154	0.0019	0.0008
32	0.0516	0.0473	0.0075	5.8942	7.9858	0.00036	14.8917	38.1334	0.00061	0.4152	0.0025	0.0008
36	0.0478	0.0482	0.0067	7.1136	9.6051	0.00037	14.7089	37.6526	0.00060	0.4889	0.0028	0.0008
40	0.0447	0.0490	0.0060	7.5860	10.2361	0.00036	14.5876	37.3334	0.00059	0.5350	0.0031	0.0008
44	0.0421	0.0497	0.0055	7.6653	10.3443	0.00035	14.5072	37.1213	0.00059	0.5609	0.0032	0.0008
48	0.0398	0.0504	0.0051	7.6674	10.3473	0.00035	14.4482	36.9656	0.00058	0.5749	0.0033	0.0008
52	0.0377	0.0510	0.0047	7.6597	10.3395	0.00034	14.4127	36.8710	0.00058	0.5826	0.0033	0.0008

Notes:
1. These are based on shocks of three sectors of investment, trade and finance to domestic incomes, based on the STAR frameworks
2. The terms of ISKY, TSKY, FSKY mean investment, trade, financial structural shocks respectively.

Among all the countries of BICS, Brazil's financial variance contributions to domestic incomes are the strongest, but they are still weaker than contributions from investment and trade. The peak values in Brazil's contributions are 0.02% in the fourth quarter, 0.14% in the fifth quarter, and 0.05% in the fifty-second quarter for

financial growth, investment ratio and trade variance contributions respectively. The variance decompositions of South Africa's domestic income are very close among the three different shocks: peak value for investment is 0.58% in the fifty-second quarter, peak value for trade is 0.003% in the fifty-second quarter, and the variance contributions of financial growth to domestic income in South Africa are relatively stable, which is always near the low level of 0.0008%, ranging from 0.00085% to 0.00089%.

Compared with India and China, the contributions of investment and trade sectors in South Africa and Brazil to the whole macroeconomic aggregates represented by domestic incomes are too weak. Both countries' weak government expenditures on building up more infrastructures, improving conditions for trade and improving education have been criticised by many development economists and organisations, such as the World Bank's Reports for African Development in 2006. According to the graphs of relative variance contributions, those innovations to four countries' domestic incomes become more important as time passes across the spectrum of other variables, the only exceptions being ISKY and FSKY in Brazil. These actually reflect the roles that factors of investment, trade and financial growth play in determining the values of the domestic macroeconomic aggregates in our estimated models of SVAR.

In terms of figures and graphs for relative variance contributions, the phenomena of business cycles for these four countries are not as significant as impulse responses showed in previous sections, except for a little cycle phenomenon

in South Africa's trade and investment contributions. Over longer periods, three countries of BICS – India, China and South Africa – indicate that the relative variance contributions from financial growth to domestic incomes are becoming more important as time passes, and therefore the peak values for these countries take place in the last period and it is highly possible the relative variance contributions from financial growth will achieve a higher level in future. The only exception is the financial growth contribution in Brazil, where the relative variance contributions from financial growth to domestic incomes are becoming weaker over time. The peak value for Brazil, however, is much higher than for the other three countries, which can be legitimately understood by the fact that Brazil's financial systems developed earlier than those of the other three countries.

These phenomena show strong evidence that financial growth will be more and more important in these large developing countries' macroeconomic aggregates; even if these contributions are still weaker than other real sectors in the next couple of years, the development of financial systems and further financial reforms will provide better services for the sectors of investment and trades; for example, further reforms to reduce the trading barriers, encourage more foreign direct investment, increase government expenditures and so on. All of these efforts will, in turn, be expected to adopt remarkable roles in these countries' economic development.

Compared with industrialised countries like G7 members, the proportions of macroeconomic aggregates in our large developing countries are mainly contributed by traditional real sectors, like investments, agriculture, manufacture and trade. Many

development economists argue that the contributions from financial growth will become more significant over time because of many objective requirements from current economic development, for example, FDI in BICS. The FDI is playing an important role in boosting economic growth in most developing countries, and the contributions of FDI at the economic taking-off stages are particularly important in BICS. The continuous developments of FDI require better financial services in these developing countries, which will definitely push the governments to develop financial systems and introduce further reforms, such as enhancing the capital flows and making the exchange rate policies more flexible. Furthermore, these reforms in NICs, New Industrialised Countries, are much more advanced than BICS.

6.6 Late 2000s Global Economic Recession and BICS

One of the most important aspects in this thesis is to answer several key questions for the contemporary growth patterns in these large developing countries, while the financial systems become a new emerging power in macroeconomic aggregates regarding with its specialised growth characteristics that compares with traditional sectors of investments and trades. The financial growth in new industrialised countries (NICs) has been studied extensively, as financial growth has contributed a great deal to boosting economic growth and sustaining economic development. For large developing countries, however, these contributions from financial growth to economic development are still controversial. Furthermore, this thesis through investigating four typical large developing countries presents relatively small contributions of financial

growth to economic developments compared with contributions from the two traditional real sectors of trade and investments.

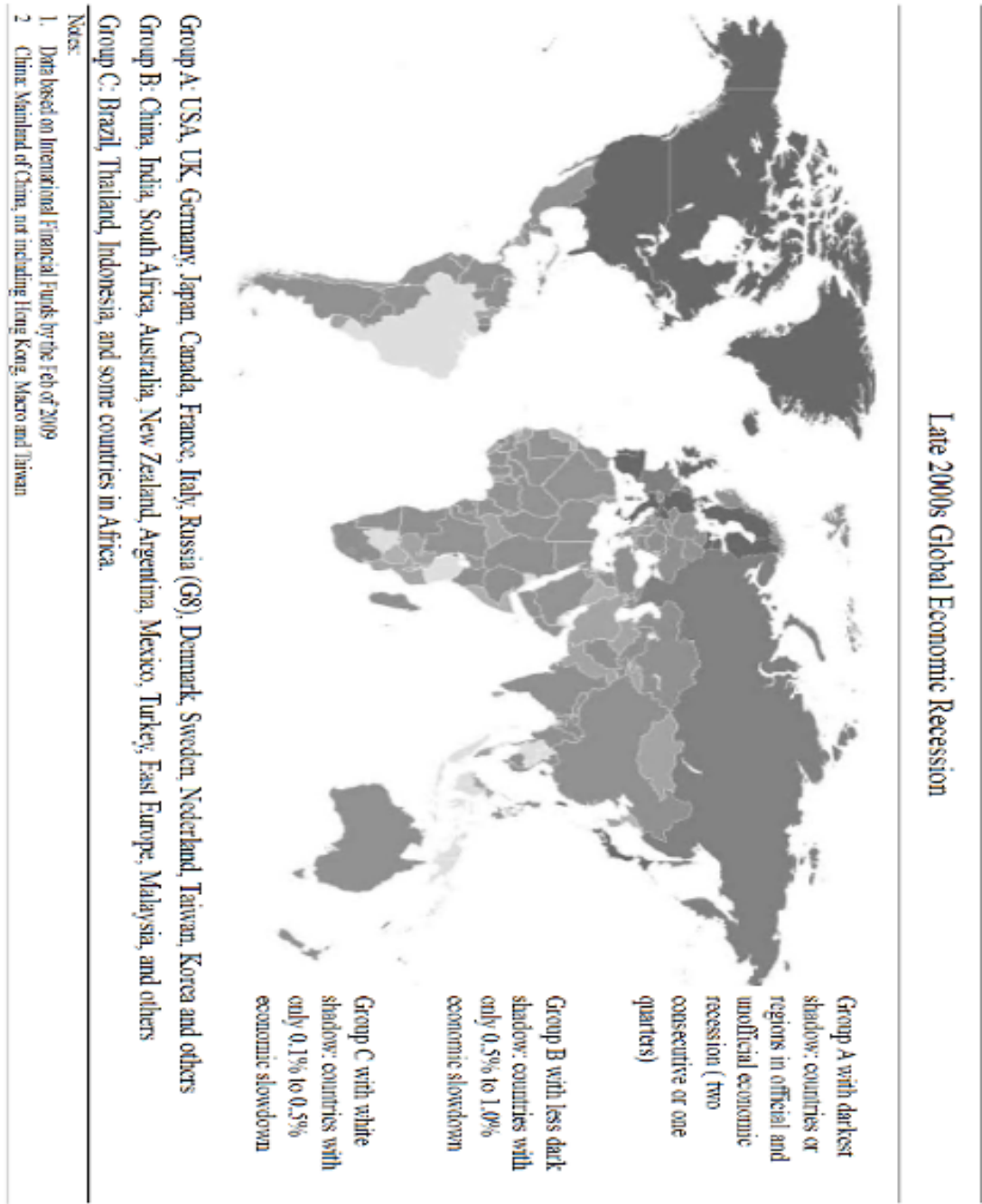
In fact, the late 2000s global economic recessions provide us with a good platform to extend our analysis of the BICS's financial growth and economic development by answering several key questions: whether these BICS economies are going downhill as badly as industrialised countries like G8 members; whether BICS have their own approaches to overcome or prevent bad influence from G8 members; whether BICS's domestic markets have sufficient ability to resist this economic crisis. In summary, the BICS might become the new powers to lead the global economies into a new period of economic take-off instead of G8 or OECD members.

The following graph and figure showing the late 2000s global economic crisis reveal that the influences in this economic crisis in developing countries are much less than in industrialised countries; of our BICS countries, India, China and South Africa have been not been regarded as suffering 'Economic Recessions' officially or unofficially by either domestic governments or intergovernmental organisations like the IMF and World Bank, and Brazil's economy is showing nearly 0.1% slowdown, whereas all members in G8 have been declared to be in the period of 'Economic Recessions'.

In fact, these results for BICS are not surprising in view of the domestic income responses with SVAR shock models in this thesis: the financial shocks and contributions from financial growth are much less important in these countries' economic development, even though the contributions from financial sectors are

becoming more and more important in terms of analysis of relative variance contributions. Furthermore, two intriguing questions arise regarding the current economic recessions: why can these four countries block the influence of the global economic crisis on their domestic macroeconomy and how so these countries use domestic resources to reduce these possible influences?

[Table 6.5.10]



First, our previous empirical estimations and analyses have proved that there are necessary bridges to link financial growth and economic development in BICS: trades and investments. In fact, the BICSs have been affected by this global economic turmoil, but less than industrialised countries; however, the vast majority of these influences work through export manufacture, foreign direct investments, foreign equity investments, imports of services and technology, remittances and foreign flows etc. Take, for instance, manufacture for export. By December 2008, at least 670,000 small and medium-sized enterprises have been closed in China; and approximately 90% of these closed enterprises are linked with exports or foreign direct investments. In Brazil, there was a sharp drop in industrial production in December 2008 to a rate 18.6% lower than December 2007, and the majority of foreign investments in Brazil are directly invested by US. In South Africa, the capital inflows to domestic markets have gone downwards quickly, so the monetary-policy inflation target measure rose 10.9% on a year-on-year basis in May 2009, which is the highest point again since the last economic recession in 2005. Thus it is not difficult to see that all of these bad influences on the BICS domestic macroeconomy do not work directly in financial systems, but through the *real effects of bridges* of trade, investments and consumption, and, in turn, domestic incomes.

These facts of economic crisis provide real proof of our analyses in this thesis and offer an acceptable reason why the BICS countries suffer less from the economic crisis: these countries can enhance the *real bridges* to inject a vaccine into their domestic economies to overcome the economic crisis. In China, in November 2008

the government announced a package of capital spending plus income and consumption support measures, and a total amount of four trillion Yuan, around \$586 billion, will be spent on upgrading infrastructure; some economic policies will concentrate on raising rural incomes via land reform and there will be more investments in social welfare projects such as affordable housing and environmental protection. In India, the government expected to inject US\$ 4.5 billion to help exporters, by continuing further reforms of financial services for exporters, reducing the taxation on exporting enterprises, enhancing government roles in helping exporters and so on. In Brazil, the government has announced packages to enhance government expenditures, especially on its energy industries. Brazil and China have just signed a new contract to explore the coastal oil fields, and the Brazilian government expects to increase its investments in refining technology.

All of these economic activities by BICSS' governments can be regarded as an efficient route to enhance the *real bridges* in large developing countries. In the context of endogenous growth frameworks, these large developing countries expect these *real bridges* to be enhanced so they can then play a dual role in helping both domestic incomes and financial systems simultaneously.

Chapter Seven

Conclusion and Remarks on the Thesis

7.1 Main Contributions of this Thesis

This thesis contributed to the study on the understanding of financial growth as an important factor in the process of economic development. But this study simultaneously suggests the impact from financial growth cannot be regarded to follow the same route in different emerging economies, and therefore, the analysis of the interrelationships between finance and economic development should depend on the various specifications and structural characteristics in different types of developing countries.

Compared with other studies in the literature, this thesis does not conduct the panel estimations based on pooled groups involving many developing countries. Instead it takes two of the most important groups of developing countries, i.e. NICs and BICS, and empirically estimates the finance growth relationship in terms of two distinctive econometric specifications, emphasising different economic developmental stages and different growth patterns. Both theoretical and empirical studies have helped us to understand several core questions about relationships between economic development and finance: whether the causations from finance to development rely on different development stages, whether every developing country has the same direction of impact from finance to development, whether financial growth can be regarded as one of the dominant factors in promoting economic growth, and, whether

the roles of financial growth can be affected by size effects to economic development.

Although there are some theoretical studies with mathematical models for developed countries, it has to be noticed that most of their contributions are less linked with economic development or important factors of economic development, in particular with investment. This thesis has attempted to connect financial factors, like financial capitals and financial intermediations, with economic development. In addition, three different theoretical models do not work uniformly for the same developing country, but they actually demonstrate the different interrelationships between growth and finance in terms of distinctive development stages. This is why we analyse the taxonomy in terms of development stages. The two empirical parts, i.e. NICs and BICS, are also linked with the conceptual ideas from the theoretical models. The NICs parts use the most important conclusion in theoretical chapter that suggests the various causations of finance and growth depend on different development stages based on the concept of taxonomy. The BICS chapter is linked with ideas from the two-sector models, presented as the second model in theoretical chapter that provides a conceptual framework for arguments about important contributions of real sectors and financial sectors to economic outputs.

In summary, the main contribution of this thesis is to link the investigation of development and finance with the different stages and growth patterns of emerging economies, instead of investigating this relationship based on general, broad and pooled studies.

7.2 Reviews of Core Questions throughout the Thesis

The investigations of this thesis can be regarded as how to answer three sets of fundamental questions based on theoretical and empirical studies with emerging economies. These questions are reviewed and summarized as follows. The answers to these key questions are presented in this conclusion chapter of the thesis that is an important conclusion of summary of results in this thesis.

- 1) Whether there is a short run relationship between economic development as expressed by per capita income and financial development, as represented by various indices of financial depth and monetisation? Whether there is also a long run relationship between these two indicators of structural change within the aggregate economy and the financial system?
- 2) Whether the causality runs in the short run from finance to growth or vice versa? Whether the stages of development have any impacts on this causality? Whether we can create an understanding of taxonomy for development which can make us understand this causality?
- 3) Whether emerging economies can have special features, in particularly for size, openness, investment, public goods, which allow us to investigate this complex bi-variate relationship better? Whether these special features could affect these relationships significantly?

7.3 General Summary of the Results

We firstly consider three models, each demonstrating how these two conceptual issues are related to each other. The first is based on an exogenous growth model, where the rate of growth is given exogenously by the rate of growth of efficiency labour and broader technological process. This model is suitable for early developers including newly industrializing countries where growth is driven by technical progress. A special feature of these countries, especially in Asia, is that technical progress comes via trade ⁴⁸so that openness is an important determinant in the nexus. The second model analyses the growth rate through an endogenous growth model. In this endogenous growth model, economic behaviour and policy variables such as taxation or human capital formation can actually affect the rate of growth in steady state equilibrium when all variables grow at the same rate. The analysis concentrates on financial capital formation, that is, the growth of the financial sector. A third model which assumes that the financial sector does not directly enter the production function nor does it have a direct productivity effect independent of capital formation. In summary, these models suggest the vital links between finance and economic development are strongly supported, and that the causations vary across different development stages.

The empirical part of NICs is composed of analysing different types of developing countries of NICs in Asian region and the various stages they pass through

⁴⁸ Imports embody new and world technologies and exports are driven by labour efficiency

in terms of their financial development and economic growth. Investment and trade are generally acknowledged as the vital factors in the process of economic development in most developing countries, especially in East Asia, and therefore the empirical part of this paper involves four factors in the econometrics analysis: economic outputs, financial indicators, investment ratio and trading openness. This paper uses a taxonomy or typology to classify various countries in terms of the finance-growth nexus. The empirical results justify the expectations from our theoretical growth models regarding the interrelationship between finance and growth. We deal with time series econometrics to investigate the interrelationships between finance and development for specific NIC countries in Asia. It also summarizes the empirical findings and provides a taxonomic analysis to explain the four different kinds of causations, based on the VECM frameworks, for countries at various stages of economic development.

The main and empirical part of another empirical part of BICS is composed of analysing interconnections among output, investment, trades and finance, for four specific large developing countries (BICS) - Brazil, India, China and South Africa in terms of their financial development and economic growth. To be similar with NICs, the BICSs are still developing countries, and therefore the investment and trade variables are still used in the process of econometric models together with financial indicators. In particular, the three control variables are added into estimation that are significantly linked with size effects on the interrelationships of finance and growth. The population is another important indicator for size effects, therefore every control

variables are measured as per capita level instead of traditional aggregate levels. In terms of relatively short development processes, this paper uses Structural VAR to build up an econometric framework to analyse these four countries' interrelationships among various factors, financial and real, in economic development over the period of 1995 to 2007. The approach is comparative and looks at how these countries respond to financial shocks.

7.4 Conclusion of the Thesis

In summary, this thesis contains three important and distinctive features that make both our theoretical and empirical studies to be different from other literatures about economic development and finance.

- 1) This thesis emphasises theoretical and structural models, and attempts to construct a taxonomic classification based on stages of development.
- 2) This thesis emphasises emerging economies which are potentially special in the world of globalisation.
- 3) This thesis distinguishes between 'small' and 'large' economies using different econometric methodologies to deal with them.

After showing crucial features above, we are now considering their implications now.

The ideas of taxonomy have been considered into both theoretical and empirical chapters throughout the whole thesis. In the theoretical chapter, the three models are used to study the interconnections of development and finance in terms of different stages of development.

The two groups of emerging economies in the thesis are in fact at two different development stages, while NICs are in a relatively higher stage of development and BICSs are regarded as new powers in recent ten years. The topic of globalisation is one of the most popular studies in recent decades. As the emerging economies are developing surprisingly, the importance of these emerging economies came to development economists' minds immediately, in particularly regarding the involvements of globalization.

There are many factors to show the importance of emerging economies in globalization. Thinking of, for example, emerging economies have been invited to attend the many international organizations, even for G8 Summits, and nearly half members of nations to attend G20 Summits, including both Washington G20 Summits and London G20 Summits, are emerging economies. The 1st BRIC summit took place in Yekaterinburg, Russia on 16th June, 2009, while four heads of government from the BRIC countries attended.

The conclusion of this thesis, even if somewhat weakened by the study of BICSs, is clear. High-quality financial expansion and development is a vital input towards economic growth, as well as several important factors of investment and trade in the process of economic development. Furthermore, finance could work in the same route as other forms of physical capital. Just as roads or infrastructures are good for growth provided they are of high quality and not excessive in terms of needs, so also is financial expansion good for growth. As most of NICs became middle-income developing countries successfully before 2000s, these roles of financial growth in

these economies become much significant than other developing countries. As the new powers in the global economy, BICSs just began their taking-off stages of development in recent ten years, so the financial roles are relatively lower than other traditional sectors of investment and trade, however, it is still believed that the impacts of financial systems are increasing sharply in the following decades.

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