Testing for Financial-Led, Export-Led and Import-Led Growth Hypotheses on Four Asian Emerging Economies

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ABSTRACT

The main objective of this study is to investigate the dynamic relationships between economic growth and macroeconomic variables, namely financial deepening, exports and investment for the cases of Singapore, South Korea, Taiwan and Thailand. The vector error-correction model (VECM) is employed to distinguish between short-run and long-run causal effects in examining the three led-growth determinants. The out-of-sample dynamics of the system are also picked up through variance decomposition analysis. The empirical results suggest that financial deepening leads to economic growth in South Korea, Singapore and Thailand. In terms of exports, the findings demonstrate that export-led growth hypothesis is supported for all four Asian economies, namely Singapore, South Korea, Taiwan and Thailand. Apart from export promotion strategies and financial liberalisation, the evidence also shows that economic growth in these four Asian economies is found to be generated by capital formation or investment.

Keywords: Finance, Exports, Imports and Economic Growth.

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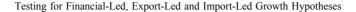
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INTRODUCTION

The study of the relationship between macroeconomic determinants, namely, financial liberalisation, exports and investment with economic growth is not new. The emergence of rapid economic growth in most of the Asian countries has however, renewed interest in the testing of finance-led growth hypothesis, as well as export-led growth hypothesis. The empirical results, among others, King and Levine (1993a, 1993b), Demetriades and Hussein (1996), Odedokun (1996), Habibullah (1999) have provided evidence that financial liberalisation contributes to economic growth. On the other hand, studies that focused on export and economic growth include Bahmani-Oskooee and Alse (1993), Dutt and Ghosh (1996), Sengupta and Espana (1994), Greenaway and Sapsford (1994), Ghatak *et al.* (1997) where the empirical findings support the idea that export and economic growth reinforce each other. Numerous studies have been conducted to test the association between economic growth and financial development, and export growth and economic growth, in both developed and developing countries. While most of these studies have examined the finance-led and export-led hypotheses, very few have examined the interrelationship among these variables. Fry (1998) explains that the importance of investment and export growth in accelerating economic growth, supported by mature financial and foreign exchange markets, should not be underrated. Fry (1998) concludes, "financial conditions established by government policies played an important role in producing virtuous cycles of high savings, investments, output growth and export growth in the Pacific Basin".

The main objective of this study is to investigate the dynamic relationships between economic growth and macroeconomic variables i.e. financial deepening, exports and investment, in four Asian countries - Singapore, South Korea, Taiwan and Thailand. It is also interesting to empirically identify the causal effect between growth and the three led-growth hypotheses. That is, either these macroeconomic determinants lead economic growth or vice versa. In order to distinguish between short-run and long-run causal effects, we employ the vector error-correction model (VECM). The out-of-sample dynamics of the system are also picked up through variance decomposition analysis.

The rest of the paper is organised as follows. Section II discusses the macroeconomic performances of the selected Asian countries for the past two

decades. Section III provides an overview of the theoretical and empirical literature on the relationship between the three led-growth variables and economic growth. Section IV discusses the data used and method of analysis. We present the results of the Granger causality analysis in Section V and Section VI contains some concluding remarks.

ECONOMIC PERFORMANCE IN SELECTED ASIAN COUNTRIES

In the last two to three decades, several Asian economies had been dubbed as the world's economic miracles. South Korea, Hong Kong, Taiwan, Singapore, Malaysia, Thailand and Indonesia have displayed rapid economic growth, having achieved remarkable rates of growth for a sustained period. The world GDP experienced an average of 2 percent growth rates per annum during the period 1990-96 while most of these Asian countries experienced GDP growth of above 4 percent during the same period. Compared with other high-income countries, growth rates in Singapore, South Korea, Taiwan and Thailand are remarkably high. Between 1980-96, the latter countries experienced an average of between 6-9 percent growth in GDP whereas the former only recorded a growth rate of 2.6 percent per annum on average according to the 1997 World Development Report (World Bank, 1997).

Despite the high economic growth, inflation rates have been extremely low in most of these Asian economies. The adoption of a sound macroeconomic policy mix kept inflationary pressures in check. Singapore, Taiwan, South Korea and Thailand are considered stable economies with relatively low inflation rates of between 2-6 percent during the period 1990-96. The combination of high growth and low inflation clearly suggests that these economies had benefited tremendously from a framework of sound macroeconomic policy-mix.

The relatively stable political and economic environment in the past three decades has allowed a faster pace of deregulation and liberalisation of financial markets. The degree of monetisation in the Asian countries has been significant over the 1976-96 period. The increasing use of narrow money (M1) relative to GNP (gross national product) has increased from 23 percent to 45 percent in Taiwan. On the other hand, these ratios have declined in Singapore (from 27 percent to

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20 percent in 1996) and Thailand (dipped to 9 percent in 1996 from 12 percent in 1976) whereas for South Korea, the ratio is fairly stable.

However, the increasing use of broad money (M2) is evident in all the four Asian countries, as shown by the consistent rise in their M2/M1 and M2/GNP ratios during the periods, reflecting the movement towards a higher level monetised economy. In 1996, Thailand registered the highest M2/M1 ratio of 8.80, followed by South Korea (4.51), Singapore (4.14) and Taiwan (4.08).
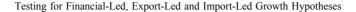
Another measure of financial development, the so-called financial intermediation ratio (the ratio between total assets of the financial system and national income) proposed by Goldsmith (1969), indicates that the banking system (comprising only the Central Bank and commercial banks) in all these Asian financial systems has evolved rapidly especially in the past two decades. The ratio of total banking system to GNP ranges from 81 percent for Taiwan to 240 percent for Singapore in 1996. On the other hand, the income elasticity[1] of financial assets during the deregulation era was way above unity for all four Asian countries. This further supports the implementation of financial liberalisation since a value greater than unity for these ratios indicates financial deepening (Goldsmith, 1969). The income elasticity of financial assets in Taiwan, as one of the highest among the four Asian countries, had recorded a ratio of 2.06 during the period 1976-96.

To sum up, there was parallelism between financial development and economic growth in these four Asian countries. Indeed, there were indications in a few countries that periods of more rapid economic growth have been followed by an above-average rate of financial deepening. Apart from the deregulation of financial developments in Asian countries, economic co-operation in Asia has also benefited very much from the favourable international trade climate (including trade facilitation, non-broader measures and investment promotion activities). In its 1987 World Report, the World Bank identified four types of countries with respect to their trade policies. South Korea, Singapore, and Thailand were the countries listed as outward oriented.

According to the 1997 World Development Report (World Bank, 1997), Singapore, as a traditional entrepot center in Southeast Asia, had an export and

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[1]The income elasticity was calculated as the assets of financial institutions to national income.
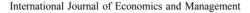
import trade of 273.2 per cent of GDP in 1996. As a country that is pursuing an export-oriented development strategy, South Korea's trade amounted to 58.5 per cent of GDP in 1970 and increased to 61.8 per cent in 1996. In Taiwan, trade accounted for 88-89 percent of GDP in both 1980 and 1996. In Thailand, with its expanded export-oriented manufacturing base, it accounted for 56.6 per cent of GDP in 1980 and increased to 81.1 per cent in 1996. The relative openness of the Asian countries could be seen and understood as a vital determinant of the superior trade and general performance of these Asian countries.

The other contributing factor for most of these Asian countries was mainly the reliance on government incentives to promote capital formation/investment. In general, there are three principle sources of investment funds: foreign aid, FDI and domestic savings. Capital accumulation, though, cannot by itself be regarded as the core process by which economic development is made possible. Savings and investment rates are high in these four countries compared with countries at similar levels of development.

For instance, capital formation over income accounted for 37 percent and 20 percent in South Korea and Taiwan respectively in 1996. Singapore and Thailand sustained a quite stable share of capital over income, at an average rate of 37 percent in Singapore, and more than 40 percent in Thailand. In short, this stable capital formation is essential for long-run and sustained economic growth.

With respect to the high gross domestic investment, gross national savings in Singapore and Taiwan amounted to 50 percent and 25 percent respectively in 1996. For South Korea and Thailand, gross national savings accounted for about 35 percent in the same period. With the investment rate increasing at the same time, the saving/investment gap remained positive in Singapore and Taiwan. However, the gap widened further and changed from a positive 2 percent of GDP in 1989 to a negative 4 percent in 1996 for South Korea, while in Thailand, the gap sharply increased from about negative one percent in 1989 to around negative 9 percent in 1996. Consequently, the widening gap was met through increased FDI inflows and external borrowing by some public enterprises which in turn have been major contributing factors to increased current account deficits in the balance of payment.

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Economic growth has brought much benefit to the populace of these Asian countries in the form of higher incomes and expanded employment opportunities. The high economic growth has also been accompanied by phenomenal export growth and sharp increases in private consumption expenditure. In short, the economic success of these Asian countries has been attributed to sound macroeconomic management, effective human resource development and open economic policies.
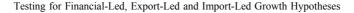
A REVIEW OF RELATED LITERATURE

There is a large body of theoretical and empirical literature on the role of financial sector development in economic growth. In the analysis of the theory of economic development, Schumpeter (1911) argues that the services provided by financial intermediaries are paramount for technical innovation and economic growth. However, the dominance of this view did not receive much attention until the 1950's when the work of Goldsmith (1969), McKinnon (1973) and Shaw (1973), among others (Kapur, 1976; Galbis, 1977 and Fry, 1978), inspired considerable interest in the role of financial development as a means of accelerating economic growth. Specifically, they advocated a "liberalised" financial system which they say is able to mobilise an increased volume of financial savings and allocate capital to more productive use, both of which enhance the volume and productivity of physical capital and contribute to economic growth. This is what Patrick (1966) refers to as the 'supply-leading' role of financial development.

By contrast, several well-known economists are sceptical of the view that finance plays any major role in economic development. According to this view, financial development is the "handmaiden" of economic development, reacting passively to the demands for new financial services in a growing economy (Robinson, 1952; Stern, 1989). According to this view, the lack of financial institutions in developing countries is an indication of lack of demand for their services.

A synthesised view of the above two approaches is that there is actually a two-way relationship between financial sector development and economic growth - financial markets develop as a consequence of economic growth which in turn feed back as stimulants for real growth (Lewis, 1955). As suggested by Patrick
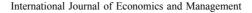
(1966), the nature of the relationship between financial development and economic growth depends on the stage of economic development.

In the 1990s, there have been a number of theoretical demonstrations of the potential role of financial factors on growth within the framework of steady endogenous growth literature. These models suggest that financial intermediation has a positive effect on steady-state growth (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991) and that government intervention in the financial system has a negative effect on growth rate (King and Levine, 1993b; Roubini and Sala-i-Martin, 1992).

The above synopsis of competing views illustrates the controversy surrounding finance-growth causality. Overall, empirical literature on finance-growth causality can be summarised as follows. Since the seminal article by Engle and Granger (1987), the method of co-integration has been a popular approach used in testing economic hypothesis. Demetriades and Hussein (1996), Arestis and Demetriades (1996), Murinde and Eng (1994) and Thornton (1996) are among the few studies that have tested the financial-led hypothesis on several Asian countries. By employing Granger non-causality test between indicators of financial development and economic growth, Murinde and Eng (1994), Rousseau and Wachtel (1998) and Darrat (1999) support the finance-led growth hypothesis. However, feedback relationships are found in other time-series studies (e.g. Demetriades and Hussein, 1996; Thornton, 1996, Greenwood and Smith, 1997 and Habibullah, 1999). For cross-country studies, Gelb (1989), King and Levine (1993a, 1993b) and La Porta *et al.* (2002) report the positive effects of financial development on growth.

Apart from the financial-led hypothesis, the export-led growth hypothesis has been the subject of considerable research in the last two decades. Theoretically, there are three possible relationships between export and economic growth in literature: export-led growth, growth-driven exports and the two-way causal relationship that was termed feedback. According to the export-led-growth hypothesis, growth of exports has a direct stimulating influence on economic growth since export is a component of aggregate output. On the other hand, exports can cause economic growth indirectly through its effects of efficient allocation of resources, greater capital utilisation, best use of economy of scale, employment

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creation and in the form of technological spillover (Feder, 1983; Ram, 1985; Tyler, 1981; Ukpolo, 1994, Giles and Williams, 2000).
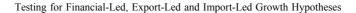
In contrast to the export-led growth hypothesis, Jung and Marshall (1985) argue that it is plausible that causality runs in an opposite direction, i.e. output growth causes export growth. In particular, innovation and technology advancement generated from growth in well-developed markets will improve export growth in the trade sector (e.g., Bhagawati, 1988, Ghartey, 1993; Marin, 1992; Greenaway and Sapsford, 1994; Sengupta and Espana, 1994).

The most interesting economic scenarios suggest a two-way causal relationship between growth and trade. These trade theories state that the realisation of economies of scale would increase productivity, which in turn gives rise to exports (Helpman and Krugman, 1985) - implies bidirectional causality between export growth and output growth. Tyler (1981), Ukpolo (1994), Ghartey (1993) and Dutt and Ghosh (1996) also argue that a feedback effect could exist when the mixed results of the openness and the size of economy or the degree of economic development is found (through the so-called "threshold effect").

The debate on the role of exports in stimulating economic growth has generated considerable interest in literature. Broadly speaking, the empirical studies can be categorised into two broad categories. The first consists of cross-country studies that use conventional econometric techniques to estimate the potential impact of exports on growth. Examples are Michaely (1977), Tyler (1981), Feder (1983) and Ram (1985), among others. The second category of studies is those based on time series data. Among time series data analysis, many researchers have directed the studies toward using Granger no-causality testing procedures. Bahmani-Oskooee and Alse (1993), Serletis (1992), Ghartey (1993), Ghatak *et al.* (1997), Bodman (1996), Doyle (1998) and Chandra (2002, 2003) provide support either for the export-led growth hypothesis or for two-way causality.

Recently, most of the recent studies have utilised the multivariate time-series analysis to address the mis-specification problem inherent in existing bivariate time-series studies. Riezman and Whiteman (1996), Khalid and Cheng (1997) and Baharumshah and Rashid (1999) include the role of imports in their studies. Riezman and Whiteman (1996) show that failure to account for the role of import growth can produce misleading results in the analysis of the relationship between

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export growth and income growth. Using the case of Singapore, Khalid and Cheng (1997) suggest that in the study of export-led growth for a resource-scarce economy like Singapore, its omission may lead to a mis-specified model. The study by Baharumshah and Rashid (1999) shows that feedback relationship exists between exports and imports thus, indicating that an important determinant of long-run growth in the fast growing Malaysian economy is imports of foreign technology.

Apart from the above mentioned hypothesis, capital formation has been widely accepted as a prerequisite for economic growth (Lewis, 1955; Nurkse, 1962). The study of endogenous growth models provides mechanisms through which changes in economic policies and accumulation of human and private physical stocks can generate sustained economic growth. The positive externality associated with private investment gives rise to a production function that exhibits increasing returns to scale; thus, raising growth in the steady-state (Romer, 1986). In addition, investment in human capital has spillover effects that give rise to sustained growth (Lucas, 1988). Private investments can also provide a linkage between imported technology and economic growth (Grossman and Helpman, 1991). Relating the growth rate of real GDP per capita to the share of fixed investment or equipment investment in GDP, De Long and Summers (1991, 1992), Barro (1991), Levine and Renelt (1992), among others, conclude that the investment ratio exerts a major influence on income growth.

Further in the recent growth literature, a new perspective on investment-led growth and their causal relations were investigated based mostly on cross-section or panel data. De Mello (1999), Nair-Reichert and Weinhold (2001), and Liu and Hsu (2006) are a few examples. On the other hand, co-integration and causality studies on the effects of investment on long- and short-run growth support both uni- and bi-directional causalities between investment and economic growth (Basu *et al.*, 2003; Liu *et al.*, 2002). The causal direction from investment to long-run growth has been well supported by these literatures.

In contrary, studies by Blomstrom *et al.* (1996) suggest that there is a one-way causal relationship running from economic growth to fixed investments. In particular, the changes in capital formation rates did not have any effect on future growth rates. Thus, in short, the relationship between the share of capital formation

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in GDP and the growth rate of real output is an important subject of analysis and debate.

METHODOLOGY AND DATA

Unit Root Tests

In this paper, three asymptotically equivalent procedures for detecting unit roots are employed,, namely, the Augmented Dickey Fuller (ADF) (see Said and Dickey, 1984), the Phillips and Perron (PP) (Phillips and Perron, 1988) tests and the weighted symmetric estimator (Pantula *et al*., 1994). The ADF test assumes that regression errors are statistically independent and have constant variances. The PP test is applicable under mild assumptions regarding error distributions and thus, is a generalisation of the DF procedure. On the other hand, as discussed in Pantula *et al.* (1994), the WS test dominates the ADF test in terms of power. If any series is identified to have a unit root by these tests, then the series is suggested to be non-stationary. If so, then data transformation such as taking first differences of the logarithm of the series will be necessary.

Cointegration Tests and Long-Run Equilibrium

The Johansen and Juseliues (1990) cointegration tests have been employed to test for long-run equilibrium between economic growth, financial deepening, export and investment in Malaysia. Cointegration refers to the possibility that non-stationary variables may have a linear combination that is stationary. The existence of a cointegrating vector implies that there is long-run equilibrium relationship between these variables.

A brief discussion on the Johansen-Juselius technique is provided below. Let

$$\Delta X_t = \alpha + \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \dots \Gamma_{k-1} \Delta X_{t-k-1} + \Pi_k X_{t-k} + \omega_t \qquad (1)$$

where X_t and w_t are (nx1) vectors and P is an (nxn) matrix of parameters.

The Johansen (1988) methodology requires estimating the system of equation in (1) and examining the rank of matrix P_k. Specifically, if rank (P_k) equals to zero, then there is no stationary linear combination of the variables in X_t, the variables are not cointegrated. Since the rank of a matrix is the number of non-zero

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eigenvalues (r), the number of $\rho > 0$ represents the number of cointegrating vectors among the variables.

Two Likelihood Ratio (LR) test statistics are usually conducted to test for non-zero eigenvalues:

$$L_{trace} = -T\sum_{i=r+1}^{p} \ln(1-\lambda_i) \qquad (2)$$

and

$$L_{max} = -T.\ln(1-\lambda_{r+1}) \qquad (3)$$

where λ_r is the estimated eigenvalues, and T is the number of valid observations. The null hypothesis of the trace statistics tests that the number of distinct cointegrating vectors is less than or equal to r against a general alternative whereas the null of λ-max statistic is that there are r cointegrating vectors, against the alternative of r+1 cointegrating vectors. Critical values for both tests are tabulated in Osterwald-Lenum (1992).

Granger Causality Test

According to cointegration analysis, if two variables are cointegrated, the finding of no-causality in either direction is ruled out. In other words, for two variables that possess a common trend, causality (in Granger sense) must exist in at least one direction, either unidirectional or bi-directional. However, although cointegration indicates presence or absence of Granger-causality, it does not indicate the direction of causality between variables. This direction of the Granger causality can only be detected through the vector error-correction model (VECM) derived from the long-run cointegrating vectors.

In addition to indicating the direction of causality among variables, the VECM approach distinguishes between the "short-run" and "long-run" Granger causality. If a number of variables are found to be cointegrated, then in the short-run, deviations from this long-run equilibrium will feedback on the changes in the dependent variable in order to force the movement towards long-run equilibrium. If the dependent variable is driven directly by this long-run equilibrium error, then it is responding to this feedback. If not, it is responding only to short-run shocks to the stochastic environment. In other words, the error-correction term in the VECM provides an additional channel for the detection of Granger-causality. The

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coefficient of the lagged error-correction term, however, is a short-run adjustment parameter and represents the proportion by which the long-run disequilibrium in the dependent variable is being corrected in each short period.

Variance Decompositions and Impulse Response Analysis

Inference from using vector autoregressions, in the way of χ^2- and t-tests may be interpreted as within-sample causality tests. They do not provide an indication of the dynamic properties of the system, nor do they allow us to gauge the relative strength of the Granger-causal chain or degree of exogeneity among the variables beyond the sample period. We thus rely upon variance decomposition analysis to provide an indication of the dynamic properties of the system. Variance decompositions (VDCs), which may be termed as out-of-sample causality tests, are a convenient method of providing a literal breakdown of the change in value of the variable in a given period arising from changes in the same variable and in other variables during previous periods. A variable that is optimally forecast from its own lagged values will have all its forecast error variances accounted for by its own disturbances (Sims, 1982).

Sources of Data

This study employed annual data spanning from 1958 to 1997. In this study, data has been collected and compiled from various issues of the International Financial Statistics published by the International Monetary Fund.

It is well known that the unit root and cointegration tests require a long time span data rather than merely a large number of observations. There is no gain in the power of these tests by switching from low frequency to high frequency data and merely increasing the number of observations (Campbell and Perron, 1991; Hakkio and Rush, 1991). Our data set has an average time span of 39 years which, in our view, is long enough to capture the long-run relationship between fundamental variables and economic growth.

The data set consists of four variables for each of the selected Asian countries. The variables included are gross domestic product (GDP), broad money supply (M2), export (X) and fixed capital formation (I). All the variables in the data set

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are transformed into natural logarithms for the usual statistical reasons. Economic growth is measured by taking the growth rate of real GDP per capita. The export-led growth variable is measured by using total export figures. The investment-led growth variable is measured using the fixed capital formation of each country. Lastly the financial-led growth variable is measured by using the ratio of M2 and GDP.

EMPIRICAL RESULTS

Result of Unit Root Tests

The prerequisite for a set of series to be cointegrated is that they should be integrated in the same order. In this study, to determine the order of integration of the series, the Weighted Symmetric (WS) (Dickey and Pantula, 1987), the Augmented Dickey-Fuller (ADF) (Said and Dickey, 1984) and the Phillips-Perron (PP) (Phillips and Perron, 1988) unit root tests are conducted on the levels as well as the difference of the logarithms of each series.

The p-values for the weighted symmetric (WS) unit root test, the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron test are reported in Table 1. To ensure the disturbances in all these equations are white noise, a sufficient number of lagged dependent variables have been estimated[2]. It is clear that the results fail to reject the null hypothesis of unit roots in their level form in the autoregressive representation of each variable, that is, they are all not I(0). The same WS, ADF and PP tests were applied to the first differences on all series which indicated that it is possible to reject a I(2) specification at 5 percent significance level in all cases. Thus, the results indicate that all the series, after differencing, do not contain a unit root and are first difference stationary. The results are consistent with the view that most macroeconomic variables are non-stationary in level but stationary in the first difference (Nelson and Plosser, 1982).

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[2]For the WS estimator, ADF and PP tests, the optimal lag length was taken to be the order selected by the Akaike Information Criteria (AIC) plus two; see Pantula *et al*. (1994) for details regarding the advantages of this p-value for the rules for choosing to number of augmenting lags.
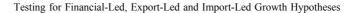
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Table 1 Unit Root Test Results

Series	Levels						First Difference					
	WS		ADF		PP		WS		ADF		PP	
	t:a	lag	t:a	lag	t:a	lag	t:a	lag	t:a	lag	t:a	lag
Singapore:												
LRYK	0.86	(2)	0.66	(9)	0.84	(9)	0.03*	(2)	0.04*	(6)	0.05*	(6)
LMYK	0.54	(3)	0.66	(4)	0.72	(4)	0.01*	(2)	0.05*	(2)	0.00*	(2)
LRXK	0.98	(2)	0.37	(2)	0.55	(2)	0.01*	(2)	0.04*	(2)	0.00*	(2)
LRIK	1.00	(5)	0.71	(3)	0.88	(3)	0.02*	(3)	0.04*	(3)	0.05*	(3)
S. Korea:												
LRYK	0.98	(2)	0.11	(3)	0.43	(3)	0.00*	(2)	0.01*	(2)	0.01*	(2)
LMYK	0.40	(3)	0.40	(8)	0.40	(8)	0.00*	(2)	0.01*	(2)	0.00*	(2)
LRXK	0.98	(2)	0.96	(4)	0.99	(4)	0.03*	(2)	0.08	(2)	0.00*	(2)
LRIK	0.78	(4)	0.82	(4)	0.57	(4)	0.00*	(3)	0.01*	(3)	0.00*	(3)
Taiwan:												
LRYK	0.90	(2)	0.09	(3)	0.60	(3)	0.00*	(2)	0.00*	(2)	0.00*	(2)
LMYK	0.70	(2)	0.25	(3)	0.24	(3)	0.00*	(2)	0.01*	(2)	0.00*	(2)
LRXK	0.96	(2)	0.99	(2)	0.96	(2)	0.00*	(2)	0.01*	(2)	0.00*	(2)
LRIK	0.96	(5)	0.90	(3)	0.83	(3)	0.00*	(2)	0.00*	(2)	0.00*	(2)
Thailand:												
LRYK	0.99	(3)	0.72	(3)	0.82	(3)	0.01*	(2)	0.04*	(2)	0.00*	(2)
LMYK	0.51	(3)	0.43	(5)	0.60	(5)	0.00*	(3)	0.03*	(3)	0.00*	(3)
LRXK	0.99	(2)	0.82	(2)	0.77	(2)	0.00*	(2)	0.00*	(2)	0.00*	(2)
LRIK	0.97	(9)	0.84	(9)	0.77	(9)	0.00*	(7)	0.00*	(7)	0.02*	(7)

Notes: WS = weighted symmetric estimator, ADF = Augmented Dickey Fuller, PP = Phillips-Perron; LRYK = real output per capita, LM2YK = ratio of broad money (M2) to income per capita, LRXK= real export per capita, LRIK= real capital formation per capita. Only p-values are reported. Asterisk (*) denotes statistically significant at the 5 percent level.

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Results of Cointegration Tests

Given the power of these unit root tests, we consider the series to be I(1) process. Next, we proceed with the cointegration tests. The Cointegration test is designed to test for the presence of common stochastic trends between a set of variables that are individually non-stationary in levels. In this study, we employ the Johansen (1988) and Johansen and Juselius (1990) multivariate cointegration procedure to test for the presence of cointegration relationships (both maximum eigenvalue and trace versions). This is important since under parameterisation would tend to bias the results and over-parameterisation would diminish the power of tests. Akaike Information Criteria (Akaike, 1969) and Schwarz Criterion (SC) (Schwarz, 1978) are utilised to select the optimal lag length. Based on the procedure mentioned above, the optimal lag length used are Singapore (2), South Korea (3), Republic of China, Taipei (2) and Thailand (4) and this uniform lag structure of the system will be used for the VECMs.

Results of using the optimal lag structure for the VAR models are summarised in Table 2. The number of cointegrating vectors (r) is determined by two likelihood ratio tests, namely maximal eigenvalue and the trace statistics. The critical values for the trace and maximal eigenvalue statistics are from Osterwald-Lenum (1992).

For the case of Singapore and Taiwan, the values of the test statistics indicate that the null hypothesis of no cointegration is soundly rejected by both tests. Hence,

Table 2   Johansen-Juselius Cointegration Test Results

H_0	H_1	C.V.	Singapore k=2 r=1	S. Korea k=3 r=2	Taiwan k=2 r=1	Thailand k=4 r=2
				l-max		
r = 0	r = 1	28.27	30.47**	33.07**	44.97**	57.25**
r ≤ 1	r = 2	22.04	14.56	27.19**	12.60	26.91**
r ≤ 2	r = 3	15.87	11.04	12.75	5.09	14.83
r ≤ 3	r = 4	9.16	4.86	9.03	0.75	3.37
				Trace		
r = 0	r ≥ 1	53.48	60.93**	82.05**	63.41**	102.35**
r ≤ 1	r ≥ 2	34.87	30.46	48.97**	18.44	45.10**
r ≤ 2	r ≥ 3	20.18	15.90	21.79**	5.84	18.20
r ≤ 3	r = 4	9.16	4.86	9.03	0.75	3.37

Note: Asterisks (**) denotes statistically significant at 5 percent level.

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concluding that there appears to be a cointegrating vector among these four series and implies that the series have three common stochastic trends. Both the maximum eigenvalye and trace likelihood ratio tests reject the null hypothesis of zero coitnegrating and null for one cointegrating vector for Thailand. This implies the existence of at least two cointegrating vectors in this system. For the case of South Korea, the trace tests indicate the existence of three vectors in the system. However, the maximal eigenvalue suggests the existence of two cointegrating vectors cannot be rejected at the 5 percent significant level for South Korea. Johansen and Juselius (1990) indicate that the trace test may lack power relative to the maximal eigenvalue test. Based on the power of the test, l-max test statistic is often preferred. Thus, the results support cointegrating rank of two cointegrating vectors for South Korea.
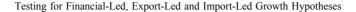
To determine whether all variables belong to the cointegrating space, we apply the log-likelihood ratio (LR) test for the exclusion of each variable in each case (Johansen and Juselius, 1990:p.195). Clearly, from Table 3, in the case of Singapore, only the export variable appears to enter in the long-run relationship. All the remaining variables are found to belong to the cointegrating space since the null hypothesis that the regarding coefficient does not enter into cointegrating relationship can be easily rejected at 5 percent significant level.

Table 3   Test of Restrictions Exclusions

	LM2Y	LRX	LRI	Constant
By Normalising LRYK:				
χ^2-statistics$_{d.f.=1}$				
Singapore	0.06 (0.80)	10.82 (0.00)**	2.52 (0.11)	2.08 (0.15)
S. Korea	6.78 (0.03)**	11.77 (0.00)**	6.39 (0.04)**	9.21 (0.01)**
Taiwan	3.23 (0.07)*	37.51 (0.00)**	32.19 (0.00)**	-
Thailand	35.05 (0.00)**	26.79 (0.00)**	15.90 (0.00)**	36.33 (0.00)**

Having identified the number of cointegrating vectors, the Granger causality tests are conducted in the environment of Vector Error Correction Model (VECM) to gain some insights into the short- and long-run lead-lag causal effect between these four macroeconomic variables.

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RESULT OF GRANGER CAUSALITY TESTS

Results of the VECM are presented in Table 4. For Singapore and Taiwan, the VECM tends to indicate that export appears to be weakly exogenous while for South Korea, financial deepening appears to be strongly exogenous and export, weakly exogenous. Finally, for Thailand, all of the variables, including financial deepening, appear to be endogenous as all of the error-correction terms are found to be jointly statistically significant at least at 10 percent level suggesting that these variables adjust to clear any disequilibrium from the system.

In the short-run analysis, financial deepening is found to lead economic growth in Singapore (indirectly through export and investment channels), South Korea (via export channel) and Thailand indicating the important role of financial deepening on the performance of economic growth. In addition instead of saying that finance-led growth is experienced in these countries, bi-directional relationship is indicated in the case of Singapore. For Taiwan, the causal relationship is found running from economic growth to financial deepening, supporting the demand following hypothesis. The results obtained by Singapore and Taiwan are consistent with the saying by Patrick (1966) that during the more advanced stages of development, financial sector expansion plays a "demand-following" role.
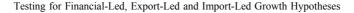
The hypothesis that export growth Granger cause economic growth is supported in all four (Singapore, South Korea, Taiwan and Thailand) countries is considered here. For instance, a feedback relationship i.e. that economic growth causes export growth and *vice versa* is supported in Singapore and Thailand. Thus, this analysis suggests that Singapore, as well as Thailand, followed the path of export-led growth, while at the same time suggesting that domestic market conditions had a significant impact on the growth process.

Besides the financial deepening and export growth, there exists an important causal link between investment and economic growth. The findings for this hypothesis are as follows. In Thailand and South Korea, investment growth Granger causes economic growth. Among the indirect Granger causal relationships, results reveal that in the case of Singapore and Taiwan, growth in investment Granger-cause economic growth via export channels. Clearly, results also indicate a bi-directional relationship between investment and economic growth in Singapore

Table 4 Granger-causality Test Results Based on VECM

Dependent Variables	ΔLRY	ΔLMY	ΔLRX	ΔLRI	ECT$_{t-1}$	AR(1)	ARCH(1)	RESET	Norm.
				χ^2 - statistics (p-value)					
A: Singapore (k=2)									
ΔLRY	-	0.43 (0.51)	4.53 (0.03)	0.57 (0.45)	13.05 (0.00)	0.17 (0.68)	1.07 (0.30)	1.27 (0.26)	0.56 (0.75)
ΔLMY	7.65 (0.01)**	-	1.48 (0.22)	0.94 (0.33)	14.42 (0.00)**	1.04 (0.31)	0.19 (0.66)	0.08 (0.78)	1.41 (0.50)
ΔLRX	13.81 (0.00)**	0.48 (0.49)	-	5.70 (0.02)**	0.17 (0.68)	0.80 (0.37)	0.50 (0.48)	0.75 (0.39)	1.53 (0.47)
ΔLRI	0.63 (0.43)	2.73 (0.10)*	6.15 (0.01)**	-	17.37 (0.00)**	0.56 (0.45)	0.08 (0.77)	0.56 (0.70)	1.75 (0.42)
B: S. Korea (k=3)									
ΔLRY	-	0.98 (0.32)	6.68 (0.01)**	4.04 (0.04)**	23.00 (0.00)**	3.51 (0.06)	0.11 (0.74)	0.01 (0.91)	4.31 (0.12)
ΔLMY	0.01 (0.94)	-	2.28 (0.13)	0.00 (0.99)	0.97 (0.32)	0.62 (0.43)	8.99 (0.00)	0.11 (0.74)	0.18 (0.92)
ΔLRX	1.20 (0.27)	6.78 (0.01)**	-	0.23 (0.63)	2.28 (0.13)	0.34 (.056)	2.76 (0.10)	0.35 (0.55)	0.77 (0.68)
ΔLRI	0.03 (0.86)	0.01 (0.92)	0.30 (0.58)	-	3.86 (0.05)**	0.01 (0.94)	0.03 (0.86)	0.35 (0.56)	0.29 (0.86)

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Table 4: (continued)

C: Taiwan (k=2)

ΔLRY	-	1.49	3.33	0.03	22.34	4.72	0.07	0.48	1.67
		(0.22)	(0.07)*	(0.86)	(0.00)**	(0.10)	(0.80)	(0.50)	(0.44)
ΔLMY	12.21	-	7.14	3.40	9.10	0.23	0.01	2.82	0.56
	(0.00)**		(0.01)**	(0.07)*	(0.00)**	(0.63)	(0.92)	(0.09)	(0.76)
ΔLRX	0.08	0.35	-	2.66	0.02	3.37	0.27	1.41	0.41
	(0.78)	(0.55)		(0.10)*	(0.88)	(0.07)	(0.61)	(0.24)	(0.82)
ΔLRI	0.04	2.08	0.54	-	4.06	0.00	1.12	0.52	0.08
	(0.85)	(0.15)	(0.46)		(0.04)**	(0.95)	(0.29)	(0.47)	(0.96)

D: Thailand (k=4)

ΔLRY	-	8.26	15.92	6.23	7.15	0.27	1.85	0.45	0.41
		(0.00)**	(0.00)**	(0.01)**	(0.01)**	(0.60)	(0.17)	(0.50)	(0.81)
ΔLMY	1.47	-	0.96	2.58	3.24	0.24	1.32	0.03	1.21
	(0.23)		(0.33)	(0.11)	(0.07)*	(0.63)	(0.25)	(0.87)	(0.55)
ΔLRX	11.18	11.38	-	6.15	28.11	0.01	1.20	1.61	2.90
	(0.00)**	(0.00)**		(0.01)**	(0.00)**	(0.93)	(0.27)	(0.20)	(0.24)
ΔLRI	4.40	2.70	15.13	-	6.63	0.25	0.37	1.55	3.05
	(0.04)**	(0.10)*	(0.00)**		(0.01)**	(0.62)	(0.54)	(0.21)	(0.22)

Notes: All Variables are as previously defined. ECT_{t-1} denotes the t-statistic of the error-correction term. χ^2-statistic for the test of joint significance of lagged x_t or y_t in respective VECM equations. Figures in brackets are p-values. Asterisks (**) and (*) denotes statistically significant at the 5 percent and 10 percent level respectively. For diagnostic checking, asterisk (+) denotes statistically significant at the 5 percent significant level.

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(in which growth indirectly causes investment via export and financial deepening) and Thailand.

RESULT OF VARIANCE DECOMPOSITION ANALYSIS

Table 5 shows the results of variance decomposition from one-standard deviation shocks. A 20-year horizon is employed to allow the dynamics of the system to workout. Looking through the main diagonal, we ascertain the extent to which a variable is exogenous. In South Korea, results indicate the relative exogeneity of financial deepening and exports in relation to others, in which about 40 percent and 54 percent of their own variances are explained by their own innovations. Besides that, innovations in financial deepening and export are found to contribute most to the forecast error variance of economic growth (52 percent and 40 percent respectively).

In the case of Singapore and Taiwan, exports are identified as the most exogenous in these systems, with a relative exogeneity of 75 percent and 98 percent respectively, in terms of innovations. On the other hand, in the case of Singapore, innovations in exports mostly explained the forecast error variance of economic growth (65 percent), while shocks in economic growth are able to explain 31 percent of its own variances. For Taiwan, the forecast error variances of economic growth are jointly contributed to by investment (72 percent) and export (17 percent).

For Thailand, financial deepening is the most exogenous variable in which 87 percent of its own variance is contributed by its own shocks. This finding is consistent with those obtained from the VECM results, which suggest that financial deepening is weakly exogenous at 5 percent in the system. Clearly, the results from variance decomposition suggest that financial deepening, export growth as well as investment are important in explaining the variance of economic growth. The forecast error variance of economic growth is jointly explained by innovation in financial deepening (52 percent), export (3 percent) and investment (44 percent) respectively, at the end of the 20-year horizon, thus, supporting the significant role of liberalisation of financial systems, export promotion strategies and investment in enhancing economic growth in these Asian economies.
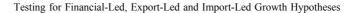
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Table 5   Variance Decomposition Results (Period ended: 20 Years)

| | **Sources of Variation** | | | |
	ΔLRI	**ΔLMY**	**ΔLRX**	**ΔLRY**
Effect Upon				
A: Singapore				
ΔLRI	15.01	1.63	75.11	8.25
ΔLMY	15.56	50.45	2.68	31.32
ΔLRX	0.98	1.86	75.16	22.00
ΔLRY	1.53	2.24	64.83	31.40
B: S. Korea				
ΔLRI	4.04	43.95	51.90	0.11
ΔLMY	13.06	40.02	44.95	1.97
ΔLRX	12.68	30.65	53.69	2.98
ΔLRY	2.01	52.25	40.32	5.42
C: Taiwan				
ΔLRI	13.88	3.36	81.98	0.78
ΔLMY	30.92	64.55	0.41	4.12
ΔLRX	0.22	1.84	97.90	2.06
ΔLRY	71.55	6.12	16.92	5.42
D: Thailand				
ΔLRI	38.37	56.56	4.86	0.22
ΔLMY	87.35	4.61	4.87	3.17
ΔLRX	59.05	38.44	1.93	0.59
ΔLRY	44.05	52.15	3.47	0.33

CONCLUSIONS AND POLICY IMPLICATIONS

The results of our analysis point out several facts that need to be considered in developing models of economic growth. Based on the empirical results of this study, financial deepening, and exports as well as capital formation are found to contribute to the success of economic performance of these countries.

The empirical evidence from the results seems to suggest that financial deepening leads to economic growth in South Korea, Singapore and Thailand. It is, therefore, clear that expanding and refining the financial sector in these countries should prove beneficial to their economic growth process, both initially as well as permanently. The results also imply the presence of bi-directional causality between

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the degree of financial deepening and economic growth in Singapore. Thus, while liberalisation in the financial market gradually incites economic growth in Singapore, economic development induces further sophistication in the financial sector.

Besides the success of financial liberalisation programs in generating economic growth, empirical evidence also suggests that export-expansion strategies contribute to a country's growth in all the export-led fast growing economies, namely Singapore, South Korea, Taiwan and Thailand.

The findings of export-led growth in this study are consistent with the study by Feder (1983), Ram (1985), Tyler (1981), Ukpolo (1994) and Bodman (1996) in which they argue that exports contribute positively to economic growth both directly, as a component of aggregate output, as well as indirectly, through its effects of efficient allocation of resources, greater capital utilisation, the best use of economic of scale, employment creation, exports earnings and the benefits of improving technology in response to competition from abroad.

Ghartey (1993), Marin (1992), Greenaway and Sapford (1994), and Sengupta and Espana (1994) also argue that economic growth may Granger cause exports as well. They have noted that economic growth, through its effect on the supply side, will create a strong desire for exports, providing the country with a strong export production base that is internationally competitive. In other words, the growth of domestic demand lags behind the growth of output and factors of production. Productivity growth is responsible for the growth of exports in this country.

However, can export promotion strategies be continued to accelerate growth in the coming decades, especially in the face of world-wide regionalism and limitation of world markets? For those countries that have had successful experiences in export promotion strategy it is argued that future success of export promotion strategies will depend on their ability to penetrate into new markets, increase labour productivity and the production of quality products through product innovation and product developments (Baharumshah and Rashid, 1999).

Apart from export promotion strategies and financial liberalisation, the evidence also shows that economic growth especially in Singapore, South Korea, Taiwan as well as Thailand is found to be generated by capital formation (investment). Indeed, our results suggest that both economic growth and investment

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reinforce each other in Singapore and Thailand. Concerning the debate between DeLong and Summers (1991, 1992) and Blomstrom *et al.* (1996), about the direction of causality between fixed investment and economic growth, the results do not find any significant evidence that causality should be running in only one direction.

Clearly, a greater abundance of capital permits the introduction of more roundabout methods of production or of consumption. It may accompany industrialisation; may accompany an extension of the market associated with population growth or of more favourable terms of trade; or it may be required to allow technical progress to take place; etc.

However, large capital inflows will increase domestic money growth and lead to higher inflation rates, and further hurt domestic competitiveness, increase exchange rate over-valuation, and often feed expectations of devaluations. In addition, despite its ability to promote growth, capital inflow may also displace savings hence increasing the saving-investment gap. By comparing the gross domestic investment and gross national savings in South Korea and Thailand, it is worth pointing out that the saving/investment gap has widened further since 1989 and was recorded at negative 4 percent and 9 percent respectively in 1996. In addition, the international debt crisis and the alarming bank failures during the 1980s signalled a message that it is dangerous to rely too heavily on foreign financing. Therefore, foreign capital should only supplement or complement domestic resources. Mobilisation of domestic resources may be one fundamental way of averting violent external shocks arising out of unpredictable and sluggish foreign capital inflows in the process of economic growth.

In conclusion, the economic fundamentals are important determinants of economic growth. However, these macroeconomic and regional liberalisation initiatives need to be supported by other complementary policies that would assure the perpetuation of high-quality growth. These complementary policies include human resource development - with increasing emphasis on the availability of a skilled labour force needed by high technology industries-continued emphasis on equity (through well targeted fiscal expenditures) and new initiatives to address growing environmental concerns. Further analysis along these and similar lines appears to be promising avenues for future research.
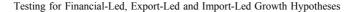
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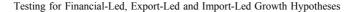
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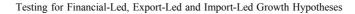
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