FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH: THE CASE OF EIGHT ASIAN COUNTRIES

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ABSTRACT

This paper looks at the relationship between financial development and economic development using time series data for eight Asian countries. First, we estimate augmented production functions where a financial development variable is added. Second, we conduct multivariate causality tests between the growth rate of income and the growth rates of the financial development variables. The regression results show a positive and significant relationship between the income variables and financial variables for India, Malaysia, Pakistan and Sri Lanka. The multivariate causality tests show a two-way causality relationship between the income and the financial variables for India and Malaysia, one-way causality from financial variables to income variables for Japan and Thailand and reverse causality for Korea, Pakistan and Philippines.

JEL Classification: C32, E51, O10

Key Words: Asia, credit, causality, finance, growth

1. Introduction

A large number of studies have analysed the relationship between financial sector development and economic growth. These studies have included both time series and cross section data. The main objective of this study is to examine the relationship between financial sector development and economic growth for the following Asian countries: India, Japan, Korea, Malaysia, Pakistan, Philippines, Sri Lanka and Thailand. A number of features distinguish this study from all other existing time series studies. First, we test for the presence of unit root(s) before proceeding with the estimation. Second, we employ a much longer time series data set. Third, we perform multivariate causality tests which no other previous studies have undertaken. If the evidence suggests that causality exists from financial sector development to economic growth then this has direct policy implications. Generally, the literature thus far has implied that a more efficient financial system will provide "better" financial services which will enable an economy to increase its real GDP growth rate. Therefore, establishing appropriate financial sector policies are of paramount importance to policymakers. Such policies, it is argued, will ameliorate market failures – by providing services that facilitate transactions, mobilize capital, exert corporate governance – which are important for economic growth. Our sample includes seven developing countries and a developed country (Japan). The inclusion of Japan is to determine whether there is a difference in the relationship between financial sector development and economic growth in Japan versus other developing Asian countries.

2. Theoretical and Empirical Literature Review

A large and diverse body of theoretical and empirical literature has investigated the importance of the financial sector for economic growth. This work can be traced as far back as Bagehot (1873), Schumpeter (1912) and Hicks (1969). More recent work includes Levine (1998), King and Levine (1993a, 1993b), Rousseau and Wachtel (1998), Rajan and Zingales (1998), and Okedokun (1998). Bagehot (1873) and Hicks (1969), for example, argued that the financial system was an important catalyst in the industrialization of England by facilitating the movement of large amounts of funds for "immense" works. Bagehot (1873, pp. 3-4) observed:

> "We have entirely lost the idea that any undertaking likely to pay, and seen to be likely, can perish for want of money; yet no idea was more familiar to our ancestors, or is more common in most countries. A citizen of London in Queen Elizabeth's time … would have thought that it was no use inventing railways (if he could have understood what a railway meant), for you would have not been able to collect the capital with which to make them. At this moment, in colonies and all rude economies, there is no large sum of transferable money; there is no fund from which you can borrow, and out of which you can make immense works."

Schumpeter's (1912) view is that a well functioning financial system would induce technological innovation by identifying, selecting and funding those entrepreneurs that would be expected to successfully implement their products and productive processes. Recently, King and Levine (1993a) found, by studying 80 countries over the period 1960-1989, the level of financial development to be a good predictor of economic growth. Furthermore, the lack of financial development could possibly induce some form of "poverty trap" because of the possible existence of multiple steady state equilibria (see Berthelemy and Varoudakis, 1996). Other economists however, have questioned the causal relationships established in the empirical studies. For example, Robinson (1952, p.86) claims that "where enterprise leads, finance

follows" – it is economic development which creates the demand for financial services not vice-versa. Moreover, Lucas (1988) has argued that economists "badly over stress" the importance of the financial system on economic growth – it is simply a "sideshow" for economic activity. Although various studies have questioned the causal nexus between financial development and economic growth, most theoretical and empirical reasoning suggests a positive first order relationship (Levine, 1997).

The financial sector – by identifying creditworthy firms, pooling risks, mobilizing savings, reallocating capital without loss via moral hazard, adverse selection or transactions costs – is important for the economic development of an economy. Levine (1997) categorizes the functions of a financial system into five basic tasks: "financial systems 1) facilitate the trading, hedging, diversifying, and pooling of risk, 2) allocate resources, 3) monitor managers and exert corporate control, 4) mobilize savings, and 5) facilitate the exchange of goods and services." Levine (1997, p.691).

There is however, considerable debate on the exact channels through which financial development induces economic growth (Gupta, 1984; Spears, 1992). The theorists can be subdivided into two broad schools of thought: (1) the structuralists and; (2) the repressionists. The structuralists contend that the quantity and composition of financial variables induces economic growth by directly increasing saving in the form of financial assets, thereby, encouraging capital formation and hence, economic growth (See Goldsmith, 1969; Gurley and Shaw 1955; Patrick, 1966; and Porter, 1966; Thornton, 1996; Demetriades and Luintel, 1996; Berthelemy and Varoudakis, 1998). Thus, factors such as financial deepening (i.e. depth and size of aggregate financial assets relative to GDP) and the composition of the aggregate financial

variables are important for economic growth. For example, Kwan, Wu and Zhang (1998) show, by employing exogeneity tests for several high performing Asian countries, that financial deepening has had a positive impact on output growth.

A recent extension of the "financial deepening" literature has been to incorporate the stock market as a measure of financial development. Levine and Zervos (1998),for example, found that stock market liquidity and banking development, for 47 countries from 1976-1993, had a positive effect on economic growth, capital accumulation and productivity, even after controlling for various other important factors such as, fiscal policy, openness to trade, education and political stability. Singh and Weisse (1998) recently examined stock market development and capital flows for less developed countries. Levine (1998), on a slightly different tangent, examined the relationship between the legal system, banking development and its impact on long run rates of growth, capital stock and productivity growth. In a related study, Jayratne and Strahan (1996) found that when intrastate banking restrictions were relaxed, real per capita GDP rose quite significantly.

The financial repressionists, led by, McKinnon (1973) and Shaw (1973) – often referred to as the "McKinnon–Shaw" hypothesis contend that financial liberalization in the form of an appropriate rate of return on real cash balances is a vehicle of promoting economic growth. The essential tenet of this hypothesis is that a low or negative real interest rate will discourage saving. This will reduce the availability of loanable funds for investment which in turn, will lower the rate of economic growth. Thus, the "McKinnon – Shaw" model posits that a more liberalized financial system will induce an increase in saving and investment and therefore, promote economic growth. Ahmed and Ansari (1995) investigated the "McKinnon – Shaw"

hypothesis for Bangladesh and found some, although weak, support for their hypothesis. They focus on price variables as the relevant financial factors for growth. Khan and Hasan (1998) in a recent study for Pakistan found strong support for the "McKinnon – Shaw" hypothesis. Further enhancements of this hypothesis were explored in the works of Galbis (1977); Mathieson (1980); Fry (1988) and Roubini and Sala-i-Martin (1992). Note however, the structuralists and the repressionists have a common underlying thread; that is, the efficient utilization of resources enhances economic growth. This is achieved via a highly organized, developed and liberated financial system.

Recently, there have been studies that have employed an endogenous growth approach. For example, Bencivenga and Smith (1991, p.196) employ an overlapping generations model and demonstrate that "an intermediation industry permits an economy to reduce the fraction of its savings held in the form of unproductive liquid assets, and to prevent misallocation of invested capital due to liquidity needs." Thus, economic growth is induced via the capital stock. Greenwood and Jovanovic (1990) employ a general equilibrium approach and conclude that as savers gain confidence in the ability of the financial intermediaries they place an increasing proportion of their savings with intermediaries. Greenwood and Smith (1997) use two models with endogenous growth formation and examine the way banks and stock markets allocate funds to the highest value user(s). King and Levine (1993b), employ an endogenous growth model in which the financial intermediaries obtain information about the quality of individual projects that is not readily available to private investors and public markets. This information advantage enables financial intermediaries to fund innovative products and productive processes, thereby inducing economic growth (also see, De La Fuente and Marin, 1994).

Although there is considerable empirical and theoretical literature that postulates a positive first order relationship between financial sector development and economic growth, it is somewhat surprising that empirical studies which attempt to establish causality by undertaking Granger-causality tests are few and far between. For example, Jung (1986), found bi-directional causality between financial and real variables using post-war data for 56 countries ,of which 19 are developed industrial economies. Demetriades and Hussein (1996), conducted causality tests and found little evidence that financial sector development causes economic growth. They found that causality patterns varied across countries. On the other hand, Wachtel (1995) argued that financial sector development Granger causes economic growth. It is also important to note that there are no empirical studies, that we are aware of, that undertake multivariate causality tests.

There is an underlying fundamental question that needs to be asked: Why are such studies important? It is clear that if causality can be established from financial sector development to economic growth then these studies have direct policy implications. The literature implies that a more efficient financial system will enable an economy to increase its real GDP growth rate. Thus, establishing appropriate financial sector policies is of paramount importance to policymakers. It is argued that these policies can ameliorate market failures by the provision of services which facilitate transactions, mobilize capital and exert corporate governance, thereby enhancing economic growth.

Data for the study was taken from the *International Financial Statistics* (1998) of the International Monetary Fund. Annual data are used as follows: India (1950-94), Japan (1955-

96), Korea (1953-97), Malaysia (1955-97), Pakistan (1960-97), Philippines (1948-97), Sri Lanka (1950-97) and Thailand (1951-97).

3. Methodology and Empirical Results

Following the previous literature, two types of analyses are performed. First, we estimate augmented production functions with the growth rates of the variables. Extensive unit root tests are performed before proceeding with the estimation. If we find at least one variable to be non-stationary, we perform regression analyses on the first difference of the growth rates of all variables. These first differences of the growth rates turn out to be stationary in all cases. Second, we perform multivariate causality tests with the growth rates of various variables. These variables are routinely used in the literature. However, while all previous studies use bivariate causality tests (which are computationally much easier), we use multivariate causality tests. Moreover, we perform the causality tests with the growth rates of the variables (we use logarithmic transformations of the variables so that the first differences of these variables give us the growth rates). Previous studies have employed variables in their levels to perform the causality tests (see Ahmed and Ansari, (1998) for example). However, these variables are almost invariably found to have unit roots in their levels. The causality tests are valid if the variables are stationary or they are cointegrated. Since the earlier studies have not tested for unit roots and for cointegration, it is possible that the estimated relationships are purely spurious. We perform extensive unit root tests before undertaking the causality tests. If a variable is found to have a unit root, we include the first difference of the variable in our causality tests (if the first difference of the variable is stationary).

The variables used in this study are as follows:

GLMR = Growth rate of money supply as a ratio of GDP (nominal)

GLPY = Growth rate of real per capita income

GLQMR = Growth rate of quasi-money as a ratio of GDP (nominal)

GLDCR = Growth rate of domestic credit as a ratio of GDP (nominal)

GLRGDP = Growth rate of real GDP

GLRINVR = Growth rate of real investment as a ratio of GDP

GLPOP = Growth rate of population

GLRM = Growth rate of real money supply

GLRDC = Growth rate of real domestic credit

GLRBM = Growth rate of real broad money

We use gross fixed capital formation as a measure of investment. Money supply is defined as the sum of currency and demand deposits (other than those of the central government). Quasi-money includes time, savings and currency deposits of resident sectors other than the central government. Finally, broad money is the sum of money supply and quasi-money. These definitions are the same as those used by the *International Financial Statistics* (1998). Money supply and broad money are, roughly speaking, M1 and M2 respectively.

Before we proceed with our analysis, we perform the unit root tests on the above variables. We use the Augmented Dickey-Fuller (ADF) (see Dickey and Fuller (1979) and (1981)) test which estimates the following equation:

$$\Delta y_t = c_1 + \omega y_{t-1} + c_2\, t + \sum_{i=1}^{r} d_i\, \Delta y_{t-i} + \nu_t \qquad (1)$$

In (1), $\{y_t\}$ is the relevant time series, Δ is a first-difference operator, t is a linear trend and ν_t is the error term. The above equation can also be estimated without including a trend term (by deleting the term c_2 t in the above equation). The null hypothesis of the existence of a unit root is H_0: $\omega = 0$. The results of the unit root tests for India, Japan, Korea, Malaysia, Pakistan, Philippines, Sri Lanka and Thailand are given in Tables 1 to 8. For each of the variables the unit root tests are performed with both a trend and without a trend. We use the Akaike Information Criterion (AIC) to determine the lag length. For India, no variable shows evidence of presence of a unit root. For Japan, GLRINVR, GLPOP and GLQMR show evidence of the presence of unit roots. For Korea, GLQMR, GLPOP, GLRM and GLRQM show such evidence. For Malaysia, GLRBM
shows evidence of a unit root. For Pakistan, none of the variables show any evidence of a unit root. For the Philippines, GLPY, GLPOP and GLRM show evidence of a unit root. For Sri Lanka, only GLPOP shows any such evidence while for Thailand, GLPY, GLRINVR and GLPOP do so. Some of these variables will be used for causality tests while other variables will be used for regression analyses.

For the regression analyses, we estimate the following equation for each country:

GLRGDP = f(GLRINVR, GLPOP, GLRM or GLQMR or GLDCR or GLRBM)

where all the variables are as previously defined. Thus, for each country, we estimate four regressions. We use OLS when the D-W statistic does not indicate any problem with serial

correlation. When serial correlation poses a problem, we use the Cochrane-Orcutt (1949) autoregressive method. The results of these regressions for the 8 countries are given in Tables 9 to 16. As noted earlier, in cases where at least one of the variables is non-stationary, we perform the regressions on the first differences of all variables. We get a variety of results. For India, GLRM (the money supply variable) is significant at the 1% level and GLRQM (the quasi-money supply variable) is significant at the 5% level. However, GLRDC (the domestic credit variable) is not significant even though it has the expected sign. GLRINVR (the investment variable) has a negative sign in all four regressions, contrary to expectations. GLPOP (the population variable) has a negative sign in two of the regressions, again contrary to expectations. For Japan, all the financial variables have negative signs while the investment variable is highly significant in all cases. For Korea, the results are fairly similar to that of Japan. For Malaysia, the financial variables have a positive sign in all cases and the coefficients are significant at least at the 5% level in three cases. However, the investment variable shows a negative sign even though it is not significant in any of the cases. For Pakistan, the financial variables have the expected signs in all cases and the variables are significant at the 5% level in three cases. Population variable has a positive sign in all cases. For Philippines, the financial variables are not significant in any of the four regressions and in two cases, these variables have a negative sign. The investment variable is significant at the 1% level in all cases. For Sri Lanka, the financial variables are significant at least at the 5% level in three cases. However, the domestic credit variable has a negative sign. The investment variable has a negative sign in all cases. For Thailand, none of the financial variables are significant and in two cases, these variables have negative signs. The investment variable is significant at the 5% level in all cases.

It is clear from the above that no generalizations can be made about the effects of the financial variables on economic growth for the countries under study. While for some countries, the financial variables seem to be very important, for other countries, they are not so. However, these regressions do not say much about causality. Thus, we also employ the block Granger non-causality tests (Granger, 1969). Consider the augmented vector autoregressive model:

$$z_t = a_0 + a_1 t + \sum_{i=1}^{p} \phi_i z_{t-i} + \Psi w_t + u_t \qquad (2)$$

where z_t is an m x 1 vector of jointly determined (endogenous) variables, t is a linear time trend, w_t is q x 1 vector of exogenous variables, and u_t is an m x 1 vector of unobserved disturbances. Let $z_t = (z'_{1t}, z'_{2t})'$, where z'_{1t} and z'_{2t} are
m_1 x 1 and m_2 x 1 subsets of z_t, and $m = m_1 + m_2$. We can now have the block decomposition of (3) as follows:

$$z_{1t} = a_{10} + a_{11} t + \sum_{i=1}^{p} \phi_{i,11} z_{1,t-i} + \sum_{i=1}^{p} \phi_{i,12} z_{2,t-i} + \Psi_1 w_t + u_{1t} \qquad (3)$$

$$z_{2t} = a_{20} + a_{21} t + \sum_{i=1}^{p} \phi_{i,21} z_{1,t-i} + \sum_{i=1}^{p} \phi_{i,22} z_{2,t-i} + \Psi_2 w_t + u_{2t} \qquad (4)$$

The hypothesis that the subset z_{2t} do not 'Granger cause' z_{1t} is given by
$H_G: \phi_{12} = 0$ where $\phi_{12} = (\phi_{1,12}, \phi_{2,12} \ldots, \phi_{1p,12})$.

We follow the previous studies in choosing the variables for causality tests. The following variables are used: GLPY, GLRGDP, GLMR, GLQMR, and GLDCR. These

variables are as defined earlier. While the first two variables are measures of income, the last three variables are financial variables (ratios). We use nominal ratios following previous literature. However, while previous studies use variables in their levels, we use the growth rates since in all cases the variables in their levels turn out to be non-stationary.

The results of the multivariate causality tests are given in Tables 17 to 24. The probability in the tables refers to the probability of accepting the null hypothesis of no causality. Again, we get a variety of results for various countries. For India, we find a two-way causality between the income variables and the financial variables. For Japan, there is sufficient evidence that the financial variables cause the income variables. However, there is less evidence of the reverse causality. For Korea, there is more evidence that income variables cause the financial variables. There is much less evidence in the reverse direction. Thus, Korea's results are exactly the opposite of Japan's. For Malaysia, the results are similar to that of India in that we find evidence of a two-way causality between the income variables and the financial variables. For Pakistan, per capita income variable (GLPY) is found to be causing the financial variable but not vice versa. For Philippines, there is some evidence that the GGLPY (the growth rate of GLPY) causes GLMR (money supply variable) and GLQMR (quasi-money supply variable). However, causality does not flow in any direction in any of the other cases. For Sri Lanka, there is hardly any evidence of causality in any direction. For Thailand, there is some evidence that the causality flows from the financial variables to the income variables.

4. Conclusion

The empirical results show a positive and significant relationship between the income and financial variables for India, Malaysia, Pakistan and Sri Lanka. The multivariate causality empirical results are mixed. For example, the multivariate causality tests for India and Malaysia the evidence suggests a two-way relationship between the income and financial variables. The results for Japan and Thailand suggests a one-way relationship, whilst for Korea, Pakistan and Phillipines the empirical analysis suggests a reverse causality. For Sri Lanka, there is little evidence of causality in either direction. Therefore, the most important implication that we can deduce from this empirical analysis is that we cannot generalize, as quite a number of cross section and time series studies have done, about the importance between the income and financial variables.

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TABLE 1. UNIT ROOT TESTS FOR INDIA

	Without Trend	With Trend
GLMR	-5.7354(3)	-6.1376(3)
GLPY	-9.5843(0)	-4.9399(3)
GLQMR	-6.5013(0)	-6.4319(0)
GLDCR	-9.9172(0)	-9.7916(0)
GLRGDP	-9.6437(0)	-5.1291(3)
GLRINVR	-3.7039(4)	-6.0872(2)
GLPOP	-4.6447(0)	-4.9498(0)
GLRM	-7.2063(1)	-5.5931(3)
GLRQM	-4.8535(0)	-4.7865(0)
GLRDC	-9.1823(0)	-9.0569(0)
GLRBM	-4.9461(1)	-5.2954(1)

Note: Lags in parentheses were determined using Akaike Information Criterion (AIC). The critical values for 5% level are –2.9378 and –3.5279 for without trend and with trend respectively.
*Indicates the presence of a unit root.

TABLE 2. UNIT ROOT TESTS FOR JAPAN

	Without Trend	With Trend
GLMR	-4.8597(0)	-4.8000(0)
GLPY	-3.5867(0)	-4.0577(0)
GLQMR	-4.4666(1)	-4.5313(1)
GLDCR	-4.1768(3)	-4.3105(3)
GLRGDP	-3.4582(0)	-4.1436(0)
GLRINVR	-3.3262(0)	-3.5209(0)*
GLPOP	-0.3964(0)*	-2.0926(0)*
GLRM	--3.6833(0)	-3.7946(0)
GLRQM	-2.8611(0)*	-3.6221(0)
GLRDC	-3.0269(0)	-5.6461(0)
GLRBM	-3.0269(0)	-3.9736(1)

Note: Lags in parentheses were determined using Akaike Information Criterion (AIC). The critical values for 5% level are –2.9446 and –3.5386 for without trend and with trend respectively.
*Indicates the presence of a unit root.

TABLE 3. UNIT ROOT TESTS FOR KOREA

	Without Trend	With Trend
GLMR	-5.5167(0)	-5.4926(0)
GLPY	-4.7365(0)	-4.9774(0)
GLQMR	-2.6445(2)*	-3.5702(3)
GLDCR	-5.8870(1)	-5.8026(1)
GLRGDP	-5.0168(0)	-4.9678(0)
GLRINVR	-5.2514(1)	-5.3296(1)
GLPOP	-0.9397(2)*	-4.8158(0)
GLRM	-4.9093(1)	-4.8553(1)
GLRQM	-2.7538(2)*	-3.2426(2)*
GLRDC	-7.2073(0)	-7.1291(0)
GLRBM	-3.7020(4)	-3.7220(4)

Note: Lags in parentheses were determined using Akaike Information Criterion (AIC). The critical values for 5% level are –2.9378 and –3.5279 for without trend and with trend respectively.
*Indicates the presence of a unit root.

TABLE 4. UNIT ROOT TESTS FOR MALAYSIA

	Without Trend	With Trend
GLMR	-6.5650(1)	-7.1909(1)
GLPY	-6.4292(1)	-6.4325(1)
GLQMR	-6.1356(1)	-6.4422(1)
GLDCR	-6.7951(0)	-5.3886(3)
GLRGDP	-6.3411(1)	-6.3531(1)
GLRINVR	-4.1565(2)	-4.1342(2)
GLPOP	-7.8816(0)	-7.9473(0)
GLRM	-5.1880(1)	-5.9290(1)
GLRQM	-4.8342(0)	-4.7032(0)
GLRDC	-4.2446(2)	-4.0452(2)
GLRBM	-2.5336(3)*	-2.7442(2)*

Note: Lags in parentheses were determined using Akaike Information Criterion (AIC). The critical values for 5% level are –2.9422 and –3.5348 for without trend and with trend respectively.
*Indicates the presence of a unit root.

TABLE 5. UNIT ROOT TESTS FOR PAKISTAN

	Without Trend	With Trend
GLMR	-4.9234(4)	-4.8540(4)
GLPY	-5.3791(1)	-5.5032(1)
GLQMR	-4.3054(0)	-4.2327(0)
GLDCR	-5.2715(1)	-5.3335(1)
GLRGDP	-4.9533(0)	-5.0924(0)
GLRINVR	-4.9153(1)	-4.8457(1)
GLPOP	-5.6735(0)	-5.8324(0)
GLRM	-4.7171(1)	-4.6443(1)
GLRQM	-4.1352(0)	-4.0651(0)
GLRDC	-4.8714(1)	-4.7983(1)
GLRBM	-4.9975(1)	-4.9309(1)

Note: Lags in parentheses were determined using Akaike Information Criterion (AIC). The critical values for 5% level are –2.9558 and –3.5562 for without trend and with trend respectively.
*Indicates the presence of a unit root.

TABLE 6. UNIT ROOT TESTS FOR PHILIPPINES

	Without Trend	With Trend
GLMR	-8.7529(0)	-8.9567(0)
GLPY	-3.3804(0)	-3.2316(0)*
GLQMR	-4.7866(2)	-4.7170(2)
GLDCR	-5.2277(0)	-5.1700(0)
GLRGDP	-3.3088(0)	-3.1850(0)*
GLRINVR	-4.7399(0)	-4.7313(0)
GLPOP	-1.1422(3)*	-7.1051(0)
GLRM	-7.4705(0)	-7.3975(0)
GLRQM	-2.2849(4)*	-2.1091(4)*
GLRDC	-4.8877(0)	-4.8190(0)
GLRBM	-5.6281(0)	-5.6090(0)

Note: Lags in parentheses were determined using Akaike Information Criterion (AIC). The critical values for 5% level are –2.9287 and –3.5136 for without trend and with trend respectively.
*Indicates the presence of a unit root.

TABLE 7. UNIT ROOT TESTS FOR SRI LANKA

	Without Trend	With Trend
GLMR	-5.3841(1)	-5.3699(1)
GLPY	-5.8354(0)	-5.9067(0)
GLQMR	-5.3990(0)	-5.5157(0)
GLDCR	-5.0840(0)	-6.0567(0)
GLRGDP	-6.1088(0)	-6.0409(0)
GLRINVR	-4.9936(0)	-5.6741(0)
GLPOP	-1.1456(2)*	-5.8350(0)
GLRM	-5.6626(1)	-5.6040(1)
GLRQM	-5.1594(0)	-5.2145(0)
GLRDC	-4.4792(0)	-5.2797(0)
GLRBM	-4.9291(0)	-4.8667(0)

Note: Lags in parentheses were determined using Akaike Information Criterion (AIC). The critical values for 5% level are –2.9320 and –3.5189 for without trend and with trend respectively.
*Indicates the presence of a unit root.

TABLE 8. UNIT ROOT TESTS FOR THAILAND

	Without Trend	With Trend
GLMR	-5.9752(1)	-5.9632(1)
GLPY	-2.3271(1)*	-2.6135(3)*
GLQMR	-3.1065(3)	-6.1191(2)
GLDCR	-4.1683(0)	-4.3230(0)
GLRGDP	-3.4147(0)	-3.2423(0)*
GLRINVR	-3.4141(1)	-3.4803(1)*
GLPOP	-0.1244(3)*	-5.4260(0)
GLRM	-4.7667(1)	-4.8152(1)
GLRQM	-3.1750(3)	-6.5421(2)
GLRDC	-4.1891(0)	-4.4336(0)
GLRBM	-4.3131(0)	-5.1399(1)

Note: Lags in parentheses were determined using Akaike Information Criterion (AIC). The critical values for 5% level are –2.9339 and –3.5217 for without trend and with trend respectively.
*Indicates the presence of a unit root.

TABLE 9. REGRESSION RESULTS FOR INDIA

	Regression 1	Regression 2	Regression 3	Regression 4
GLRINVR	-0.1669*	-0.0411	-0.0078	-0.1780**
	(-2.4831)	(-0.5983)	(-0.1106)	(-2.6519)
GLPOP	1.9414	-0.1927	0.7394	-1.5946
	(0.9163)	(-0.0763)	(0.2662)	(-0.7440)
GLRM	0.4528**			
	(4.5053)			
GLRQM		0.1596*		
		(2.0924)		
GLRDC			0.0036	
			(0.0779)	
GLRBM				0.5211**
				(4.6739)
CONS.	-0.0252	0.0286	0.0252	0.0358
	(-0.5464)	(0.5411)	(0.4313)	(0.8066)
$\overline{R}^2$	0.41	0.19	0.10	0.43
Technique	AR(1)	AR(1)	AR(1)	AR(1)

T-ratios are in parentheses.
**Significant at the 1% level.
*Significant at the 5% level.

TABLE 10. REGRESSION RESULTS FOR JAPAN

	Regression 1	Regression 2	Regression 3	Regression 4
GLRINVR	0.5469**	0.5801**	0.5572**	0.5689**
	(11.3667)	(11.4965)	(11.6309)	(11.4409)
GLPOP	0.6316	1.6952	-0.1187	1.4138
	(0.1983)	(0.5404)	(-0.0377)	(0.4467)
GLRM	-0.0237			
	(-0.5824)			
GLRQM		-0.1082		
		(-1.7589)		
GLRDC			-0.0344	
			(-1.2637)	
GLRBM				-0.0878
				(-1.4551)
CONS.	-0.0034	-0.0009	-0.0006	-0.0006
	(-0.1504)	(-0.3374)	(-0.2297)	(-0.2281)
$\overline{R}^2$	0.77	0.79	0.78	0.78
Technique	OLS	OLS	OLS	OLS

T-ratios are in parentheses.
**Significant at the 1% level.

*Significant at the 5% level.
Note: All regressions are in the first differences of the mentioned variables.

TABLE 11. REGRESSION RESULTS FOR KOREA

	Regression 1	Regression 2	Regression 3	Regression 4
GLRINVR	0.1197*	0.1207**	0.0902**	0.1452**
	(2.4855)	(3.2224)	(2.7331)	(3.0464)
GLPOP	-0.6496	-0.2751	-0.4864	-0.3039
	(-0.3901)	(-0.1831)	(-0.3015)	(-0.1939)
GLRM	-0.0513			
	(-0.8885)			
GLRQM		-0.0305		
		(-1.4984)		
GLRDC			-0.0018	
			(-0.0822)	
GLRBM				-0.8812
				(-1.5861)
CONS.	0.0003	0.0002	0.0004	0.0002
	(0.0119)	(0.0942)	(0.1470)	(0.0723)
$\overline{R}^2$	0.39	0.41	0.38	0.42
Technique	AR(2)	AR(2)	AR(2)	AR(2)

T-ratios are in parentheses.
**Significant at the 1% level.
*Significant at the 5% level.
Note: All regressions are in the first differences of the mentioned variables.

TABLE 12. REGRESSION RESULTS FOR MALAYSIA

	Regression 1	Regression 2	Regression 3	Regression 4
GLRINVR	-0.0577	-0.0396	-0.0749	-0.0817
	(-0.5547)	(-0.3611)	(-0.6868)	(-0.6010)
GLPOP	1.6929	1.4192	2.2069	1.9631
	(0.9731)	(0.7710)	(1.2074)	(1.1437)
GLRM	0.3064**			
	(2.9389)			
GLRQM		0.2795*		
		(2.0304)		
GLRDC			0.1417*	
			(2.1518)	
GLRBM				0.2882
				(1.5897)
CONS.	-0.0017	-0.0071	-0.0123	0.0016
	(-0.0342)	(-0.1377)	(-0.2397)	

$\overline{R}^2$	0.15	0.06	0.07	0.32
Technique	OLS	OLS	OLS	AR(2)

T-ratios are in parentheses.
**Significant at the 1% level.
*Significant at the 5% level.
Note: Regression 4 is in the first differences of the mentioned variables.

TABLE 13. REGRESSION RESULTS FOR PAKISTAN

	Regression 1	Regression 2	Regression 3	Regression 4
GLRINVR	0.0199	0.0416	-0.0232	0.0124
	(0.3475)	(0.7029)	(-0.3827)	(0.2118)
GLPOP	0.0706	0.0467	0.0679	0.0652
	(1.3857)	(0.9032)	(1.4026)	(1.2976)
GLRM	0.1249*			
	(2.0249)			
GLRQM		0.0412		
		(1.0303)		
GLRDC			0.1784**	
			(2.6510)	
GLRBM				0.1391*
				(2.0780)
CONS.	0.0436**	0.0480**	0.0353**	0.0411**
	(5.5505)	(5.8841)	(3.8998)	(4.8167)
$\overline{R}^2$	0.09	0.01	0.16	0.10
Technique	OLS	OLS	OLS	OLS

T-ratios are in parentheses.
**Significant at the 1% level.
*Significant at the 5% level.

TABLE 14. REGRESSION RESULTS FOR PHILIPPINES

	Regression 1	Regression 2	Regression 3	Regression 4
GLRINVR	0.1304**	0.1156**	0.1436**	0.1142**
	(6.6418)	(6.7652)	(7.7546)	(5.9571)
GLPOP	1.1828	0.9325	0.9612	0.9307
	(1.2983)	(1.0312)	(1.1074)	(0.9954)
GLRM	-0.0133			
	(-0.5403)			
GLRQM		0.0300		
		(1.4633)		
GLRDC			-0.0340	
			(-1.8389)	
GLRBM				0.0362
				(1.2001)

CONS.	-0.0001	-0.0002	-0.0001	
	(-0.0379)	(-0.0835)	(-0.0242)	
$\overline{R}^2$	0.57	0.59	0.60	0.58
Technique	AR(1)	AR(1)	AR(1)	AR(1)

T-ratios are in parentheses.
**Significant at the 1% level.
*Significant at the 5% level.
Note: All regressions are in the first differences of the mentioned variables.

TABLE 15. REGRESSION RESULTS FOR SRI LANKA

	Regression 1	Regression 2	Regression 3	Regression 4
GLRINVR	-0.1349**	-0.1411**	-0.1547**	-0.1489**
	(2.9053)	(-2.7306)	(-2.7622)	(-3.0777)
GLPOP	1.6321	0.7773	3.2356	2.6378
	(0.8052)	(0.3751)	(1.5224)	(1.3218)
GLRM	0.1792**			
	(2.8997)			
GLRQM		0.1085*		
		(2.4995)		
GLRDC			-0.0155	
			(-0.2790)	
GLRBM				0.2198**
				(3.2835)
CONS.	0.0005	0.0005	0.0011	0.0007
	(0.0960)	(0.1772)	(0.2786)	(0.1887)
$\overline{R}^2$	0.43	0.48	0.36	0.50
Technique	AR(1)	AR(3)	AR(2)	AR(2)

T-ratios are in parentheses.
**Significant at the 1% level.
*Significant at the 5% level.
Note: All regressions are in the first differences of the mentioned variables.

TABLE 16. REGRESSION RESULTS FOR THAILAND

	Regression 1	Regression 2	Regression 3	Regression 4
GLRINVR	0.0442*	0.0729*	0.0779*	0.0585*
	(2.1793)	(2.0733)	(2.1056)	(2.0055)
GLPOP	0.2947	0.2209	0.2193	0.2058
	(0.4064)	(0.2905)	(0.2865)	(0.2702)
GLRM	0.1227			
	(1.9731)			
GLRQM		-0.0066		
		(-0.1389)		
GLRDC			-0.0172	
			(-0.4036)	

GLRBM				0.0565
				(0.5582)
CONS.	-0.0008	-0.0012	-0.0011	-0.0001
	(-0.3154)	(-0.4140)	(-0.3906)	(-0.4135)
$\overline{R}^2$	0.34	0.28	0.28	0.28
Technique	AR(2)	AR(2)	AR(2)	AR(2)

T-ratios are in parentheses.
******Significant at the 1% level.
*****Significant at the 5% level.
Note: All regressions are in the first differences of the mentioned variables.

TABLE 17. MULTIVARIATE GRANGER CAUSALITY TESTS FOR INDIA

Cause	Effect	Test Stat.(*)	Probability(**)
GLPY	GLMR, GLQMR, GLDCR	30.7(2)	.000(6)
GLMR, GLQMR, GLDCR	GLPY	21.7(2)	.001(6)
GLMR, GLDCR	GLPY, GLQMR	39.8(2)	.000(8)
GLMR, GLQMR	GLPY, GLDCR	47.0(2)	.000(8)
GLRGDP	GLMR, GLQMR, GLDCR	30.0(2)	.000(6)
GLMR, GLQMR, GLDCR	GLRGDP	11.2(2)	.083(6)
GLMR, GLDCR	GLRGDP, GLQMR	40.4(2)	.000(8)
GLMR, GLQMR	GLRGDP, GLDCR	41.0(2)	.000(8)
GLPY	GLMR, GLQMR	14.9(2)	.005(4)
GLMR, GLQMR	GLPY	16.6(2)	.002(4)

Note: The test statistic indicates the chi-square value. The probability refers to the probability of accepting the null hypothesis of no causality.
*indicates the number of lags which was determined by using the Akaike Information Criterion (AIC).
**indicates the degrees of freedom of the chi-square.

TABLE 18 . MULTIVARIATE GRANGER CAUSALITY TESTS FOR JAPAN

Cause	Effect	Test Stat.(*)	Probability(**)
GLPY	GLMR, GLQMR, GLDCR	4.31(2)	.634(6)
GLMR, GLQMR, GLDCR	GLPY	33.3(2)	.000(6)
GLMR, GLDCR	GLPY, GLQMR	20.1(2)	.010(8)
GLMR, GLQMR	GLPY, GLDCR	35.5(2)	.000(8)
GLRGDP	GLMR, GLQMR, GLDCR	4.30(2)	.636(6)
GLMR, GLQMR, GLDCR	GLRGDP	33.0(2)	.000(6)
GLMR, GLDCR	GLRGDP, GLQMR	19.7(2)	.012(8)
GLMR, GLQMR	GLRGDP, GLDCR	35.1(2)	.000(8)
GLPY	GLMR, GLQMR	0.20(1)	.904(2)
GLMR, GLQMR	GLPY	17.6(1)	.000(2)

Note: The test statistic indicates the chi-square value. The probability refers to the probability of accepting the null hypothesis of no causality.
*indicates the number of lags which was determined by using the Akaike Information Criterion (AIC).
**indicates the degrees of freedom of the chi-square.

TABLE 19 . MULTIVARIATE GRANGER CAUSALITY TESTS FOR KOREA

Cause	Effect	Test Stat.(*)	Probability(**)
GLPY	GLMR, GLQMR, GLDCR	20.1(3)	.017(9)
GLMR, GLQMR, GLDCR	GLPY	11.0(3)	.274(9)
GLMR, GLDCR	GLPY, GLQMR	28.3(3)	.005(12)
GLMR, GLQMR	GLPY, GLDCR	45.4(3)	.000(12)
GLRGDP	GLMR, GLQMR, GLDCR	18.5(3)	.030(9)
GLMR, GLQMR, GLDCR	GLRGDP	11.7(3)	.229(9)
GLMR, GLDCR	GLRGDP, GLQMR	27.6(3)	.006(12)
GLMR, GLQMR	GLRGDP, GLDCR	45.1(3)	.000(12)
GLPY	GLMR, GLQMR	9.31(3)	.157(6)
GLMR, GLQMR	GLPY	6.31(3)	.389(6)

Note: The test statistic indicates the chi-square value. The probability refers to the probability of accepting the null hypothesis of no causality.
*indicates the number of lags which was determined by using the Akaike Information Criterion (AIC).
**indicates the degrees of freedom of the chi-square.

TABLE 20. MULTIVARIATE GRANGER CAUSALITY TESTS FOR MALAYSIA

Cause	Effect	Test Stat.(*)	Probability(**)
GLPY	GLMR, GLQMR, GLDCR	27.8(2)	.000(6)
GLMR, GLQMR, GLDCR	GLPY	19.1(2)	.004(6)
GLMR, GLDCR	GLPY, GLQMR	28.7(2)	.000(8)
GLMR, GLQMR	GLPY, GLDCR	21.6(2)	.006(8)
GLRGDP	GLMR, GLQMR, GLDCR	26.4(2)	.000(6)
GLMR, GLQMR, GLDCR	GLRGDP	19.8(2)	.003(6)
GLMR, GLDCR	GLRGDP, GLQMR	29.1(2)	.000(8)
GLMR, GLQMR	GLRGDP, GLDCR	21.5(2)	.006(8)
GLPY	GLMR, GLQMR	0.06(2)	.970(2)
GLMR, GLQMR	GLPY	4.22(2)	.122(2)

Note: The test statistic indicates the chi-square value. The probability refers to the probability of accepting the null hypothesis of no causality.
*indicates the number of lags which was determined by using the Akaike Information Criterion (AIC).
**indicates the degrees of freedom of the chi-square.

TABLE 21 . MULTIVARIATE GRANGER CAUSALITY TESTS FOR PAKISTAN

Cause	Effect	Test Stat.(*)	Probability(**)
GLPY	GLMR, GLQMR, GLDCR	21.4(2)	.002(60
GLMR, GLQMR, GLDCR	GLPY	5.12(2)	.528(6)
GLMR, GLDCR	GLPY, GLQMR	6.29(2)	.615(8)
GLMR, GLQMR	GLPY, GLDCR	6.08(2)	.638(8)
GLRGDP	GLMR, GLQMR, GLDCR	2.97(1)	.397(3)
GLMR, GLQMR, GLDCR	GLRGDP	5.51(1)	.138(3)
GLMR, GLDCR	GLRGDP, GLQMR	10.2(1)	.037(4)
GLMR, GLQMR	GLRGDP, GLDCR	8.17(1)	.086(4)
GLPY	GLMR, GLQMR	19.5(2)	.001(4)
GLMR, GLQMR	GLPY	4.54(2)	.338(4)

Note: The test statistic indicates the chi-square value. The probability refers to the probability of accepting the null hypothesis of no causality.
*indicates the number of lags which was determined by using the Akaike Information Criterion (AIC).
**indicates the degrees of freedom of the chi-square.

TABLE 22. MULTIVARIATE GRANGER CAUSALITY TESTS FOR PHILIPPINES

Cause	Effect	Test Stat.(*)	Probability(**)
GGLPY	GLMR, GLQMR, GLDCR	5.76(1)	.124(3)
GLMR, GLQMR, GLDCR	GGLPY	4.21(1)	.240(3)
GLMR, GLDCR	GGLPY, GLQMR	4.35(1)	.361(4)
GLMR, GLQMR	GGLPY, GLDCR	7.14(1)	.128(4)
GGLRGDP	GLMR, GLQMR, GLDCR	6.80(1)	.079(3)
GLMR, GLQMR, GLDCR	GGLRGDP	4.03(1)	.258(4)
GLMR, GLDCR	GGLRGDP, GLQMR	4.03(1)	.402(4)
GLMR, GLQMR	GGLRGDP, GLDCR	6.65(1)	.156(4)
GGLPY	GLMR, GLQMR	5.70(1)	.058(2)
GLMR, GLQMR	GGLPY	4.18(1)	.123(2)

Note: The test statistic indicates the chi-square value. The probability refers to the probability of accepting the null hypothesis of no causality. GGLPY and GGLRGDP stand for the first differences of GLPY and GLRGRDP respectively.
*indicates the number of lags which was determined by using the Akaike Information Criterion (AIC).
**indicates the degrees of freedom of the chi-square.

TABLE 23. MULTIVARIATE GRANGER CAUSALITY TESTS FOR SRI LANKA

Cause	Effect	Test Stat.(*)	Probability(**)
GLPY	GLMR, GLQMR, GLDCR	5.88(2)	.436(6)
GLMR, GLQMR, GLDCR	GLPY	8.52(2)	.202(6)
GLMR, GLDCR	GLPY, GLQMR	9.51(2)	.301(8)
GLMR, GLQMR	GLPY, GLDCR	7.20(2)	.515(8)
GLRGDP	GLMR, GLQMR, GLDCR	7.00(2)	.321(6)
GLMR, GLQMR, GLDCR	GLRGDP	7.72(2)	.260(6)
GLMR, GLDCR	GLRGDP, GLQMR	9.37(2)	.312(8)
GLMR, GLQMR	GLRGDP, GLDCR	6.88(2)	.550(8)
GLPY	GLMR, GLQMR	3.70(1)	.157(2)
GLMR, GLQMR	GLPY	0.96(1)	.619(2)

Note: The test statistic indicates the chi-square value. The probability refers to the probability of accepting the null hypothesis of no causality.
*indicates the number of lags which was determined by using the Akaike Information Criterion (AIC).
**indicates the degrees of freedom of the chi-square.

TABLE 24. MULTIVARIATE GRANGER CAUSALITY TESTS FOR THAILAND

Cause	Effect	Test Stat.(*)	Probability(**)
GGLPY	GLMR, GLQMR, GLDCR	0.99(1)	.803(3)
GLMR, GLQMR, GLDCR	GGLPY	6.63(1)	.085(3)
GLMR, GLDCR	GGLPY, GLQMR	10.9(1)	.028(4)
GLMR, GLQMR	GGLPY, GLDCR	7.11(1)	.130(4)
GLRGDP	GLMR, GLQMR, GLDCR	1.22(1)	.748(3)
GLMR, GLQMR, GLDCR	GLRGDP	3.69(1)	.297(3)
GLMR, GLDCR	GLRGDP, GLQMR	5.30(1)	.258(4)
GLMR, GLQMR	GLRGDP, GLDCR	8.13(1)	.087(4)
GGLPY	GLMR, GLQMR	1.48(1)	.478(2)
GLMR, GLQMR	GGLPY	5.58(1)	.062(2)

Note: The test statistic indicates the chi-square value. The probability refers to the probability of accepting the null hypothesis of no causality. GGLPY stands for the first difference of GLPY.
*indicates the number of lags which was determined by using the Akaike Information Criterion (AIC).
**indicates the degrees of freedom of the chi-square.