Finance and growth in a small open emerging market

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Abstract: This study contributes to the debate on financial development and economic growth in Malaysia using quarterly observations for a sample period from 1980 to 2002. It utilises a battery of financial indicators. Based on multivariate framework which takes real interest rate and capital stock into account, the findings are suggestive that finance does play a crucial role in promoting economic growth. Policymakers should, therefore, focus their attention on the creation and promotion of modern financial institutions including banks, non-banks, and stock markets in delivering both short- and long-run economic benefits.

JEL Classification codes: O4O, G2O
Key words: financial development, economic growth, Malaysia

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I. Introduction

Ever since the seminal works by Patrick (1966) and Goldsmith (1969) – the financial development would support growth; the relationship between financial development and economic growth has remained an important issue in finance and economic development literature. According to Bencivenga and Smith (1991), financial markets can facilitate the transfer of productive capacity across agents and time from less productive users to those with greater potential. Using the simple AK production function, Pagano (1993) demonstrates that financial development can affect growth through the private saving rate; the proportion of savings channelled to productive investment; and may increase the marginal productivity of capital. Goodhart (2004), on the other hand, points out that the increased availability of financial instruments reduces transaction and information costs while larger and more efficient financial markets help economic agents hedge, trade, pool risk, raising investment and economic growth.

The advancement of econometrics techniques recently has helped the researchers to analyse the role of finance in determining growth, such as cross-country growth regressions, time series analyses and panel studies. By and large, empirical studies suggest that better functioning financial systems promote long-run economic growth (King and Levine, 1993a and 1993b; Demetriades and Hussein, 1996; Levine, 1997; Demirgüç-Kunt and Maksimovic, 1998, Beck *et al*. 2000). Levine (2003), Wachtel (2003) and Demetriades and Andrianova (2004) provide excellent overviews of a large body of empirical literature, as well as directions this area of research. By using panel data analysis, Beck and Levine (2004) find that stock markets and banks positively influence economic growth, and these findings are not due to potential biases induced by simultaneity, omitted variables or unobserved country specific effects.

Most of the empirical findings reveal that financial development is an important determinant of economic growth. Nevertheless, the interest of researchers is not only to examine the relationship between financial development and economic performance, but they are more likely to know the causal patterns between these two variables. For instance, do higher levels of financial development independently generate economic growth? Or does financial development come about only as a result of economic development? Patrick (1966) categorises the possible direction of causality as supply-leading and demand-following. Under the supply-leading hypothesis, the development of financial markets and their related services induce real investment and growth. Financial development therefore leads economic growth. Alternatively, under the demand-following hypothesis, the financial sector responds to increasing demand for their services resulting from the growing real economy. In other words, causality runs from economic growth to financial development.

King and Levine (1993a) do provide evidence to suggest that economies with more developed financial systems at the beginning of the period experienced, on average, more rapid growth. This finding supports the views of researchers who feel that financial development causes economic growth. However, the issue of causality remains due to the methodology techniques employed in the analysis. Demetriades and Hussein (1996) point out that causality patterns vary across countries, and therefore, highlight the dangers of statistical inference based on cross-country studies. Arestis and Demetriades (1997) demonstrate that the question of causality cannot satisfactorily be addressed in a cross-section framework due to the cross-country regressions can only refer to the 'average effect' of a variable across country. The researchers can only determine the unidirectional causality from financial evolution to economic development and they implicitly assumed that countries under study have a similar financial structure, population distribution, and technology level.

Since cross-country analysis do not resolve the issue of causality, the time-series approach is therefore still preferable to address the causality patterns. Several time-series studies, however, provide mixed empirical evidence. Demetriades and Hussein (1996) employ the cointegration and Granger causality tests to analyse the link between finance and growth within 16 developing countries. Two financial development indicators are employed, namely the ratio of bank deposit liabilities to GDP and the ratio of bank claims on the private sector to GDP. The empirical results suggest in general, there is a bidirectional causal effect (seven out of sixteen countries) between finance and growth. According to Arestis and Demetriades (1997) and Habibullah (1999), the finance-growth relationship need not be similar across countries. Shan *et al*. (2001) find little support to the hypothesis that financial development 'leads' economic growth in nine OECD countries and China. They also find evidence of reverse causality in some countries and bi-directional causality in others. However, Rousseau and Wachtel (1998) find evidence of one-way causality from financial development to economic growth.

Most of the above time series literature is criticised by Luintel and Khan (1999) for its bivariate nature. They believe that a time series study in finance-growth relationship should include the real interest rate and the capital stock to avoid misspecification. Luintel and Khan (1999), on the other hand, employ multivariate vector autoregressive (VAR) model to examine the long run relationship between finance and growth using the Johansen cointegration technique. In the 10 developing countries analysed, they find causality between finance and growth is not uni-directional, but rather than bi-directional for all countries.

The objective of this study is to examine the link between finance and economic growth in a small open emerging market of Malaysia during 1980 - 2002. In recent years, the Malaysian economy has been characterised by trends towards increased liberalisation, greater openness to world trade and higher degree of financial integration. The increased liberalisation and openness in 1990s have led to enormous flow of cross-border capital. Against the background of increased liberalisation of particularly the financial sector, financial development in the country has been remarkable.

Malaysia is a very interesting country for the link between finance and growth for at least two reasons. First, it has the highest financial market development among the emerging markets in terms of private sector credit and stock market capitalization. As depicted in Figures 1 and 2, Malaysia ranks the first in terms of both financial development indicators and real GDP growth rate as well among the emerging markets. These observations motivate us to explore the possible role of financial development in promoting the remarkable growth of Malaysian economy. Second, Malaysia has a rich history of financial sector reforms. A series of financial restructuring programs that aimed at improving the financial system had been launched since the 1970s. Immediately after the Asian financial crisis hit the country in 1997-98, a series of macroeconomic policy responses such as capital controls and reflationary policy has taken place. This was followed by restructuring in the corporate and banking sectors. Nevertheless, there is little empirical evidence providing the policy makers on the real sector.

<FIGURE 1 HERE>

<FIGURE 2 HERE>

This study departs from the earlier work in three respects. First, a battery of financial development indicators is employed in the analyses that represent banking sector development and stock market development. Second, this study used quarterly data covering the period of 1980:1 to 2002:4, during which financial deregulation and innovations have been prominent features in the Malaysian financial system. Among the important features are interest rate liberalisation, the emergence of bank and non-bank financial intermediaries and the offering of new financial instruments in the financial system. Finally, besides using the VAR model, the Toda and Yamamoto (1995) levels VAR is also employed in the analysis, where this technique has advantages irrespective whether the regressors are I(0) or I(1).

The rest of the paper is organized as follows. Section II explains the econometric techniques and the data employed in the analysis. Section III reports the estimation results and the last section presents conclusion and policy implication.

II. Methodology and the data

Model Specification

Following Luintel and Khan (1999), the model specification to examine the link between finance and growth is based on multivariate framework, which includes the real interest rate and capital stock variables to avoid mis-specification. The McKinnon (1973) - Shaw (1973) models and the endogenous growth literature predict that financial development to be a positive function of real income and the real interest rate, which can be specified as:

$$FD = f(RGDP, R) \tag{1}$$

where FD is financial development, RGDP is the real GDP per capita and R is the real interest rate (deflated by inflation). The real income is specified as a function of capital stock per capita following the standard AK production function:

$$RGDP = f(K) \tag{2}$$

where K is measured by the capital stock divided by total population.

Econometric Methodology

VAR Model

In this study, the VAR model consists of four variables, namely: financial development indicator (FD); economic growth (RGDP); capital stock (K) and real interest rate (R) is setup to examine the link between finance and economic growth. It is an econometric modelling used in a situation when one is dealing with relationship described by a system involving more than one equation. Since these four variables are interrelated, the VAR provides a very useful tool to capture the dynamic and interdependent relationship amongst these variables.

$$\begin{bmatrix} RGDP_t \\ R_t \\ K_t \\ FD_t^i \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{bmatrix} + \begin{bmatrix} \beta_{1,1}(L) & \cdots & \beta_{1,4}(L) \\ \vdots & \cdots & \vdots \\ \vdots & \cdots & \vdots \\ \beta_{4,1}(L) & \cdots & \beta_{4,4}(L) \end{bmatrix} \begin{bmatrix} RGDP_t \\ R_t \\ K_t \\ FD_t \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \end{bmatrix} \tag{3}$$

where i = five finance indicators.

The long-run relationships amongst the variables are investigated by the Johansen-Juselius (1990) multivariate cointegration test. The short-run relationships, on the other hand, are analyzed by the Granger-causality analysis with the vector error-correction model (VECM) to avoid problem of misspecification (see Granger, 1988). Otherwise, the analysis may be conducted as a standard vector autoregressive (VAR) model. One of the important criteria in setting up a VAR model is to select an appropriate lag structure for the estimation of the model. In this study, the lag length of the VAR model is determined by the likelihood ratio test as described in Sims (1980).

Multivariate Cointegration Test

Before conducting the cointegration test, it is necessary to examine the order of integration of individual series. To this end, four unit root test, namely the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski et al (1992) (henceforth, KPSS) unit root tests are applied to the levels and first differences of the variables. In addition, the Perron (1997) unit root under structural break is also employed.

After having determined the order of integration of each series, the maximum llikelihood multivariate cointegration test is then utilized to determine the number of linearly independent cointegrating vectors in the system. The cointegration analysis is conducted in a VAR model of nonstationary time series[1]:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \mu + \Theta t + \varepsilon_t , \tag{4}$$

where $\Pi = -\left(\mathrm{I} - \sum_{i=1}^{k} \Pi_i \right)$, and $\Gamma_i = -\left(\mathrm{I} - \sum_{j=1}^{i} \Pi_j \right)$, for $i = 1, \ldots, k-1$.

X_t is a vector of p variables (or p = 4 for this study), μ are the intercepts, t are deterministic trends and ε_t is a vector of Gaussian random variables. The coefficient matrix Π, is also referred to as the long-run impact matrix, contains information about the stationarity of the four variables and the long-run relationship amongst them. The rank (r) of the matrix determines the number of cointegrating vectors in the system. In the absence of cointegration, Π is a singular matrix (its rank, r = 0). Hence, in a cointegrated case, the rank of Π could be anywhere between zero. If = 1, there is a single cointegrating vector, whereas for 1 < r < 4, there are multiple cointegrating vectors. This is an indication that the

[1] A variable that is found to be stationary at level, or is I(0), is treated as an exogenous variable in the system.

variables in the system are cointegrated in the long run with r cointegrating vectors. In other words, these variables possess a long-run equilibrium relationship, and are moving together in the long run. The Π matrix can be factored as $\Pi = \alpha\beta^{T}$, where the α matrix contains the adjustment coefficients and the β matrix contains the cointegrating vectors. Johansen and Juselius approach uses two likelihood ratio statistics, the trace and the maximum eigenvalue statistics, to test for the possible number of cointegrating vectors in the system. Critical values for these statistics are tabulated in Osterwald-Lenum (1992). The optimal lag structure of the system is determined by using the Likelihood ratio test.

Granger Causality within VECM Framework

If cointegration is present, the short-run Granger-causality is then analysed using VECM framework, to avoid problem of misspecification (see Granger 1988)[2]. Otherwise, the analysis may be conducted as a standard VAR model[3]. The direction of Granger-causal effect running from one variable to another can be detected using the VECM derived from the long-run cointegrating vectors. The VECM model employed for the testing of Granger-causality across various variables in the system can be represented by

$$X_t = \begin{pmatrix} \Delta RGDP_t \\ \Delta R_t \\ \Delta K_t \\ \Delta FD_t \end{pmatrix} = \begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{pmatrix} + \begin{pmatrix} \beta_{11}(L) & \beta_{12}(L) & \cdots & \beta_{14}(L) \\ \beta_{21}(L) & \beta_{22}(L) & \cdots & \beta_{24}(L) \\ \vdots & & & \\ \beta_{41}(L) & \beta_{42}(L) & \cdots & \beta_{44}(L) \end{pmatrix} \begin{pmatrix} \Delta RGDP_t \\ \Delta R_t \\ \Delta K_t \\ \Delta FD_t \end{pmatrix}$$

$$+ \begin{pmatrix} \gamma_1 z_{1,t-1} \\ \gamma_2 z_{2,t-1} \\ \vdots \\ \gamma_4 z_{4,t-1} \end{pmatrix} + \begin{pmatrix} \Phi(L) & 0 & \cdots & 0 \\ 0 & \Phi(L) & 0 \cdots & 0 \\ \vdots & & & \\ 0 & \cdots & 0 & \Phi(L) \end{pmatrix} \begin{pmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,,t} \\ \vdots \\ \varepsilon_{4,t} \end{pmatrix} \quad (5)$$

[2] If the variables in a system are cointegrated, then the short-run analysis of the system should incorporated the error-correction term (ECT) to model the adjustment for the deviation from its long-run equilibrium.
[3] When an ECT is added to the VAR model, the modified model is referred to as the VECM. VECM is thus a special case of VAR.

where X_t is an (4 x 1) vector of the variables in the system, α's represent a vector of constant terms, β's are estimable parameters, Δ is a difference operator, L is a lag operator, β(L) and $\Phi(L)$ are finite polynomials in the lag operator, z_{t-1}'s are error-correction terms, and ε_t's are disturbances.

The Granger causality test is applied by calculating the F-statistic based on the null hypothesis – that the set of coefficient on the lagged values of independent variables are not statistically different from zero. If the null hypothesis is not rejected, then it can be concluded that the independent variable does not cause dependent variable. For instance, if the *F*-statistic of the *FD* (*FD* as a independent variable in the equation) is significant at a 5% level (i.e. H_0: β_i(L) = 0, for i refers to *FD*, is rejected at a 5% significance level), and the RGDP is the dependent variable of the equation, then we can say that there is a short-run causal effect running from *FD* to the *RGDP*. Besides the detection of the short-run causal effects, the VECM also allows us to examine the effective adjustment towards equilibrium in the long run through the significance or otherwise of the *t*-test of the lagged ECT of the equation.

Toda-Yamamoto Levels VAR

According to Toda and Yamamoto (1995), Rambaldi and Doran (1996) and Zapata and Rambaldi (1997), several alternatives method for detecting causality such as ECM and VECM are cumbersome and sensitive to the values of the nuisance parameters in finite samples and hence, the results are unreliable. In addition, pre-tests are necessary to determine the number of unit roots and the cointegrating ranks before proceeding to estimate a VECM. The Granger non-causality test suggested by Toda and Yamamoto (1995), on the other hand, offered a simple procedure requiring the estimation of an 'augmented' VAR model in a straightforward way, which is based on the Modified Wald (MWALD) test statistic for testing linear restriction on the parameters. Therefore, the Toda and Yamamoto causality procedure has been labelled as the long run causality tests. All one needs to do is to determine the maximal order of integration d_{max} that expect the model to incorporate and ascertain the lag structure, and then to construct a VAR with variables appearing in their levels with a total of $p = (k + d_{max})$ lags. However, at the inference stage, linear or nonlinear restrictions should only be tested on the first k lags since the $p - k$ lags are assumed zero and ignored. Toda and Yamamoto point out that, for $d = 1$, the lag selection procedure is always valid since k . 1 = d. If d = 2, then the procedure is valid unless k =1. Moreover, according to Toda and Yamamoto, the MWALD statistic is valid regardless whether a series is I(0), I(1) or I(2), non-cointegrated or cointegrated of an arbitrary order.

Rambaldi and Doran (1996) have demonstrated that the MWALD procedure for testing Granger non-causality can be easily constructed using a Seemingly Unrelated Regression (SUR). Following Toda and Yamamoto (1995), Granger non-causality test for this study can be estimated using SUR as follows:

$$\begin{bmatrix} RGDP_t \\ R_t \\ K_t \\ FD_t^i \end{bmatrix} = A_0 + A_1 \begin{bmatrix} RGDP_{t-1} \\ R_{t-1} \\ K_{t-1} \\ FD_{t-1}^i \end{bmatrix} + A_2 \begin{bmatrix} RGDP_{t-2} \\ R_{t-2} \\ K_{t-2} \\ FD_{t-2}^i \end{bmatrix} + A_3 \begin{bmatrix} RGDP_{t-3} \\ R_{t-3} \\ K_{t-3} \\ FD_{t-3}^i \end{bmatrix} + A_4 \begin{bmatrix} RGDP_{t-4} \\ R_{t-4} \\ K_{t-4} \\ FD_{t-4}^i \end{bmatrix} + A_5 \begin{bmatrix} \varepsilon_{RGDP_t} \\ \varepsilon_{R_t} \\ \varepsilon_{K_t} \\ \varepsilon_{FD_t^i} \end{bmatrix} \tag{6}$$

where As are four by four matrices of coefficients with A_0 as an identity matrix.

For instance, to test the hypothesis that "no Granger causality from *RGDP* to *FD*", the restriction test procedure is applied with null hypothesis H$_0$: $\alpha_1^{(41)} = \alpha_2^{(41)} = \alpha_3^{(41)} = 0$, where $\alpha_i^{(41)}$ are the coefficients of $RGDP_{t-1}$, $RGDP_{t-2}$ and $RGDP_{t-3}$ respectively in the fourth equation of system Equation 4 where the system is being estimated as a VAR(4). Causality from *RGDP* to *FD* can be established through rejecting the above null hypothesis which requires finding the significance of the MWALD statistic for the group of the lagged independent variables identified above. A similar, analogous testing procedure can be applied to the alternative hypothesis that "no Granger causality from *FD* to *RGDP*", for example, to test H_0: $\alpha_1^{(14)} = \alpha_2^{(14)} = \alpha_3^{(14)} = 0$, where $\alpha_i^{(14)}$ are the coefficients of FD_{t-1}, FD_{t-2} and FD_{t-3} respectively in the first equation of system Equation 6.

Data

In this study, the quarterly data set is employed covering a period from 1980 to 2002. The data comprises of real GDP per capita, three-month treasury interest rate, gross fixed capital formation, and various finance indicators. All data are collected from *Monthly Statistical Bulletin*, published by *Central Bank of Malaysia* (CBM) and *International Financial Statistics* (IFS). The capital stock is constructed from the gross fixed capital formation figures following the perpetual inventory method. Initial capital stocks are calculated using the assumption that over long periods of time capital and output grow at the same rate. A depreciation rate of 6% and the average growth rate of the initial 3 years are used to generate the initial level of capital stock[4]. Capital stock per capita is derived as a ratio of the total capital stock to total population.

Two groups of financial development indicator are employed in the analysis, namely banking sector development and stock market development. Three banking sector development indicators are bank deposit liabilities (BDL), private sector credit (PRI) and domestic credit provided by banking sector (DC), and two stock market development indicators are stock market capitalization (SMC) and total share value traded. All of these indicators are expressed as ratios to GDP. The main sources of these quarterly data are gathered from Monthly and Quarterly Bulletin, published by CBM, IFS and Malaysian Stock Exchange (formerly known as Kuala Lumpur Stock Exchange). The definitions of the financial development indicators are provided in Appendix A.

[4] See Hall and Jones (1999) and Bernanke and Gurkaynak (2001). The initial capital stock is defined as $K = I/(g+\delta)$.

III. Results and discussion

Unit Root Tests

Table 1 and 2 present the results of the ADF, PP and KPSS unit root tests of real GDP, real interest rate, capital stock per capita and various financial indicators. The results support the presence of a unit root at the level of all variables and the absence of any unit root after first differencing except for the real interest rate and domestic credit variables, which are I(0) based on the ADF and PP tests, respectively. Since two out of three unit root tests result indicates that the real interest rate and domestic credit are I(1), thus, all variables are treated as I(1) in the analysis. In addition, the KPSS unit root test proposed by Kwiatkowski *et al*. (1992) is more powerful in detecting unit root indicates all variables are I(1). Thus, all variables are nonstationary in the levels, but stationary in the first differences.

<TABLE 1 HERE>

<TABLE 2 HERE>

Table 3 reports the Perron (1997) unit root test with structural break that undertake estimation without assuming any prior knowledge of any potential break dates. The model is estimated over all possible break dates in the data set, and the break date is chosen to maximize the probability of rejection of the unit root hypothesis. Model 2 of Perron (1997) for both a change in the intercept and the slope are estimated in this study. The results suggest that all these variables are not stationary around a break in the mean and/or trend at the 5 percent level of significant.

<TABLE 3 HERE>

Multivariate Cointegration Test

The Johansen cointegration test is performed to test the existence of long run relationship amongst four variables, namely financial development, real RGDP per capita, real interest rate and capital stock per capita. The empirical results reported in Table 4 reveal that there is one cointegrating vector in the system for all models except Model 4, where the financial development indicator is the ratio of stock market capitalisation to GDP. Overall, the results provide sufficient evidence to support the existence of a long run relation amongst these four variables.

<TABLE 4 HERE>

Granger Causality based on VECM

The Granger causality test results based on the VECM framework are reported in Table 5 for all five models. As demonstrated by the Johansen multivariate cointegration test there is evidence of one cointegrating relationships exist in the system except for the ratio of stock market capitalisation to GDP. Since this study aims to establish the link between finance and growth, therefore, only the causal patterns between both variables are discussed. The Granger causality results reveal that there is a unidirectional causal effect running from total share value traded to real GDP per capita; bi-directional causal effects are detected between private sector credit, stock market capitalisation and real GDP per capita; whereas reverse causation from real GDP per capita to bank deposit liabilities and domestic credit. The Granger causality test results above are summarised in Table 6.

<TABLE 5 HERE>

<TABLE 6 HERE>

Most of the VECM equations of real output per capita and finance indicators indicate that the error-correction coefficients are statistically significant, suggesting that real output and finance indicators are adjusted to divergence from long-run equilibrium steady state.

The robustness of the estimated VECM models is diagnostically tested for possible misspecification (refer Table 7). The null hypothesis of homoscedasticity is rejected based on Q^2 statistics for the BDL and SMC models. In addition, there is an ARCH effect for the capital stock per capita equation of BDL model. Nevertheless, as long as the RGDP and finance indicators equations have desired econometric properties, then the causality results reported are valid and reliable. Overall, the results of the diagnostic tests suggest that all VECM models are relatively well specified.

<TABLE 7 HERE>

Toda and Yamamota Level VAR

The results of long-run causality due to Toda and Yamamoto (1995) are reported in Table 8. The results from this analysis indicate that there is a unidirectional causal effect running from total share value traded to real GDP per capita; bi-directional causality effects between bank deposit liabilities, private sector credit, domestic credit and stock market capitalisation with real GDP per capita. The long run causal channels based on levels VAR are summarised in Table 9.

<TABLE 8 HERE>
<TABLE 9 HERE>

The result inferred from both VECM and VAR model uncover that the causal patterns between stock market capitalisation and total share value traded with real GDP per capita are the same. This indicates that the causal effects of these two stock market development indicators are similar in the short-run and long-run. However, the causal patterns are slightly different demonstrate by the three banking sector development indicators. For example, there is a uni-directional causal effect running from real GDP per capita to bank deposit liabilities in the short-run, whereas bi-directional causal effects are detected between both variables in the long-run.

The finding of this study is consistent with Luintel and Khan (1999), Habibullah (1999) and Sinha and Macri (2002). For instance, Luintel and Khan (1999) find that the existence of bi-directional long-run relationship between financial development and growth in Malaysia, using bank deposit liabilities as a proxy for financial development based on Johansen cointegration long-run framework; whereas Habibullah (1999) demonstrates that economic growth causes financial development in Malaysia by using the traditional simple-sum money and divisia monetary aggregate as proxy for financial development.

IV. Conclusions

This study examines the link between finance and economic growth in a case of small open economy, Malaysia, for a period spanning from 1980 to 2002. Using several financial development indicators, the analysis shows that there exist stable long-run relationship amongst financial development, real GDP per capita, real interest rate and capital stock per capita. This implies that these variables although they may have occasional short-term or transitory deviations from their long-run equilibrium, eventually forces will prevail that will drive them together in the long run.

The short-run dynamic relationships based on VECM reveal that all banking sector and stock market development indicators postulate causal effects on real GDP per capita, either uni-directional or bi-directional. The causal relationships are also predominantly long-term in nature, as exhibited by the Toda and Yamamoto (1995) levels VAR results. Thus, the causally independent hypothesis between finance and growth is completely rejected for the case of Malaysia, thus supporting the supply-leading and demand following hypotheses, depends on the financial development indicators employed in the analysis.

The overall findings suggest that financial sector evolution tends to stimulate and promote economic development in Malaysia. Policy makers should therefore focus their attention on the creation and promotion of modern financial institutions including banks, non-banks, and stock markets in delivering long-run economic benefits.

Appendix A. Definition and source of the data

Variable	Definition	Source
Bank Deposit Liabilities/GDP (%)	Broad money stock minus currency in circulation.	IFS
Private Sector Credit/GDP (%)	Financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable that establish a claim for repayment.	IFS
Domestic Credit Provided by Banking Sector (%)	Includes all credit to various sectors on a gross basis. The banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits).	IFS
Stock Market Capitalisation/GDP (%)	Market capitalization (also known as market value) is the share price times the number of shares outstanding.	Malaysian Stock Exchange, Monthly Statistically Bulletin of the CBM.
Total Share Value Traded/GDP (%)	Stock traded refers to the total value of shares traded during the period.	Malaysian Stock Exchange, Monthly Statistically Bulletin of the CBM.

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Figure 1. Private sector credit and real GDP growth 1980-2001

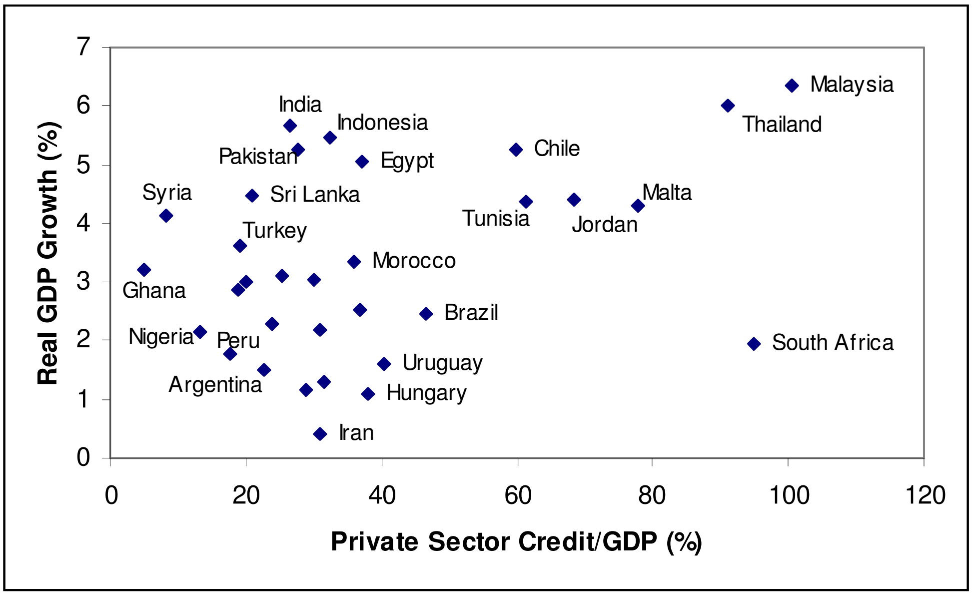

Figure 2. Stock market capitalization and real GDP growth 1988-2001

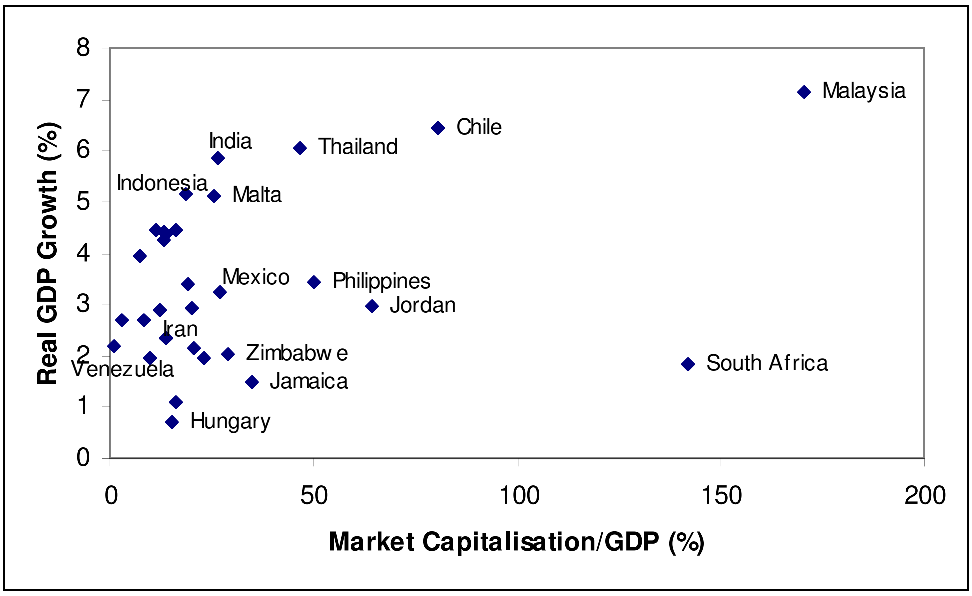

Table 1. ADF and PP Unit root tests

	ADF		PP	
	No Trend	Trend	No Trend	Trend
	Level			
Real GDP Per Capita	-0.5236 (8)	2.5360 (8)	-0.4453 (1)	-2.4923 (1)
Real Interest Rate	-3.8040 (8)**	-3.5745 (8)**	-2.6841 (1)	-2.5225 (1)
Capital Stock Per Capita	-1.5050 (7)	-1.6192 (7)	-1.2931 (1)	-1.4541 (1)
Financial Development Indicators:				
Bank Deposit Liabilities	-0.9022 (8)	-2.5190 (8)	-1.2878 (1)	-2.6311 (1)
Private Sector Credit/GDP	-1.5514 (6)	-2.7882 (6)	-2.1839 (1)	-2.8058 (1)
Domestic Credit/GDP	-2.2935 (2)	-2.5525 (2)	-8.6645 (1)**	-9.4811 (1)**
Stock Market Capitalisation / GDP	-0.7369 (6)	-1.4809 (6)	-1.1949 (1)	-1.2880 (1)
Total Share Value Traded /GDP	-1.3677 (5)	-1.5222 (5)	-2.2410 (1)	- 2.4732 (1)
	First Difference			
Real GDP Per Capita	-3.2776 (8) **	-3.2352 (8)	-8.9005 (1) **	-8.8821 (1) **
Real Interest Rate	-3.3208 (9) **	-3.4827 (9) **	-9.0995 (1) **	-9.1054 (1) **
Capital Stock Per Capita	-2.8963 (9) **	-3.5004 (9) **	-11.132 (1) **	-11.093 (1) **
Financial Development Indicators:				
Bank Deposit Liabilities	-3.1309 (8)**	-3.0871 (8)**	-8.1562 (1)**	-8.1291 (1)**
Private Sector Credit/GDP	-3.2200 (8) **	-3.3361 (8)	-8.0601 (1) **	-8.1841 (1) **
Domestic Credit/GDP	-7.5772 (2) **	-7.5897 (2) **	-29.753 (1) **	-29.769 (1) **
Stock Market Capitalisation / GDP	-3.2193 (6) **	-3.2179 (6)	-6.0063 (1) **	-6.0124 (1) **
Total Share Value Traded /GDP	-5.1530 (5) **	-5.1400 (5) **	-11.570 (1) **	-11.531 (1) **

Notes: the null hypothesis is that the series is I(1). The critical values for rejection are –2.86 at a significant level of 5% for models without a linear trend and –3.41 for models with a linear trend. These values are provided by the SHAZAM output based on MacKinnon (1991).

Table 2. KPSS unit root test

Variables\ lag	ημ-statistic					ητ-statistic				
	0	1	2	3	4	0	1	2	3	4
	Levels									
Real GDP Per Capita	8.7834**	4.4557**	3.0041**	2.2739**	1.8341**	0.9001**	0.4774**	0.3359**	0.2624**	0.2168**
Real Interest Rate	1.7829**	0.9483**	0.6653**	0.5247**	0.4416	1.0643**	0.5683**	0.4004**	0.3171**	0.2679**
Capital Stock Per Capita	1.2625**	0.6584**	0.4516	0.3479	0.2862	0.9224**	0.4798**	0.3283**	0.2524**	0.2073**
Financial Development Indicators:										
Bank Deposit Liabilities	8.0824**	4.1288**	2.8040**	2.1380**	1.7370**	0.8635**	0.4630**	0.3300**	0.2599**	0.2157**
Private Sector Credit/GDP	8.0330**	4.1205**	2.8063**	2.1461**	1.7492**	0.4952**	0.2657**	0.1891**	0.1501**	0.1264
Domestic Credit/GDP	0.8579**	0.7703**	0.5843**	0.4813**	0.4116	0.1966**	0.1904**	0.1461**	0.1218	0.1050
Stock Market Capitalisation / GDP	8.6756**	4.3929**	2.9607**	2.2446**	1.8156**	0.7692**	0.3970**	0.2734**	0.2125**	0.1768**
Total Share Value Traded/GDP	3.8680**	2.0554**	1.4243**	1.1041**	0.9139**	0.8844**	0.4842**	0.3420**	0.2695**	0.2270**
	First-Difference									
Real GDP Per Capita	0.0884	0.0832	0.1139	0.1420	0.1114	0.0738	0.0697	0.0958	0.1200	0.0940
Real Interest Rate	0.1159	0.1122	0.1121	0.1160	0.1370	0.0298	0.0291	0.0294	0.0307	0.0370
Capital Stock Per Capita	0.1107	0.1336	0.1271	0.1184	0.1144	0.0963	0.1165	0.1109	0.1035	0.1002
Financial Development Indicators:										
Bank Deposit Liabilities	0.0592	0.0518	0.0690	0.0837	0.0725	0.0554	0.0485	0.0648	0.0787	0.0681
Private Sector Credit/GDP	0.2310	0.2006	0.2215	0.2253	0.1949	0.0809	0.0714	0.0806	0.0830	0.0717
Domestic Credit/GDP	0.0200	0.0521	0.0617	0.0770	0.0810	0.0115	0.0299	0.0353	0.0440	0.0461
Stock Market Capitalisation / GDP	0.2292	0.1628	0.1386	0.1230	0.1172	0.1717**	0.1221**	0.1042	0.0926	0.0883
Total Share Value Traded/GDP	0.0518	0.0653	0.0710	0.0676	0.0719	0.0373	0.0472	0.0513	0.0489	0.0520

Notes: ** indicates significant at the 0.05 level. The critical values for ημ statistic for null of stationary around a level is 0.463 and ητ statistic for null of stationary around a deterministic trend is 0.146.

Table 3. Perron (1997) unit root test with structural break

	T_b	k	$t_{\hat{\alpha}}$
Real GDP Per Capita	1989.Q4	5	-2.7391
Real Interest Rate	1984.Q2	11	-4.7846
Capital Stock Per Capita	1999.Q4	11	-2.8287
Financial Development Indicators:			
Bank Deposit Liabilities	1986.Q3	8	-4.0718
Private Sector Credit/GDP	1986.Q3	12	-3.2680
Domestic Credit/GDP	1996.Q2	8	-4.4141
Stock Market Capitalisation / GDP	1991.Q4	12	-4.6616
Total Share Value Traded/GDP	1992.Q3	11	-4.1489

Notes: based on Model 2 (i.e. changes in both intercept and slope). The critical values at 0.01and 0.05 significance levels are –6.21 and –5.55 for 100 observations, based on Perron (1997).

Table 4. Cointegration tests

H_0	λ_{Trace}	$\lambda_{\max}$
Model 1: Bank Deposit Liabilities [L = 4]		
r = 0	53.06*	30.01*
r ≤ 1	23.05	15.29
r ≤ 2	7.76	7.51
r ≤ 3	0.25	0.25
Model 2 Private Sector Credit [L = 3]		
r = 0	64.93*	42.89*
r ≤ 1	22.03	13.89
r ≤ 2	8.14	7.32
r ≤ 3	0.81	0.81
Model 3 Domestic Credit [L = 4]		
r = 0	49.27*	26.92
r ≤ 1	22.35	14.18
r ≤ 2	8.17	8.07
r ≤ 3	0.09	0.09
Model 4: Stock Market Capitalisation [L = 3]		
r = 0	38.82	22.52
r ≤ 1	16.29	12.66
r ≤ 2	3.63	2.86
r ≤ 3	0.77	0.77
Model 5: Total Share Value Traded [L = 4]		
r = 0	48.84*	32.93*
r ≤ 1	15.90	12.31
r ≤ 2	3.59	3.49
r ≤ 3	0.10	0.10
5 % Critical values		
r = 0	47.21	27.07
r ≤ 1	29.68	20.97
r ≤ 2	15.41	14.07
r ≤ 3	3.76	3.76

Notes: * indicate statistical significance at the 5% level. L is the optimal lags.

Table 5. Granger causality test based on VECM

	ΔRGDP	ΔR	ΔK	ΔFD	ECT_{t-1}
Model 1: Bank Deposit Liabilities (BDL)					
ΔRGDP	-	0.56 (0.68)	0.79 (0.53)	1.24 (0.30)	-0.08 [-3.07]***
ΔR	1.43 (0.23)	-	0.49 (0.74)	1.36 (0.25)	0.01 [0.27]
ΔK	0.52 (0.71)	1.73 (0.15)	-	0.25 (0.90)	-0.07 [-1.05]
ΔBDL	5.61(0.00)***	0.86 (0.49)	0.37 (0.82)	-	0.15 [5.22]***
Model 2: Private Sector Credit (PRI)					
ΔRGDP	-	2.34 (0.05)*	1.44 (0.22)	2.41 (0.05)*	-0.21 [-5.36]***
ΔR	0.69 (0.59)	-	0.36 (0.83)	0.96 (0.43)	-0.02 [-0.72]
ΔK	0.25 (0.90)	1.48 (0.21)	-	0.93 (0.44)	-0.06 [-0.47]
ΔPRI	3.44 (0.01)**	3.20 (0.01)**	0.52 (0.71)	-	0.28 [6.32]***
Model 3: Domestic Credit (DC)					
ΔRGDP	-	0.99 (0.41)	0.72 (0.57)	1.44 (0.22)	0.00 [0.62]
ΔR	0.27 (0.89)	-	0.12 (0.97)	1.59 (0.18)	0.00 [1.74]
ΔK	0.68 (0.60)	0.80 (0.52)	-	1.49 (0.21)	0.01 [3.65]***
ΔDC	4.46 (0.00)***	1.21 (0.31)	0.20 (0.93)	-	0.02 [2.32]**
Model 4: Stock Market Capitalisation (SMC)					
ΔRGDP	-	0.56 (0.68)	0.37 (0.82)	2.63 (0.04)**	
ΔR	0.21 (0.93)	-	0.25 (0.90)	0.43 (0.78)	
ΔK	0.49 (0.74)	1.58 (0.18)	-	1.93 (0.11)	
ΔSMC	3.16 (0.01)***	0.78 (0.53)	0.31 (0.86)	-	
Model 5: Total Share Value Traded (SVT)					
ΔRGDP	-	0.24 (0.91)	0.40 (0.80)	3.18 (0.02) **	-0.03 [-2.61] ***
ΔR	0.12 (0.97)	-	0.64 (0.62)	1.34 (0.26)	0.02 [1.85]
ΔK	0.62 (0.64)	1.79 (0.14)	-	2.15 (0.08) *	-0.14 [-2.90] ***
ΔBC	0.68 (0.60)	0.38 (0.82)	0.75 (0.55)	-	0.71 [1.80]

Notes: figures in parentheses ( ) and brackets [ ] are p-value and t-test, respectively. The asterisks indicate the following levels of significance: *10%, **5% and ***1%. FD represents different finance indicators.

Table 6. Summary of short-run causality

Finance Indicator	Channel	Remarks
Bank Deposit Liabilities (BDL)	BDL ← RGDP	Economic growth causes BDL
Private Sector Credit (PRI)	PRI ↔ RGDP	Bi-directional
Domestic Credit (DC)	DC ← RGDP	Economic growth causes DC
Stock Market Capitalisation (SMC)	SMC ↔ RGDP	Bi-directional
Total Share Value Traded (SVT)	SVT → RGDP	SVT causes Economic growth

Table 7. Diagnostic tests

Model	Finance Indicator	Dep Var	Q(4)	Q^2 (4)	ARCH LM
1	BankDeposit Liabilities (BDL)	RGDP	1.69 (0.79)	3.62 (0.459)	3.38 (0.49)
		R	0.66 (0.95)	0.25 (0.99)	0.28 (0.99)
		K	0.17 (0.99)	14.5 (0.00)***	11.9 (0.01)**
		BDL	1.07 (0.89)	2.93 (0.56)	2.55 (0.63)
2	Private Sector Credit (PRI)	RGDP	1.09 (0.89)	4.48 (0.34)	3.74 (0.44)
		R	1.02 (0.90)	0.31 (0.98)	0.31 (0.98)
		K	7.55 (0.47)	11.2 (0.18)	8.05 (0.08)
		PRI	1.73 (0.78)	2.76 (0.59)	2.61 (0.62)
3	Domestic Credit (DC)	RGDP	5.17 (0.27)	3.02 (0.55)	2.84 (0.58)
		R	1.06 (0.90)	0.53 (0.97)	0.53 (0.96)
		K	0.71 (0.94)	3.50 (0.47)	2.91 (0.57)
		PRI	0.79 (0.94)	0.99 (0.91)	0.79 (0.93)
4	Stock Market Capitalisation (SMC)	RGDP	4.99 (0.28)	1.71 (0.78)	1.49 (0.82)
		R	1.02 (0.90)	0.42 (0.98)	0.40 (0.98)
		K	0.25 (0.99)	10.0 (0.04)**	8.71 (0.06)
		SMC	1.63 (0.80)	4.10 (0.39)	3.47 (0.48)
5	Total Share Value Traded (SVT)	RGDP	4.31 (0.36)	5.17 (0.27)	4.52 (0.33)
		R	1.33 (0.85)	0.45 (0.97)	0.52 (0.97)
		K	0.35 (0.98)	9.23 (0.05)	9.08 (0.06)
		SVT	1.38 (0.84)	2.04 (0.72)	1.98 (0.73)

Note: asterisks indicate the following levels of significance: *10%, **5% and ***1%.

Table 8. Toda and Yamamoto (1995) Granger non-causality test

	RGDP	R	K	FD
Model 1: Bank Deposit Liabilities (BDL)				
RGDP	-	5.49(0.24)	4.48(0.34)	10.72(0.02)**
R	7.41(0.11)	-	1.20(0.87)	6.93(0.13)
K	1.11(0.89)	11.35(0.02)**	-	2.32(0.67)
BDL	14.5(0.00)***	7.86(0.09)	2.17(0.70)	-
Model 2: Private Sector Credit (PRI)				
RGDP	-	26.20(0.00)***	9.32(0.04)*	17.31(0.00) ***
R	3.67(0.45)	-	1.17(0.88)	4.76(0.31)
K	0.86(0.92)	10.06(0.03)**	-	5.38(0.24)
PRI	12.2(0.02)**	22.11(0.00)***	9.73(0.04)**	-
Model 3: Domestic Credit (DC)				
RGDP	-	7.06(0.13)	3.52(0.47)	8.40(0.07)*
R	1.20(0.87)	-	1.44(0.83)	9.18(0.05)*
K	0.37(0.98)	5.82(0.21)	-	12.83(0.01)**
DC	23.8(0.00)***	10.01(0.04)**	1.80(0.77)	-
Model 4: Stock Market Capitalisation (SMC)				
RGDP	-	1.76(0.77)	0.75(0.94)	19.00(0.00)***
R	1.56(0.81)	-	0.97(0.91)	3.55(0.46)
K	1.20(0.87)	8.53(0.07)*	-	9.17(0.05)*
SMC	16.2(0.00)***	4.03(0.40)	1.90(0.75)	-
Model 5: Total Share Value Traded (SVT)				
RGDP	-	3.53 (0.47)	0.37 (0.98)	15.34 (0.00) ***
R	3.22 (0.52)	-	4.66 (0.32)	7.27 (0.12)
K	1.54 (0.81)	10.82 (0.03) **	-	13.60 (0.00) ***
SVT	3.90 (0.41)	3.79 (0.43)	1.11 (0.89)	-

Notes: figures in parenthesis are *p*-value. Asterisks indicate the following levels of significance: *10%, **5% and ***1%. FD represents different finance indicators.

Table 9. Summary of long-run causality

Finance Indicators	Channel	Remarks
Bank Deposit Liabilities (BDL)	BDL ↔ RGDP	Bi-directional
Private Sector Credit (PRI)	PRI ↔ RGDP	Bi-directional
Domestic Credit (DC)	DC ↔ RGDP	Bi-directional
Stock Market Capitalisation (SMC)	SMC ↔ RGDP	Bi-directional
Total Share Value Traded (SVT)	SVT → RGDP	SVT causes Economic growth