Savings-led growth theories: A time series analysis for Malaysia using the bootstrapping and time-varying causality techniques

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SAVINGS-LED GROWTH THEORIES: A TIME SERIES ANALYSIS FOR MALAYSIA USING THE BOOTSTRAPPING AND TIME-VARYING CAUSALITY TECHNIQUES

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ABSTRACT

The purpose of this study is to empirically investigate the vindication of savings-led growth hypothesis for the Malaysian economy with the long run TYDL version of Granger causality – Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996). This study used the quarterly sample from 1970:Q1 to 2008:Q4. The recursive regression procedure will also incorporate into the TYDL causality test to measure the stability of the savings-led growth hypothesis in the long run. Our empirical results support that the savings-led growth hypothesis is long run phenomenon and stable over time. Therefore, the Malaysian dataset supports the endogenous growth theory.

Keywords: Causality; Malaysia; Recursive regression; Savings-growth; Stability
JEL Classification: C22; E21; O16

1. INTRODUCTION

Is high savings countries grow faster? Logically, to achieve economic growth, one must invest. To encourage investment, one should save. Therefore, savings may play important role in the process of economic growth and development. The role of savings on economic growth has long been debated and many empirical studies have been conducted to examine the vindication of the savings-led growth hypothesis. In general, there are two famous economic thought that explaining the savings-led growth theory. Harrod (1939) and Domar (1946) were the first group of economists that systematically modelled the role of savings on economic growth. They claimed that the speed of economic growth depend on the ability to save as high savings rate will increase the rate of investment and hence trigger economic growth. Solow (1956) added that although savings was an important source for economic growth through its impact on capital formation, it does not affect the economic growth in the long run because of the assumption of *diminishing returns to scale* and technological progress is assumed to be exogenous. Therefore, the neoclassical growth economists believed that savings-led growth is a transitory or short run phenomenon rather than growing endlessly. Ironically, the endogenous growth theory proposed by Romer (1986) argued that technological progress is determined endogenously and the production function is subject to the *increasing returns to scale*. Therefore, the endogenous or new growth theory articulated that savings-led growth is a long run phenomenon.

Given the policy relevance and the controversy between the growth theories, many researchers have empirically investigated the validity of the savings-led growth hypothesis in developed and also developing economies. For this reason, it is implausible for the present study to comprehensively review all the relevant studies within the ambit of this paper. With regard to the objective of this study, our aim is to review some empirical studies pertaining to the causal relationship between savings and economic growth in the Malaysian economy. A summary of the preceding studies on the subject is reported in Table 1.

In general, Table 1 showed that the existing research efforts failed to provide clear evidence for the savings-led growth hypothesis. The vindication of savings-led growth hypothesis is of concern because it is directly relates to the formulation and implementation of appropriate growth policy. If savings-led growth hypothesis is a long run phenomenon as initiated by the endogenous growth theory, enhance savings may be a potential long run stimulus economic growth policy. Otherwise, alternative growth policies should be implemented in order to achieve sustainable economic growth in the long run.

Using the annual data from 1955 to 1988, World Bank (1993) attempted to investigate the causal relationship between savings and economic growth within the bi-variate vector autoregression (VAR) framework. The study found that savings and economic growth is Granger cause each other. In a next study, Agrawal (2001) performed an empirical analysis on seven Asian economies with the residuals-based cointegration and Granger causality tests. For the case of Malaysia, the study found that savings and its determinants are stationary at different orders. Therefore, the residuals-based cointegration test cannot be used to examine the presence of long run equilibrium relationship. For this reason, the above authors assumed that savings and its determinants for Malaysia are not cointegrated. Therefore, the Granger causality test based on first difference VAR framework was used to examine the causality between savings and economic growth. The finding showed uni-directional causality running from savings to economic growth. On the contrary, Baharumshah et al. (2003) and Boo and Normee (2004) used the multivariate Johansen and Juselius (1990) cointegration and Granger causality tests to examine the relationship between savings and its determinants. They found that savings and its determinants for Malaysia are moving together in the long run; therefore Granger causality test within the vector error-correction model (VECM) was used to examine the direction of causality between savings and economic growth. Contrary with the earlier studies and also with the growth theories, Baharumshah et al. (2003) found no causality between savings and economic growth, while Boo and Normee (2004) observed that economic growth Granger-causes savings in Malaysia. However, Baharumshah and Thanoon (2003) re-investigated the long run causal relationship between savings and economic growth in Malaysia using the Toda and Yamamoto (1995) causality approach. They found that savings and economic growth in Malaysia is bi-directional causality in the long run. Furthermore, Tang (2008a) proposed to incorporate the modified dependency ratio into the savings-growth relationship for Malaysia. In addition to that, the author also used a relatively new cointegration test developed by Pesaran et al. (2001) – bounds testing approach to examine the presence of long run relationship. The Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) – TYDL approach within the augmented-VAR system was used to verify the causal relationship between savings and economic growth in Malaysia. The authors observed that savings and its determinants are cointegrated and the TYDL Granger causality test implied bilateral causality between savings and economic growth over the sample period of 1970 to 2006.

Table 1: Summary of selected empirical studies on the relationship between savings and economic growth in Malaysia

No.	Authors	Research Period	Econometric Methods		Empirical Results				
			Cointegration	Causality	Cointegrated	Causality			
						$S \rightarrow G$	$G \rightarrow S$	$S \leftrightarrow G$	$S \not\leftrightarrow G$
1.	World Bank (1993)	1955 – 1988	–	Granger (1969) – VAR	–			✓	
2.	Agrawal (2001)	1960 – 1994	–	Granger (1969) – VAR	–	✓			
3.	Baharumshah et al. (2003)	1960 – 1997	Johansen and Juselius (1990)	Granger (1988) – VECM	Yes				✓
4.	Baharumshah and Thanoon (2003)	1960 – 2000	Johansen and Juselius (1990)	Toda and Yamamoto (1995) – Augmented VAR	Yes			✓	
4.	Boo and Normee (2004)	1970:Q1 – 1999:Q4	Johansen and Juselius (1990)	Granger (1988) – VECM	Yes		✓		
5.	Tang (2008a)	1970 – 2007	Pesaran et al. (2001)	Toda and Yamamoto (1995) – Augmented VAR	Yes			✓	
6.	Tang (2009)	1991:Q1 – 2006:Q3	–	Granger (1969) – VAR	–			✓	
				Geweke et al. (1983) – Modified Sims test				✓	
				Hsiao (1981)				✓	
				Toda and Yamamoto (1995) – Augmented VAR				✓	
				Holmes and Hutton (1990) – Multiple Rank F-test				✓	
7.	Tang and Chua (2009)	1991:Q1 – 2006:Q2	Beirens (1997)	Holmes and Hutton (1990) – Multiple Rank F-test	Yes			✓	

Notes: (1) ✓ indicates the presence of causality
(2) "Yes" represents the variables are cointegrated
(3) $\rightarrow$ represents uni-directional causality
(4) $\leftrightarrow$ represents bilateral / bi-directional causality
(5) $\not\leftrightarrow$ represents none / neutral causality

The causality result is consistent with the finding of World Bank (1993) and Baharumshah and Thanoon (2003), but contradicted to the earlier studies. Recently, Tang (2009) attempts to investigate whether the causal inference between savings and economic growth in Malaysia is sensitive to the particular causality tests employed to ascertain the causal relationship. To achieve the objective of his study, the author employed five different causality techniques such as Granger (1969), Geweke et al. (1983), Hsiao (1981), Toda and Yamamoto (1995) and Holmes and Hutton (1990) causality approaches. Interestingly, the author found bilateral causality between savings and economic growth regardless of the causality techniques employed. With these findings, the author concluded that causality methods do not influence the causality results. Similarly, using quarterly data from 1991:Q1 to 2006:Q3, Tang and Chua (2009) also detected bilateral causality between savings and economic growth in Malaysia with the Holmes and Hutton (1990) causality test.

Motivated by the paradoxical empirical evidences presented above, this study attempts to re-investigate the savings-led growth hypothesis for the Malaysian economy from 1970:Q1 to 2008:Q4. This study differs from the earlier studies in at least three dimensions. First, none of the Malaysian study has taken into consideration the effect of structural break(s) in the unit root tests. Perron (1989) pointed out that the conventional unit root tests such as Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) may be biased when the time series are pertaining to structural change. Therefore, apart from using the conventional unit root tests, we also apply the Lagrange Multiplier (LM) unit root tests with one and two structural breaks developed by Lee and Strazicich (2003, 2004) to fill the detected gap. This is because the ADF-type structural break(s) unit root tests (e.g. Zivot and Andrews, 1992; Lumsdaine and Papell, 1997) tend to select the incorrect breakpoints (see Lee and Strazicich, 2001). Second, we employ the TYDL Granger causality test within the augmented-VAR system to ascertain the direction of causality in the long run. Nevertheless, Hacker and Hatemi-J (2006) found that the MWALD tests statistics bias to reject the null hypothesis of non-Granger causality. Therefore, a correction has to be done to avoid this bias. Following Hacker and Hatemi-J (2006), we employ the leveraged bootstrap simulation approach to yield robust causality test results. Finally, this study contributes to the empirical literature by testing the persistency or stability of the savings-led growth hypothesis by incorporating the recursive regression procedure into the TYDL Granger causality test as suggested by Tang (2008b). To the best of our knowledge, no author has hitherto demonstrated the stability or persistency of the savings-led growth causality. The stability of the savings-led growth causality is of concern because it is an important criterion for modelling appropriate growth policies. If the causal relationship is unstable, the macroeconomic policy initiatives that encourage savings may be less effective in stimulating economic growth in the long run.

The remainder of this study is organised as follows. In the next section, we will briefly discuss the econometric techniques used in this study. Section 3 reports the source of data and empirical finding of this study. Finally, the concluding remarks of this study will be presented in Section 4.

2. ECONOMETRIC TECHNIQUES

2.1 LM unit root tests with structural breaks

In this section, we discuss the LM unit root test with one and two structural breaks introduced by Lee and Strazicich (2003, 2004). The Model C and Model CC for one and two structural breaks LM unit root tests will be estimated. This is because Sen (2003) noted that Model C and Model CC are typically performed better than other models. Therefore, we estimate the following model to determine the order of integration with one and two structural breaks.

$$\Delta z_t = \delta' \Delta W_t + \phi \overline{S}_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta \overline{S}_{t-i} + \varepsilon_t \quad (1)$$

Here, Δ is the first difference operator and the residuals ε_t are assumed to be spherically distributed and white noise. $\overline{S}_{t-1} = z_t - \overline{\psi}_x - \overline{\delta} W_t$, $\overline{\delta}$ are the estimated coefficients in the regression of Δz_t on ΔW_t. In addition, $\overline{\psi}_x = z_t - \overline{\delta} W_t$ and W_t is a set of exogenous variables. As the Augmented Dickey-Fuller (ADF) unit root tests, the augmented term $\Delta \overline{S}_{t-i}$ are accommodated into the model to remove the autocorrelation problem. For the one break case (i.e. Model C), $W_t = \left[1, t, D_{1t}, DT_{1t}\right]'$, while for the two breaks case (i.e. Model CC), $W_t = \left[1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}\right]'$, where:

$$D_{1t} = \begin{cases} 1 & \text{if } t \geq TB1 \\ 0 & \text{Otherwise} \end{cases} \qquad DT_{1t} = \begin{cases} t - TB1 & \text{if } t \geq TB1 \\ 0 & \text{Otherwise} \end{cases}$$

and

$$D_{2t} = \begin{cases} 1 & \text{if } t \geq TB2 \\ 0 & \text{Otherwise} \end{cases} \qquad DT_{2t} = \begin{cases} t - TB2 & \text{if } t \geq TB2 \\ 0 & \text{Otherwise} \end{cases}$$

$TB1$ and $TB2$ are the time period of potential breaks and $\delta' = \left(\delta_1, \delta_2, \delta_3\right)$. Finally, the potential breakpoints, $TB1$ and $TB2$ are chosen where the $\tau =$ t-statistics is minimised. The GAUSS programming codes will be employed to perform the LM unit root tests with one and two structural breaks.

2.2 Granger causality test

This study uses the Granger causality test proposed by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) – TYDL to verify the long run causality direction between the candidate variables $z_t = \left[\ln Y_t,\ \ln S_t,\ \ln FCI_t,\ \ln FD_t\right]'$. Zapata and Rambaldi (1997) explored the performance of Wald and likelihood ratio tests for Granger non-causality test in the cointegrated systems. The Monte Carlo results indicate that the likelihood ratio and Wald test are very sensitive to the specification of the short-run dynamics. Indeed, Yamada and Toda (1998) conducted a Monte Carlo simulation experiment to investigate the performance of three causality procedures. The simulation results indicate that among three causality procedures, TYDL is the most stable approach. Furthermore, the Error-Correction Modelling (ECM) and Fully-Modified VAR (FM-VAR) causality approaches tend to have larger size distortion than the TYDL approach. To implement the TYDL Granger causality test, we estimate the following augmented-VAR framework with the $p = \left(k + d_{\max}\right)$ lag length.

$$z_t = \begin{bmatrix} z_t^1 \\ z_t^2 \\ z_t^3 \\ z_t^4 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \\ b_4 \end{bmatrix} + \begin{bmatrix} B_{11,1} & B_{12,1} & B_{13,1} & B_{14,1} \\ B_{21,1} & B_{22,1} & B_{23,1} & B_{24,1} \\ B_{31,1} & B_{32,1} & B_{33,1} & B_{34,1} \\ B_{41,1} & B_{42,1} & B_{43,1} & B_{44,1} \end{bmatrix} \times \begin{bmatrix} z_{t-1}^1 \\ z_{t-1}^2 \\ z_{t-1}^3 \\ z_{t-1}^4 \end{bmatrix} + \cdots + \begin{bmatrix} B_{11,k} & B_{12,k} & B_{13,k} & B_{14,k} \\ B_{21,k} & B_{22,k} & B_{23,k} & B_{24,k} \\ B_{31,k} & B_{32,k} & B_{33,k} & B_{34,k} \\ B_{41,k} & B_{42,k} & B_{43,k} & B_{44,k} \end{bmatrix}$$

$$\times \begin{bmatrix} z_{t-k}^1 \\ z_{t-k}^2 \\ z_{t-k}^3 \\ z_{t-k}^4 \end{bmatrix} + \begin{bmatrix} B_{11,p} & B_{12,p} & B_{13,p} & B_{14,p} \\ B_{21,p} & B_{22,p} & B_{23,p} & B_{24,p} \\ B_{31,p} & B_{32,p} & B_{33,p} & B_{34,p} \\ B_{41,p} & B_{42,p} & B_{43,p} & B_{44,p} \end{bmatrix} \times \begin{bmatrix} z_{t-p}^1 \\ z_{t-p}^2 \\ z_{t-p}^3 \\ z_{t-p}^4 \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \end{bmatrix} \tag{2}$$

Where k is the optimal lag length for the VAR system determine by AIC. Even though Toda and Yamamoto (1995) noted that the maximum order of integration for economics series are commonly at either $I(1)$ and $I(2)$ process, according to simulation result produced by Dolado and Lütkepohl (1996) the performance of $d_{\max} = 1$ is better than any other order of $d_{\max}$. Thus, the $d_{\max} = 1$ is preferable in this study. From equation (2), the null hypothesis of z_t^2 does not Granger-cause z_t^1 if $B_{12,k} = 0 \forall_k$ cannot be rejected, if $B_{13,k} \neq 0 \forall_k$ is rejected, the z_t^3 Granger-cause z_t^1, and so on. Nevertheless, before we define the TYDL version of Granger causality test – MWALD, Lütkepohl (2005) suggested the following notations for the general form of the VAR system:

$Z := (z_1, \ldots, z_T) \qquad (4 \times T)$ matrix,

$D := (b, B_1, \ldots, B_p) \qquad (4 \times (4p+1))$ matrix,

$$Y_t := \begin{bmatrix} 1 \\ z_t \\ z_{t-1} \\ \vdots \\ z_{t-p+1} \end{bmatrix} \qquad ((4p+1) \times 1) \text{ matrix,}$$

$Y := (Y_0, \ldots, Y_{T-1}) \qquad ((4p+1) \times T)$ matrix,

and

$\delta := (e_1, \ldots, e_T), \qquad (4 \times T)$ matrix

From the above notation, the augmented-VAR(p) model together with the constant term (b) can be expressed compactly as below:

$$Z = DY + \delta \tag{3}$$

The estimated $(4 \times T)$ matrix of the residuals from the unrestricted and restricted regression model (3) can be denoted as $(\hat{\delta}_{UR})$ and $(\hat{\delta}_R)$, respectively. Then the variance-covariance matrix of the estimated residuals are generated by $S_{UR} = \hat{\delta}'_{UR} \hat{\delta}_{UR}$

and $S_R = \hat{\delta}'_R \hat{\delta}_R$. Eventually, the MWALD test statistics for Granger causality can be computed by the following equation:

$$MWALD = (T - p) \times \left(\frac{S_R - S_{UR}}{S_{UR}} \right) \tag{4}$$

where T is the total number of observation and p is the lag length in the augmented-VAR system. Nevertheless, it is noteworthy to point out here that the additional lag order i.e. $d_{\max}$ in equation (2) is unrestricted because the inclusion of this additional lag was to ensure that the asymptotic χ^2 - distribution critical values can be used when the Granger causality test is conducted with the non-stationary variables (Toda and Yamamoto, 1995).

Next, the residuals-based bootstrapping approach will be adopted to compute the critical values for MWALD test with the empirical distribution. Following Davidson and MacKinnon (2004), 1000 times of bootstrapping will be performed to yield the leveraged bootstrap critical values. As the common interpretation for statistical inferences, the null hypothesis of non-Granger causality is rejected if the computed MWALD test statistic greater than the bootstrapped critical values.[1]

2.3 Recursive regression-based TYDL causality test

This section will briefly discuss the estimation procedure for the recursive regression-based TYDL causality test. The idea of the stability of causal relationship was raised by Tang (2008b). His study noted that the causal relationship may be not stable owing to the frequent change of global economy and political environments. With this regards, Tang (2008b) proposed the recursive regression-based causality tests to examine the stability of the causal relationship. The major advantage of this recursive causality test is that it can be used to examine the volatility or fluctuation of the causal relationship over time. In other words, we can visually inspect the stability of the causal relationship over the analysis period. The recursive regression-based TYDL causality test can be conducted by first estimate the augmented-VAR system with the initial sub-sample of T observations. Then, a new observation will be added into the end of the sub-sample without deleting the first observation (i.e. $T + 1$). The causality test will be performed for each sub-sample. For interpretation, the computed MWALD statistics will be normalised by the 10 per cent χ^2 critical values. If the calculated ratio is exceed one meaning that the null hypothesis of non-Granger causality will be rejected at the 10 per cent level.

3. EMPIRICAL RESULTS

3.1 Source of data

This study examines the savings-led growth theories for Malaysia within a multivariate framework. This study uses the interpolated quarterly data from 1970:Q1 to 2008:Q4 for real Gross Domestic Products (GDP), real Gross Domestic Savings

[1] To conserve space and the bootstrapping procedure has been well defined in the literature, we will not discuss the bootstrapping estimation procedure. Interested readers can refer to Mantalos (2000) and Hacker and Hatemi-J (2006) for a detailed discussion on how to compute the bootstrap critical values.

(GDS), real foreign capital inflow (FCI), and real money supply M2 (FD) as a proxy to financial development indicator. The interpolated data was used in this study to increase the statistical test power and to avoid the size distortion problem (Zhou, 2001). The raw data for interpolation were extracted from World Bank, *World Development Indicator* (WDI) and Bank Negara Malaysia, *Monthly Statistical Bulletin*. All data were transformed into natural logarithm form. The analyses in this study were conducted with GAUSS 9.0 and Eviews 6.0 software.

3.2 Unit root tests results

According to the time series econometrics literatures, the regression results may be spurious if the variables are non-stationary (see for example, Granger and Newbold, 1974; Phillips, 1986). Thus, it is interesting to examine the order of integration for each variable to avoid spurious correlation problem. Although the TYDL version of Granger causality test do not require pre-testing of unit root, the unit root tests result can shed some light on the order of $d_{\max}$ in the augmented-VAR system.

Table 2: The results of LM unit root tests with structural breaks(s)

Panel A: Univariate LM test for unit root with one structural break

	$\ln Y_t$	$\ln S_t$	$\ln FCI_t$	$\ln FD_t$
TB1	Jun-1981	Dec-1996	Dec-2004	Dec-1978
S_{t-1}	–3.632	–2.853	–4.530	–3.354
Lag length	9	4	12	12
Critical values				
1%	–5.15	–5.11	–5.11	–5.07
5%	–4.45	–4.51	–4.51	–4.47

Panel B: Univariate LM test for unit root with two structural breaks

	$\ln Y_t$	$\ln S_t$	$\ln FCI_t$	$\ln FD_t$
TB1	Sep-1984	Dec-1980	Dec-1987	Sep-1980
TB2	Dec-1997	Jun-1996	Dec-2001	Sep-1993
S_{t-1}	–5.199	–4.673	–5.272	–4.000
Lag length	8	9	12	12
Critical values				
1%	–6.45	–6.45	–6.42	–6.45
5%	–5.67	–5.67	–5.65	–5.67

Note: The asterisks *** and ** indicates statistical significance at the 1 and 5 per cents level, respectively. The GAUSS programming codes provided by Prof. Dr. Junsoo Lee have been used to perform the above LM tests for unit root with one and two structural breaks, respectively.

To ascertain the order of integration, we begin through applying the conventional ADF and PP unit root tests. Interestingly, the conventional unit root tests results suggest that the variables under investigation $\left[\ln Y_t, \ln S_t, \ln FCI_t, \ln FD_t\right]$ are integrated of order one $I(1)$ process. To save space, these results are not reported here. Since one of the main concerns in this study is the implications of structural break(s) on unit roots, we conducted the LM unit root tests for one and two structural breaks. The LM unit root tests results are reported in Table 2.

At the 5 per cent significance level, both LM unit root tests statistics failed to reject the null hypothesis of a unit root at level for all the variables. Therefore, we concluded that the variables are integrated of order one, $I(1)$ process. This result is corroborate to the Nelson and Plosser's (1982) assertion that most of the macroeconomics variables are non-stationary at level, but it is stationary after first differencing. Moreover, the evidence of $I(1)$ process also affirmed that the appropriate order of $d_{\max}$ for TYDL Granger causality test is one.

3.3 Granger causality test results

In this section, the long run causal relationships between the candidate variables $\left[\ln Y_t, \ln S_t, \ln FCI_t, \ln FD_t\right]$ are examined by using the TYDL Granger causality test. The results for the TYDL Granger causality test statistics together with the leveraged bootstrap critical values are delineated in Table 3.

Table 3: The results of TYDL Granger causality tests

Null Hypothesis	Estimated MWALD tests	Bootstrapped critical values		
		1 per cent	5 per cent	10 per cent
$\ln S_t \nrightarrow \ln Y_t$	20.934***	19.401	15.383	13.063
$\ln FCI_t \nrightarrow \ln Y_t$	14.983*	27.632	19.097	14.510
$\ln FD_t \nrightarrow \ln Y_t$	83.272***	15.910	10.607	8.486
$\ln Y_t \nrightarrow \ln S_t$	27.064***	23.118	16.134	13.480
$\ln FCI_t \nrightarrow \ln S_t$	26.454***	20.644	14.684	11.417
$\ln FD_t \nrightarrow \ln S_t$	8.316	20.748	15.724	13.187
$\ln Y_t \nrightarrow \ln FCI_t$	29.865**	38.120	26.940	22.602
$\ln S_t \nrightarrow \ln FCI_t$	6.497*	12.969	8.570	6.393
$\ln FD_t \nrightarrow \ln FCI_t$	0.044	6.818	3.938	2.667
$\ln Y_t \nrightarrow \ln FD_t$	94.450***	14.909	9.653	7.987
$\ln S_t \nrightarrow \ln FD_t$	12.037	21.132	15.948	12.722
$\ln FCI_t \nrightarrow \ln FD_t$	28.539**	32.739	24.189	19.594

Note: The asterisks ***, ** and * denotes statistically significant at 1, 5 and 10 per cents level, respectively.

According to the estimation results, we found that at the 10 per cent significance level the causality results could be summarised as follows: (1) causality runs from savings, foreign capital inflows and financial development to economic growth; (2) causality runs from economic growth and foreign capital inflows to savings; (3) causality runs from economic growth and savings to foreign capital inflows; (4) causality runs from economic growth and foreign capital inflows to financial development. As opposed to the neoclassical growth theory, our empirical results indicate that the savings-led growth hypothesis is a long run phenomenon. In other words, Malaysian dataset supports the endogenous growth theory. This is not an unexpected result as Malaysia is the second largest savings economies among the Association of Southeast Asia Nations (ASEAN) and this will attracted voluminous of foreign direct investment that will simultaneously enhance the technological progress (see Aghion et al., 2009). Therefore, the discovery of savings-led growth hypothesis in the long run is plausible. Indeed, this is consistent with our causality result that savings Granger-causes foreign capital inflows. Toward knowledge-based economy (K-economy), the expenditure on education and health as a proportion of total government development expenditure in Malaysia (i.e. human capital investment) increased steadily during the period of 1970 to 2007. During the decade from 1981 to 1990, the proportion of total expenditure on education increased from 7 per cent to 15 per cent, while that on health rose from 1 per cent to 4 per cent. The proportion of expenditures on education further increased from 13 per cent in 1991 to a peak of 35 per cent in 2002. This implied that the Malaysian government has recognised the important of human capital investment in stimulating economic growth and development. According to Romer (1986), increase the investment on human capital will enhance the labour force and capital productivity and efficiency because human capital does not subject to diminishing returns of scale. Meanwhile, savings is a pre-requisite for human capital investment, hence savings Granger-causes economic growth in the long run.

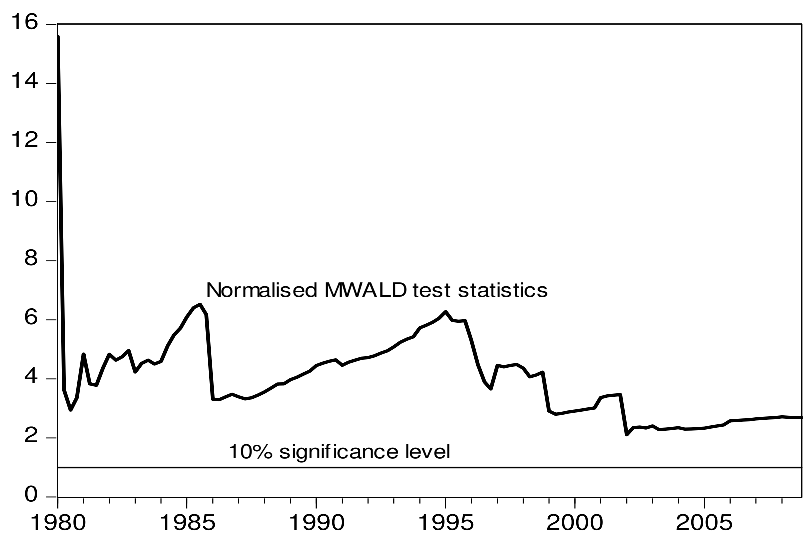

Figure 1: *The plots of recursive TYDL causality tests for the savings-led growth hypothesis*

Although we have observed a strong evident to support the vindication of savings-led growth hypothesis in the long run, the causal relationship may be not stable over time, thus we also examine the stability of the savings-led growth hypothesis with the recursive regression-based TYDL Granger causality tests. In order to implement the recursive regression-based causality test, we have to decide the initial sample size for estimation. To serve the purpose of long run causality and also to avoid the size distortion problem, we begin the estimation with 10 years sample (i.e. 40 observations). For interpretation, the computed MWALD statistics for each sample (i.e. T + 1) will be normalised by the 10 per cent χ^2 critical values. Therefore, the null hypothesis of savings does not Granger-causes economic growth is rejected if the normalised MWALD statistics greater than unity. The plots of normalised MWALD causality test statistics are presented in Figure 1. From the visual inspection, we discovered that the normalised MWALD statistics are fluctuate widely, but the causality inference for the savings-led growth is stable over the analysis period. As a result, our empirical study again rejects the neoclassical growth theory that savings does not affect economic growth in the long run. Therefore, high savings economies should be grow faster and policies initiative to enhance savings could be a potential long run sustainable economic growth strategy for the Malaysian economy.

4. CONCLUDING REMARKS

The aim of this study is to empirically examine the vindication of the savings-led growth hypothesis for Malaysia within the multivariate frameworks through the TYDL Granger causality test. This study covered the sample period from 1970:Q1 to 2008:Q4. With the TYDL Granger causality evidence, we conclude that savings-led growth hypothesis for Malaysia is valid in the long run. Interestingly, the recursive regression-based TYDL causality test also affirmed that the savings-led growth hypothesis is valid and stable over the sample period. These findings are in tandem with the new growth theory that increases of savings will affect the capital accumulation and thus economic growth in the long run. Therefore, policies initiative to encourage savings such should be implemented to boost the long run economic growth in Malaysia.

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