Fixed investment, household consumption, and economic growth : a structural vector error correction model (SVECM) study of Malaysia

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Abstract

This paper examines the dynamic linkages between economic growth, fixed investment, and household consumption in Malaysia by using a structural vector error correction model (SVECM) approach. The empirical results revealed that household consumption and fixed investment are only significantly influenced output growth in the short run. This finding tends to support the alternative view of growth hypothesis, namely fixed investment-led growth, and household consumption-led growth in the short run. In the long run, there is no significant effect of fixed investment and household consumption on growth. However, in the long run, there is a permanent effect of economic growth on household consumption and investment. This empirical finding signals that a demand side policy (for example, fiscal and monetary policy) by affecting the household consumption and investment is ineffective to stimulate the economic growth in the long run.

Keywords: Economic growth, fixed investment, consumption, SVECM
JEL: E21, E22, C22, C32

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1. Introduction

The Keynesian macroeconomic model stipulates that household consumption and fixed investment play an important role in influencing economic growth by stimulating the aggregate expenditure. Therefore, the policy maker should implement an appropriate policy (for example, fiscal and monetary policy) in order to encourage household consumption and fixed investment spending. In the meantime, household consumption and fixed investment are cyclically components, which is can change according to the business cycle conditions. For example, according to Keynesian model, aggregate consumption is volatile rather than smooth because any changes in the current income is reflected to a change in consumption.

In the demand side model, economists have identified two key driver of economic growth, namely the role of finance, and export. There are two renowned growth hypotheses in the current literature that is finance-led growth (FLG), and export-led growth (ELG). However, previous literature has given little attention in examining other growth hypothesis such as household consumption-led growth (CLG), and investment-led growth (ILG). Therefore, a good understanding of the role of consumption and fixed investment on growth is crucial to the policy maker in understanding the key driver of economic growth, and also to design an appropriate policy in stimulating household consumption and fixed investment.

In the Malaysian context, study relating to the growth-hypothesis is still limited in the literature. Therefore, Malaysia is very interesting case study for this subject for two reasons. First, there is some study in Malaysia has focused on finance-led growth, and export-led growth hypotheses, but no attention has been given in examining the role of aggregate household consumption, and fixed investment on economic growth. For example, Ang and McKibbin (2007), and Ang (2008c) has supported the evidence of finance-led growth hypothesis. In contrast, Baharumshah and Rashid (1999) has supported the evidence of the export-led growth in Malaysia. Second, household consumption and investment has contributed a significant portion of Malaysia GDP. On average, since 2000 until 2009, the share of household

consumption and investment on GDP is 70.7 %[1]. This figure indicates that the important role of household consumption and fixed investment (gross fixed capital formation) in stimulating the Malaysian economic growth.

In this paper, we provide new empirical evidence about the linkages between economic growth, investment, and household consumption in a small open economy (i.e. Malaysia). Specifically, this study tries to answer two main questions. First, what is the role of household consumption and fixed investment in influencing the economic growth? Second, how is the business cycle condition (for example, a change in economic growth) influence the aggregate demand component in terms of household consumption and investment. In order to answer the research question, the following research strategy has been used. First, we estimate the Johansen cointegration test in order to identify the number of cointegrating equations in the VAR model. Then, we used SVECM methodology in identifying the short run and long run impact matrix. Finally, SVECM impulse response function and SVECM variance decomposition has been estimated in order to examine the dynamic linkages of the variables.

The contribution of this study has twofold. First, as mentioned before, the empirical growth study in Malaysia has focused on export-led growth, and finance led-growth. There is no study try to investigate the role of aggregate household consumption, and investment (gross fixed capital formation) on growth. Therefore, this study contribute to the literature by examining the relevance of investment-led growth, and household consumption-led growth hypothesis, and complementary to the finance-led growth, and export-led growth hypothesis in Malaysia. Second, this study employs most recent time series technique, namely SVECM. This methodology allows us to examine the dynamic linkages of the macroeconomic variables by identifying the long run and short run impact matrix. To the best our knowledge, this is the first study on Malaysia, modeling fixed investment, household consumption, and GDP in multivariate framework by using SVECM methodology.

[1] This figure based on author calculation from Bank Negara Malaysia, Monthly Statistical Bulletin.

Results of the study indicate that, the significant role of household consumption and fixed investment in influencing Malaysia's economic growth in the short run. This finding tends to support the relevance of household consumption-led growth, and investment-led growth in the short run. However, in the long run, economic growth plays a significance role in affecting the household consumption and investment. This empirical finding signals that a demand side policy (for example, fiscal and monetary policy) by affecting the household consumption and investment is ineffective to stimulate the economic growth in the long run.

The rest of the paper is structured as follows. Section 2 provides the literature review about the link between investment, consumption, and economic growth. Section 3 describes the econometric framework. Section 4 presents the empirical results, and finally section 5 summarises and concludes.

2. Review of the Literature

There is a huge number of studies have examined the link between economic growth and finance (finance-led growth)[2], and export (export-led growth)[3]. Most of the studies have supported the important role of finance and export in stimulating output growth. The significant role of finance led-growth indicates that the country need to develop and deepening their financial market in order to take advantage of the positive role of financial development on economic activity. Meanwhile, the significant role of export on economic growth suggests that the countries should promote their export sector in order to obtain economic growth.

However, there is a limited number of study investigates the link between investment and household consumption on economic growth. In macroeconomic context, household consumption and fixed investment is the key driver in stimulating the aggregate expenditure. Therefore, it is expected that more consumption and investment will stimulate more aggregate spending, and subsequently will fuel economic growth.

[2] An excellent literature survey about the role of finance on economic growth can be found in Ang (2008b). In general, most of the empirical studies have supported the view that financial development plays an important role in stimulating the economic growth.

[3] The excellent review about the role of export on economic growth can be found in Giles and Williams (2000). They found that, most of the empirical studies have supported the important role of export in generating the economic growth, in particular from trade-dependent economy.

Investment-Growth Nexus

The role of fixed investment on economic growth has been examined empirically by De Long and Summers (1991), De Long et al. (1992), and Mankiw et al. (1992) in the US economy. They conclude that the rate of capital formation in the form of capital equipment plays an important role in determining the rate of country's economic growth. However, Blomstrom et al. (1996) by using Granger-Sims causality tests indicate that the causality running from economic growth to investment, which is has rejected the investment-led growth hypothesis. Another study by De Long and Summers (1993) in the developing economies has also supported the important role of investment in influencing the economic growth. Specifically, a rapid growth is found where the equipment investment is high, and slow growth when the equipment investment is low.

In a small-open economy, the investment-growth nexus is more important. This is because higher investment ratio has a positive impact on economic growth. In fact, it is likely that an increase in economic growth also lead to further increase in the investment ratio. Study by Yu (1998), Kwan et al. (1999), and Jun (2003) in China, find that fixed investment is a key determinants of China's economic growth. The findings support the view that the Chinese economy is an investment-driven economy. Therefore, the pragmatic policy should be implemented in encouraging the private investment. However, Qin et al. (2006) find that growth of capital stock and growth of investment does not lead or exogenously drive output growth either in the short run or in the long run. In contrast, Chinese output drives investment demand in the economy. Therefore, their finding rejects the investment-led growth hypothesis in China economy.

Consumption-growth nexus

Besides investment-led growth nexus, there is also well-documented in the existing literature to link the role of consumption on growth. However, most of the empirical studies have focused on the role of energy consumption (for example, electricity) on economic growth. This is because electricity plays a vital role in both the production and consumption of goods and services within an economy. For example, Ferguson et al (2000) find that a strong correlation between electricity usage and the level of economic development and growth in over one hundred

countries. However, the strong correlation does not imply a causal relationship between energy consumption and economic growth.

According to literature survey by Payne (2010), 31.15% of the previous study support the neutrality hypothesis, that is the absence of causal relationship between electricity consumption and economic growth; 27.87% the conservation (unidirectional) hypothesis, that is causality running from economic growth to electricity consumption; 22.95% support the consumption-growth hypothesis, and 18.03 percent the feedback hypothesis, which is the interdependent relationship electricity consumption and growth (causality runs in both directions)[4].

In the Malaysian context, there is some study has examined the electricity consumption-growth nexus, for example, Yoo (2006), Tang (2008), Ang (2008a), and Chandran et al. (2010). The empirical findings seem to show mixed evidence of energy-income causality in Malaysia. For example, Yoo (2006) and Tang (2008) found a bi-directional are running from electricity consumption and economic growth. However, Ang (2008a) found unidirectional causality are running from economic growth to electricity consumption, whereas, Chandran et al. (2010) find that the causality are running from electricity consumption on economic growth. However, the previous study is not taking into account the role of aggregate household consumption and fixed investment in their model.

3. Econometric Framework

In order to investigate the dynamic relationship between household consumption, fixed investment, and growth, this study used the structural vector error correction model (SVECM) framework. The most general model of structural VECM can be written as follows;

$$A\Delta y_t = \Pi^* y_{t-1} + \Gamma_1^* \Delta y_{t-1} + ... + \Gamma_{p-1}^* \Delta y_{t-p+1} + C^* D_t + B^* z_t + \nu_t \quad [1]$$

Where,

[4] Payne (2008) also provides the excellent literature survey about the causal relationship between energy consumption and economic growth.

$y_t = (y_{1t},....,y_{Kt})'$ is a $(Kx1)$ vector of endogenous variables [in this study, $y_t = (LGDP, LHCON, LGFCF)'$], where LGDP is log of gross domestic product, LHCON is log of household consumption, and LGFCF is log of gross fixed capital formation; z_t is a vector of exogenous or unmodeled stochastic variables; D_t contains all deterministic terms; the Π^* , $\Gamma_j^*(j = 1,...., p-1)$, C^* , and B^* are structural form parameter matrices; and v_t is a $(Kx1)$ structural form error that is a zero mean white noise process with time-invariant covariance matrix $\sum_v$. The invertible (KxK) matrix A allows instantaneous relations among the variables in y_t .

Following Lutkepohl (2005), by assuming all variables area stationary at I(1), the data generation process can be represented as a VECM as follows;

$$\Delta y_t = \alpha\beta' y_{t-1} + \Gamma_1 \Delta y_{t-1} + ...\Gamma_{p-1}\Delta y_{t-p+1} + \mu_t \text{ , } t = 1,2,3..... \quad [2]$$

Where,

y_t is a K -dimensional vector of observable variables and α and β are (Kxr) matrices of rank r . More precisely, β is the cointegration matrix, and r is the cointegration rank of the process. The term $\alpha\beta' y_{t-1}$ is referred to the error correction term. The $\Gamma_{j's}$, $j = 1,..., p-1,$ are (KxK) short-run coefficient matrices, and μ_t is a white noise error vector with mean zero and non-singular covariance matrix $\sum_{\mu,} \mu_{t\sim}(0, \sum_{\mu})$. Moreover, $y_{-p+1,...,} y_0$ are assumed to be fixed initial conditions.

The VECM model can also represented by MA representation as;

$$y_t = \Xi \sum_{i=1}^{t} \mu_i + \Xi^*(L)\mu_t + y_0^* \quad [3]$$

Where, $\Xi = \beta_\perp \left(\alpha_\perp' \left(I_K - \sum_{i=1}^{p-1} \Gamma_i\right)\beta_\perp\right)^{-1} \alpha_\perp'$, $\Xi^*(L) = \sum_{j=0}^{\infty} \Xi_j^* L^j$ is an infinite-order polynomial in the lag operator in the lag with coefficient matrices Ξ_j^* that go to zero as $j \to \infty$. The term y_0^* contains all initial values. Notice that, Ξ has rank $K-r$ if the

cointegrating rank of the system is r. It represents the long-run effects of the forecast error impulse response, whereas $\Xi_j^{*}{}'s$ contain transitory effects.

In order to examine the dynamic relationship between the variables, impulse response is often used to study the relationship between the variables of the dynamic model such as in equation (1). Therefore, we follow the methodology proposed by King et al. (1991) in order to specify the reduced form model. According to King et al. (1991), there are two steps in estimating the SVECM model. First, the cointegration rank (r) in the VAR model has to be specified. Second, the structural shocks of the VAR model have to be recovered by imposing enough identifying restrictions. For example, in this study, with $K=3$ variables, and with $r=2$, this indicates that a maximum number of two shocks may have transitory effects. Therefore, there will be one permanent shock $\left(k^{*}=K-r\right)$ in the system. The permanent shocks is identified by restricting the long-run effects of the last two structural shocks in the system to zero (King et al., 1991). Because $k^{*}=1$, the permanent shock is identified without further assumptions $\left(k^{*}\left(k^{*}-1\right)/2=0\right)$. For identification of the transitory shocks, $r(r-1)/2=1$ further restriction is needed.

The identification of long-run (ΞB) and short run (B) impact matrix is given by;

$$\Xi B=\begin{bmatrix} * & 0 & 0 \\ * & 0 & 0 \\ * & 0 & 0 \end{bmatrix} \text{ and } B=\begin{bmatrix} * & * & * \\ * & * & 0 \\ * & * & * \end{bmatrix} \qquad [4]$$

Where, asterisks denote unrestricted elements. Because ΞB has rank 2, the two zero column represents two independent restrictions only. It is assumed that household consumption (LHCON) and fixed investment (LGFCF) has a transitory effect, whereas output (LGDP) has a permanent effect in the system. A third restriction is placed on matrix B, and thus we have a total of $K(K-1)/2$ independent restrictions as required for just-identification. The recursive structure of the transitory shock (matrix B) is assumed such that the second transitory shocks (household consumption) does not have an instantaneous impact on the third transitory shocks (gross fixed capital formation).

4. Empirical Findings

Table 1 reports the result of the unit root test by using the Augmented Dickey-Fuller test. As can be seen, all variables that are LGDP, LHCON, and LGFCF are not stationary at level form. However, after first differencing, all variables are stationary at least at 5 percent significance level. The stationary of the variables in the same integrated order, which is I(1), permit to examine the long run relationship between the variables in the VAR model. The optimum lag in the VAR model is 5 according to Schwarz (SC) and Hannan-Quinn (HQ) information criteria. The result of the Johansen cointegration test is presented in Table 2. As can be seen in Table 2, by using Trace (Panel A) and Max-Eigen statistics (Panel B), there are two cointegrating equation are emerged. This indicates that, there is a long run relationship between LGDP, LHCON, and LGFCF.

Table 1 : Unit root test : Augmented Dickey Fuller (ADF)

	Level Form		First Difference	
Variables	Constant and no trend	Constant and trend	Constant and no trend	Constant and trend
LGDP	-1.657 (10)	-2.515 (12)	-2.948** (8)	-3.165** (8)
LHCON	-0.122 (7)	-2.105 (12)	-4.144*** (8)	-4.125*** (8)
LGFCF	-1.899 (1)	-2.510 (1)	-6.389*** (1)	-6.334*** (12)

Note: *** Denotes significant at the 1% level, ** significant at 5% level and * significant at 10 % level which reject of the null hypothesis on non-stationary. Critical value obtain from Fuller (1976) for constant but no time trend is -3.53, -2.91 and -2.59 for 1%, 5% and 10% significant level respectively, and the critical value for constant and time trend is -4.11, -3.48 and -3.17 for 1%, 5% and 10% significant level respectively.

Number in bracket is the optimum lagged based on Akaike Information Criterion (AIC).

Table 2 : Johansen Cointegration Test

Panel A : Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.292766	37.35175	24.27596	0.0007
At most 1 *	0.154102	12.4114	12.3209	0.0483
At most 2	0.005012	0.361763	4.129906	0.6105
Panel B : Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.292766	24.94035	17.7973	0.0036
At most 1 *	0.154102	12.04963	11.2248	0.0357
At most 2	0.005012	0.361763	4.129906	0.6105

Note: * denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

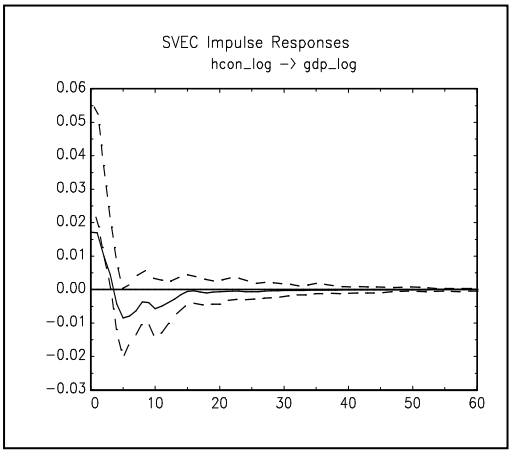
Figure 1 reports the result of structural VECM impulse-response. As can be seen in Panel A, LGDP has responded positively to the innovation in LHCON up to 5 quarters. For example, in first quarter, a 1 percent innovation shock in LHCON lead to increase LGDP by 0.017 percent. However, from quarter 5 until quarter 15, the LGDP has responded negatively to the positive innovation in LHCON. The effect of LHCON to LGDP returns to the equilibrium path after 15 quarters. LGDP has responded positively to the positive innovation in LGFCF. For example, in the first quarter, a one percent increases in LGFCF lead to an increase in LGDP by 0.013 percent. The effects of LGFCF to LGDP are decaying after 20 months. This finding indicate that, household consumption and investment can only influence the economic growth in the short run.

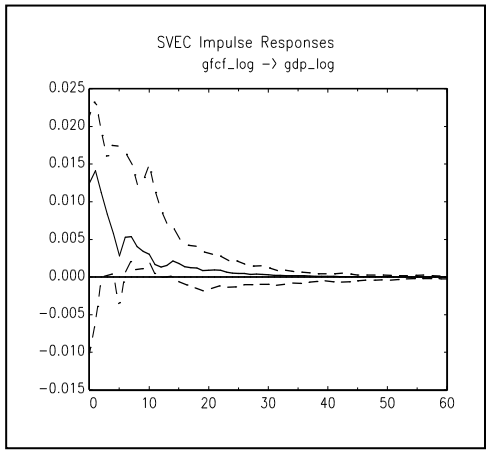
In Panel B, LGDP has a permanent effect to LHCON and LGFCF. In the long run, a one percent increase in LGDP lead to an increase in LHCON and LGFCF by 0.04 and 0.14 percent, respectively. This finding signals that business cycle condition plays an important role in affecting the household consumption and fixed investment in the long run. In Panel C, there is a negative response of GFCF to the positive innovation of LHCON in the short run, which indicates that, the more spending from the household is associated with less capital investment. However, the effect is decaying after 20 quarters. In contrast, there is a hump-shaped response of LHCON following to the positive innovation in LGFCF. However, in general the response of LHCON is positive. This indicate that, an increase in capital accumulation tend to encourage household spending.

Table 3 reports the result of SVECM variance decomposition. As can be seen in Panel A, in the first quarter, LHCON and LGFCF has contributed 96 percent in explaining the variability of LGDP. This indicate that the important role of household consumption and fixed investment in stimulating the economic growth in the short run. However, after 18 quarters, there is a small role of LHCON and LGFCF in influencing the LGDP, which is their contribution, is less than 10 percent in explaining the output variability. In Panel B and Panel C, LGDP plays a significant role in explaining the variability of LHCON and LGFCF. For example, LGDP has contributed more than 90 percent in explaining the variability in LHCON and LGFCF in the long run.

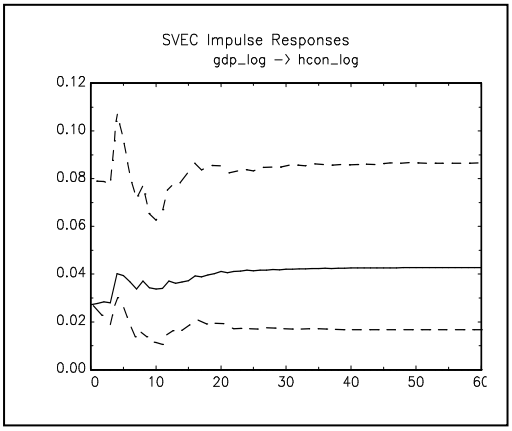
Figure 1: Structural VECM Impulse-Response

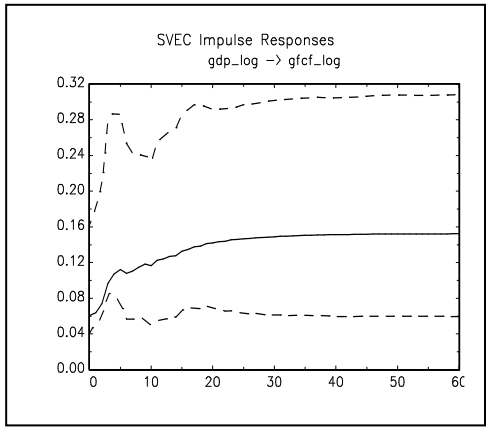
Panel A : The response of LGDP to the LHCON and LGFCF impulses



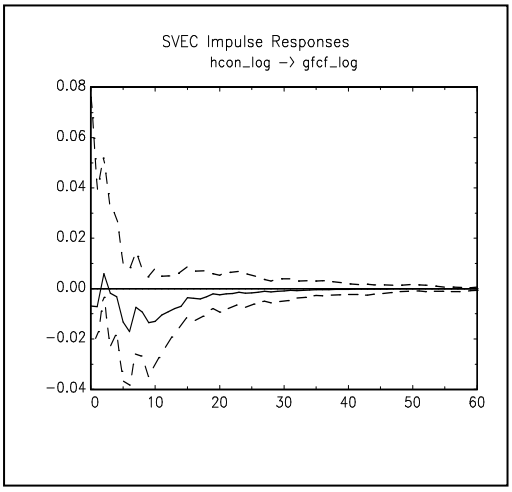


Panel B : The response of LHCON and LGFCF to the LGDP impulses





Panel C : The impulse-response of LHCON and LGFCF



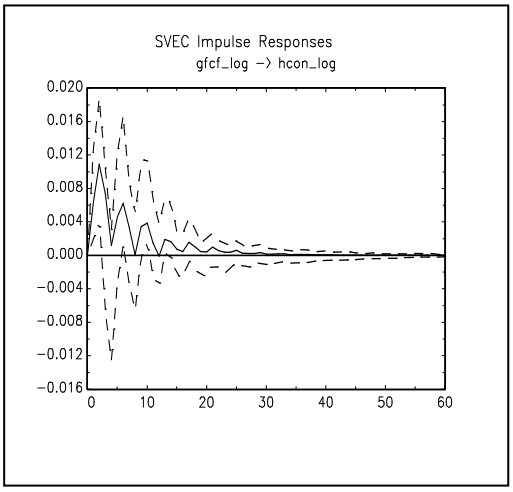


Table 3: SVECM Variance Decomposition

Panel A : SVEC Forecast Error Variance Decomposition in LGDP			
forecast horizon	LGDP	LHCON	LGFCF
1	0.04	0.63	0.33
6	0.57	0.25	0.18
12	0.67	0.19	0.14
18	0.78	0.13	0.09
24	0.86	0.08	0.06
30	0.9	0.06	0.04
36	0.92	0.05	0.03
42	0.93	0.04	0.03
48	0.94	0.03	0.02
Panel B : SVEC Forecast Error Variance Decomposition in LHCON			
forecast horizon	LGDP	LHCON	LGFCF
1	0.9	0.1	0
6	0.93	0.04	0.04
12	0.95	0.02	0.02
18	0.97	0.02	0.01
24	0.98	0.01	0.01
30	0.98	0.01	0.01
36	0.99	0.01	0.01
42	0.99	0.01	0.01
48	0.99	0	0
Panel C : SVEC Forecast Error Variance Decomposition in LGFCF			
forecast horizon	LGDP	LHCON	LGFCF
1	0.59	0.01	0.4
6	0.9	0.01	0.09
12	0.95	0.01	0.04
18	0.97	0.01	0.03
24	0.98	0	0.02
30	0.98	0	0.01
36	0.99	0	0.01
42	0.99	0	0.01
48	0.99	0	0.01

5. Summarizes and conclusions

This paper provides new empirical evidence about the link between economic growth, fixed investment, and household consumption in a small-open economy (i.e. Malaysia) by using a SVECM approach. It tests the relevance of another growth hypothesis namely household consumption-led growth, and fixed investment-led growth. In the meantime, the long run effects of growth to household consumption, and fixed investment has also examined.

The finding indicates that the relevance of household consumption-led growth and fixed investment-led growth in the short run in the case of Malaysia. This finding signals to the policy maker to design an appropriate fiscal and monetary policy in order to stimulate the household consumption and fixed investment in the short run. Since the effects of household consumption and fixed investment on economic growth only significant in the short run, therefore, the policy maker should also concern another long run growth strategy, for example by implementing a policy that encourage the supply side effect in the economy. This is because any demand side policy (for example, fiscal and monetary policy) that encourages household consumption and fixed investment has only effective to stimulate economic growth in the short run. The stability in the business cycle condition (for example, stability in the long run economic growth) is also important in influencing household consumption and capital accumulation (fixed investment) in the long run. Therefore, the policy maker can implement a prudent fiscal and monetary policy as well as supply side policy in order to stabilize the business cycle conditions.

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