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THREE DECADES OF BUDGET DEFICIT AND SHOCK RESPONSES: THE MALAYSIA CASE

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Abstract
Malaysia has experienced budget deficits for the past three decades. The accumulated deficits and public debts have escalated, thus casted doubts on the capacity of fiscal expansion to endure economic growth. Yet, the limited empirical evidences are far from conclusive. This paper examines the Malaysian budget deficit-economic growth nexus during 1980-2018, with other macroeconomics variables (e.g. interest rate, inflation, exchange rate, domestic investment) taken into consideration. To capture the dynamic relationship, a set of comprehensive econometric procedures has been employed, including cointegration, Granger causality, error correction modelling, impulse response function and variance decomposition. Our analysis reveals that budget deficits contributed to economic growth and were bounded together with macroeconomic variables in both the long-run and short run with different magnitudes and shock adjustments. In brief, GDP is negatively linked to budget deficits, foreign exchange rate and interest rate, but positively linked with domestic investment and inflation. In addition, budget deficits exhibited bidirectional causality with domestic investment, and showed unidirectional causal effect on GDP. The finding would suggest that increases of budget deficits and domestic investment promotes economic productivity. Monetary expansion with lower interest rate and exchange rate appreciation would help to correct budget deficits but the impacts are minor, due to less-profound financial deepening. A balancing and well-coordinated public finance policy would help to sustain economic growth.

Research paper

Keywords: Budget Deficit, Public Debts, Financial Crises, Macroeconomics variables, Sustainable Growth

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Introduction

Studies on fiscal expansion and public debt sustainability has been dynamic since three decades ago due to the increasing occurrence of budget deficits in many economic giants including the United States, Japan, and members of European Union. In 2017, only 47 out of 222 countries worldwide are not in a fiscal deficit (CIA's World Factbook, 2018). There are different theories explaining the phenomenon of fiscal deficits and could be many reasons to the deficit. And to date there are still unsettled argument on the effect of government budget deficit on economic growth when financial crises are considered. On the negative part, studies showed that the fiscal deficit has causal effect on higher inflation and interest rates, weaker exchange rates, decreased productivity and discouraged private investment, thus creating negative impact to economic stability (Tung, 2018; Kurantin, 2017; Hakkio, 1996). Scholars also argued that financing deficit through borrowing is a feasible method for short term but would not work for persistent deficits. If government expand monetary supply to finance the deficit, it will lead to rise in inflation. Inflation further reduced growth by reducing investment and productivity growth (Fischer, 1993). In addition, effect of budget deficits on foreign exchange rates was not uniform among OECD countries, and was subjected to the inflation and debt conditions (Apergis, 1998; Hakkio, 1996). But for most emerging economies, budget deficit can be a tool for government to stabilize a country's macroeconomics such as income redistribution and poverty reduction, as well as to stimulate economic productivity and sustainable growth (Lizzeri, 1999; Huynh, 2007; Radovic

Markovic & Salamzadeh, 2012; Antwi et al., 2013; Kurantin, 2017). It also helps in gaining popular votes for existing government against the opponent parties (Persson & Svensson, 1989).

Malaysia experienced budget deficits for more than 30 years (except for 1993-1997), with an average ratio of -4.5% to GDP. The data reached an all-time high of 6.2 % in 1997 and a record low of -21.0 % in 1981 (Central Bank of Malaysia, 2019). In the 1970s, National Economic Policy stimulated the establishment of large commercial enterprises. During that time, Malaysian government intervened directly in the socioeconomic development process for overall country development needs, and budget started to show deficit. In addition, external factors such as the global financial turbulences and oil shocks also increase the likelihood of fiscal imbalances among the small and open economies, like Malaysia. In the past, there were oil price shocks in 1970s, aggravate in commodities prices in 1980s and, Asian crisis in 1998. Lately, there were global recession in 2008 and oil price depreciation in 2013. During or after crisis, the Malaysian authority had taken steps such as countercyclical fiscal policy to stimulate local economic activities against recession. Privatization was then introduced and nurtured to reduce the burden of government and to ease the budget deficit. Further involvement of the private sector to stimulate economic growth and the re-structuring of taxation structure, have improved national saving and remarkably strengthen national fiscal position, to achieve surplus during 1993-1997. However, the 1998 remarked as a turning point for enlargement of fiscal deficit and public debts. The following dot-com crisis (2003), sub-

prime crisis (2007), European debt crisis (2008) and recent oil price depreciations started in 2013, have all further putting pressure on fiscal expansion, despite the less-profound financial deepening in Malaysia (Chan et al, 2019). By December 2018, Malaysia's national government debt reached US$177.7 billion, about 197.6% of nominal GDP (CEIC database, 2019).

In recent literature, the relationship of budget deficits and macroeconomics variables are inconclusive. But what worries most is that, studies showed that most of the country's economic performance could not recover back to prior crisis. The budget deficit tended to increase and persist, thus raise the concern that it would affect macroeconomic stability. A government's ability to sustain its deficit is very much depending on its ability to raise funds, for example via borrowing. For instance, Central Bank of Malaysia had reported that a high budget deficit in the fourth quarter of 2006, at RM 24,605 million was due to domestic debt which government was financing via Malaysian Government Securities – MGS (Rahman, 2012). Malaysian government debt-to-GDP ratio that has increased significantly since the global financial crisis. In addition, the government-guaranteed loans in the past, reduce of oil tax revenues and outstanding debts from state fund and 1 Malaysia Development Bhd, have all contributed to lower financial ratings and foreign exchange depreciations.

To date, there is limited empirical study on Malaysian case and the findings are inconclusive. Study by Aziz, et al (2000) showed support for 'Fiscal Synchronization' hypothesis due to bi-directional causal effects among the federal government revenue and expenditure from 1960 to 1996.

Rahman (2012), in the following study, showed that Malaysia budget deficit has no long run relationship with GDP, but positively linked with expenditure. However, another study by Lau, Lee, and Baharumshah (2015) showed the presence of causal effect between GDP and budget deficit. Baharumshah, Soon, and Lau (2017) further claimed that government had implemented sustainable fiscal policy during the period of 1980-2014. The study also demonstrated uni-directional causal linkage between debt and economic growth, but the variables would have negative correlation when a certain threshold is exceeded, in which a reduced in deficit is necessary for long run sustainability. Dzarr, Rus, Hidthiir, and Bhuiyan (2016), in a study covers the period of 1965-2005, found significant relationship between budget deficit and inflation in long run but not in short-run. Inflation in Malaysia was peaked around 1981 due to the increased oil prices, and then in 1998 again, in accordance to Asian financial crisis. The latter was somehow controlled with the pegging of exchange rate. Along the line, Wong and Lim (2005) postulated that the healthy status of the national fiscal finance and low dependency on external borrowing are the reason the country has less difficulty during the Asian crisis. However, to our best knowledge, no study has assessed the dynamics of fiscal deficits during the recent oil price crash that entailed with the Ringgit depreciation for more than 30%. The incidents have resulted in reduce of oil tax revenues and enlarge the public debts. On the other hand, cross-sectional and cross-national analyses that involved Malaysia and regional economies were claimed as ineffective to capture one

specific country's context of fiscal management (Makin, 2005; Van & Sudhipongpracha, 2015).

Motivated by the unsolved issues mentioned above, this study is set to gain a better understanding of the budget deficit-economic growth nexus with other macroeconomic factors taken into accounts. Our study will fill up the research gap based on recent updates of econometric procedures. The analysis period of 1980-2018, covers all major crises experienced by Malaysia and, the recent period of exchange rate depreciation and oil price crash. We aim to provide more insights on government response to shocks and potential policy implementation that could strengthen Malaysia position in global economic, even during undesirable recession or crisis.

The paper is organized as follows: Section 2 reviews the relevant literature, followed by brief description of methodology setting in Section 3. Section 4 then discusses the empirical results and policy implications. Section 5 concludes the paper.

Literature Review

a) Budget Deficit and Theories

Budget is the financial planning, which can serve several purposes such as monitor of the income and expenditure over a specified period of time which normally is over the time of a year, determine whether any adjustments would be required in achieving the goals set, to forecast the timing and availability of income and expenses, and lastly to provide a fundamental accountability and transparency on the expenses and incomes (Ku-

rantin, 2017). A budget can be either in surplus or deficit. Surplus happens when revenues generated is higher than the budgeted expenditure, whereas deficit indicates that the national expenditure has exceeded the revenue generated. There could be many reasons to the deficit, for example lower exportation generated income than projected, delays or poor in revenue collection. Countries such as Unites States and United Kingdon have gone through large budget deficits since the 80s, while Japan as well has huge budget deficits beginning 90s. A deficit policy may be important for country's macro stability, such as income redistribution, poverty reduction and sustainable economic growth, and therefore may not necessary a bad situation (Antwi, et al., 2013).

These phenomena have spark off the investigation on the sustainability of government budget deficits and its economic consequences. Budget sustainability is the ability of a government to support its spending in long run without threaten its solvency. Intertemporal budget constraint states that that if a government experienced deficit for some years, it is expected that it will go back to surplus in future (Wong, 2014). Sustainable economic growth and sound macro economy policy could determine the welfare of future generation and play important role in changing people's living standard, furthermore, a country which have achieved high level of economic growth would provide an example model to the other countries thus increase the country's wealth and status among them (Buscemi & Yallwe, 2012).

Three main streams of budget deficit study and its effect on economic development can be viewed from the Neo-classical, Ricardian Equiva-

lence and Keynesian framework. Neo-classical and Ricardian paradigm pays attention to long run while Keynesian perspective more towards short run. According to Neo-classical perspective, budget deficit leads to effect of increase current consumption, shifting taxes to future generation, cause the decrease in saving, therefore the lower interest rate which would have to be balanced with increase of interest rate in capital market at the end resulted a decreased investment in private sector. This is the budget deficit "crowding-out" effect (Bernheim, 1989). In short run, the tendency of budget deficits to "crowd-out" its domestic investment is low as well as its capital stock in long run (Taş, 1992). According to Kurantin (2017), the phenomenon of increased real interest rate could only be caused by country which is influencing enough to influence the world market or when the debts provoke higher expectation of the foreign lenders on the returns. Due to the budget deficit, country's government could decide to replace the deficit with current taxes, increase in foreign borrowing, leads to current account deficits.

Keynesian theoretical framework on the other hand supports the "crowding-in" effect of budget deficit. Buffet deficit is increasing the domestic production to support the private sector investment. And during deficit, there are unemployed economic resources, consumers are limited by liquidity constraints and aggregate consumption is sensitive to individual disposable income changes. Kurantin (2017)'s study has depicted that the public infrastructure supports the production and distribution of goods and services in private capital, thus causing the "crowding-in" effect. The conventional framework does not distinguish the alternatives uses of deficits or the

alternative source of financing. The expenditure could be due to government consumption or investment expenditure; the financing could be from borrowing either from internal or external, or via monetization policy. Therefore, there is no explicit constraint in analysis. Subsequently, the Keynesian postulates that an increase in expenditure which financed by borrowing could cause multiplier-based expansion leading to increased demand for money (or bond have to finance it if money amount is fixed) then interest rate rises to offset the multiplier effects. In respond to the interest rate spike up, savings and investment may be stimulated because utilization of the previously unused resources. Co-integration analysis on the quarterly data from the U.S. over year 1947–1992 supported the "Crowd-in" argument (Bahmani-Oskooee, 1999). Nevertheless, at full employment, deficits would steer towards "crowding-out".

The Ricardin equivalence model viewed deficits have neutral impacts on economic growth. It focusses on the budget deficit must be recompensed in the future with total present value of revenue fixed by total present value of spending (Kurantin, 2017). Implication from this paradigm is that the reduction of current tax revenues must be paid off by increased future taxes, with un-changed interest rates and private investments (Bernheim, 1989). In other words, the present value of spending must be paid off by the equal to present value of tax and no-tax revenues. There would be no impact on real interest rate as the deficits decrease the government saving is offset by increased private saving. From this perspective, budget deficit can be a well practicable tool to deal with consequences of revenue shock and

meeting unforeseen expenditure by spreading the impacts over a period of time. The time horizon can be extremely long and extended beyond current generation to take care tax liabilities of future. Government of Ghana aimed to run fiscal deficits to raise enough capital stock and stimulate economic growth via its steady state growth path therefore deficits could be offset through issuing debt which to be repaid in the future (Antwi et al., 2013).

Strategic deficit theory suggests that budget deficit is a strategy and tool for a current in-charged government to utilize budget deficit to secure its success in winning voters' support. Lizzeri (1999) in the publication "Budget deficit and political redistributive politics", same forces that push politicians to redistribute resources across voters to pursue political advantage are forces that generate budget deficits. A deficit policy may be important in country's macroeconomics stability, income redistribution, poverty reduction and sustainable economic growth (Antwi et al., 2013). On the other hand budget deficit is interpreted as a way to constrain the current government candidate's opponent party as successors after election. Persson and Svensson (1989) validated this second theory and stated that this constrain strategy is beyond fiscal policy strategy and worth further research. The examples portraying this strategy are the Thatcher government (Britain) privatization policy and the Likud government (Israel) settlement policy and the Reagan government (United States) administration policy.

b) Budget Deficit and Macroeconomics Performance

Gross Domestic Product (GDP) is the broadest quantitative measure of a nation's total economic activity. It is an indicator to a nation's economic health status. In the study of Huynh (2007) on the developing countries in Asia, showed that the persistent budget deficit in Vietnam over the period of 1990 to 2006 has negatively impacted the country's GDP growth rate. Kurantin (2017) illustrated that 5% increase in the Ghana national budget deficit resulted 0.36 times decrease in the GDP. In similar vein, Gale and Orszag (2003) reviewed the literature and found significant connections between deficits and interest rates. According to their earlier work, a sustained increase in deficit of 1% of GDP would increase the interest rates by 40-50 basis points after 1 year and 50-100 basis points in long run (after 10 years). There is positive impact from the increased budget deficit on United States' long-term nominal interest rate illustrated in the study by Cebula (1988), using the data from year 1971 to 1984 (Kurantin, 2017). Meta-analysis on the G-7 countries (major industries countries): Canada, France, Germany, Italy, Japan, United Kingdom, and United States showed that the budget deficit increase short-term interest rate but not impact the long term interest rate, worsen the trade balance yet overall improved economic growth in these countries (Al-Khedair, 1997). In 2003, Cebula updated his statement on relationship between budget deficits and real interest rate. Using error-correction estimation (ECM), he strongly suggested a bi-directional relationship existence between deficits and real interest rate, to justify William Simons' concern empirically (Cebula, 2003). In Ghana, the economic varia-

bles inflation, interest rate and real GDP has been found to behaved negatively towards changes in budget deficit (Antwi et al., 2013). Due to the budget deficit, central bank expanded the monetary base and supply to finance this burden in Ghana. This would further relate budget deficits to the high rise in inflation. Fischer (1993) provided evidence to show that the economic growth is negatively associated with inflation, large budget deficits, and distorted foreign exchange markets. He further explained that the inflation reduces growth by reducing investment and productivity growth; budget deficits also reduce both capital accumulation and productivity growth. Hakkio (1996) demonstrated that there are a negative relationship between budget deficit and exchange rate in Sweden and Finland, using a simple regression analysis.

Domestic investment is important in economic processes and have relations to various economics variables. Public investment includes in public infrastructure, social welfare as well as economic activities. Both the extended Neo-classical and endogenous growth model mentioned about the role of domestic investment in economic growth. Several studies on domestic investment and its relations to economic growth, based on co-integration analysis for and Granger causality test, suggesting that direct investment is causing GDP and not the other opposite (Bakari, 2017). Different conclusion was drawn on the relationship of budget deficits and macroeconomics variables. For Vietnam – one with the highest budget deficit among the ASEAN, Van and Sudhipongpracha (2015) demonstrated that the government deficits had no direct impact on the country's economic productivity

after the implementation of Doi Moi reform policy in the late 1990s. Instead, the foreign direct investment (FDI) stimulated the economic growth over period of 1989-2001, and real interest rate negatively impact the economic growth. Tung (2018), on the other hand, using the data from 2003-2016 and the ECM, convinced that budget deficit affected the economic development in both short and long-run, with negative impacts on private investments, foreign direct investments, and net exports. Hakkio (1996), in addition, suggested that improved budget deficits would strengthen exchange rate for country with poor debt and inflation. However, Apergis (1998) reported that among 8 OECD countries, the impacts of budget deficits on exchange rate movement are indecisive. Simply, influence of budget deficit on exchange rate is as well determined by a country's inflation and debt condition.

Data and Methodology

In this paper, the annual data on Malaysia federal government budget deficit, national gross domestic product, inflation rate (Consumer Price Indicator), exchange rate (RM/USD), gross investment (by proxy real gross fixed capital formation, GFCF), and real interest rate (Treasury Bills), from year 1980 to 2018, are sourced from Department of Statistics Malaysia (DOSM), Bank Negara Malaysia (BNM) and World bank. The data are transformed into natural logarithm prior to the analysis which carried out via the E-views software.

The theoretical model is hypothesized in such way that the national economic performance, Y, is a function of inflation rate, exchange rate, interest rate, budget deficit, and gross domestic investment.

$$Yt = \int(DF_t, FOREX_t, INV_t, R_t, INF_t) \quad (1)$$

where Y represents economic performance, gross domestic product (GDP), DF represents budget deficit, FOREX represents exchange rate of Malaysian Ringgit against the US dollar, INV represents gross domestic investment, R represents interest rate, and INF represents inflation rate; at year *t*. In the empirical analysis, primary model is expressed as:

$$lnY_t = \beta_0 + \beta_1 lnDF_t + \beta_2 lnFOREX_t + \beta_3 lnINV_t + \beta_4 lnR_t + \beta_5 lnP_t + \varepsilon \quad (2)$$

where Y = real gross domestic product, represents national economic performance, DF = budget deficit, FOREX = real exchange rate, INV = gross domestic investment, R = real interest rate, P = consumer price index that taken as proxy for inflation rate, t = year (1980-2018), and ε = an error term. β_0, β_1, β_2, β_3, β_4, β_5 are the respective parameters.

a) Unit Root and Cointegration Tests

Regression analysis cannot proceed with non-stationary variables. First, we use the augmented Dickey-Fuller (ADF) unit root test to examine the stationarity of each variables. Second, we run Johansen-Juselius's (JJ) multivariate co-integration test. Co-integration exists when there is a linear combination of two or more non-stationary variables that is stationary. This test would identify any relationships that link these variables together in

long-run. Johansen test applies Trace test and Maximum Eigenvalue test. In Trace test, null hypothesis states that the number of co-integrating vectors are less than or equal to con-integrating relations, r; the alternative hypothesis states that there are more than r co-integrating relations.

$$LR_{tr}(r|k) = -T \sum_{i=r+1}^{k} \log(1-\lambda_i) \quad (3)$$

where λ_i is the *i*-th largest eigenvalue of the Π matrix. The Maximum eigenvalue test the null hypothesis of the number of co-integrating vectors are less than or equal to r, the alternative hypothesis states that there are r+1 co-integrating relations between variables. Critical value for JJ test is computed using MacKinnon-Haug-Michelis (1999) *p*-values.

$$LR_{max}(r|r+1) = -T\log(1-\lambda_{r+1}) = LR_{tr}(r|k) - LR_{tr}(r+1|k) \quad (4)$$

for $r = 0, 1, \ldots, k-1$.

b) Granger Causality Test

Then, we evaluate causal interrelationship (either unidirectional or bidirectional) between the macroeconomic variables. In Granger test, bivariate regression is run the form of

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \cdots + \alpha_t y_{t-1} + \beta_t x_{t-1} + \cdots + \beta_t x_{t-1} + \epsilon_t \quad (5)$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \cdots + \alpha_t x_{t-1} + \beta_t y_{t-1} + \cdots + \beta_t y_{t-1} + \upsilon_t \quad (6)$$

for all possible pairs of (x, y) series in the group. The null hypothesis is that x does not Granger-cause y in the first regression and that y does not Granger-cause x in the second regression.

c) Impulse Response Function (IRF) and Variance Decompositions

A vector autoregressive (VAR) model is commonly used to analyze the dynamic impact of random disturbances on the system of variables. Using reduced form VAR approach, every endogenous variable is treated as a function of the system variables p-lagged values. Our VAR structure has six endogenous variables and an exogenous intercept C. Impulse response function (IRF) complement Granger causality test to provide a complete view on interactions among the variables in a system. A shock to the variable would affect the variable and the effect is further transmitted to the other variables throughout the dynamic VAR structure, thus this effect is traced in IRF. IRF is interpreted by assumed all of the other shocks are constant. Furthermore, we conduct variance decomposition to separates the variation in an endogenous variable into the component shocks to the VAR to provide information about the relative importance of each random innovation in affecting the variables in the VAR. We use the Cholesky decomposition, also named Cholesky factorization, which is a decomposition of a Hermitian positive-definite matrix, to identify the underlying shock (Hatemi-J, 2014).

Results

This study involves six macroeconomics variables, spanning from 1980 to 2018 annually. The descriptive statistics are presented in Table 1. As shown, the skewness for a normal distribution is zero while the skewness score for the variables are deviated from zero, therefore the variables less likely to be normally distributed. All are skewed to the left (negative value),

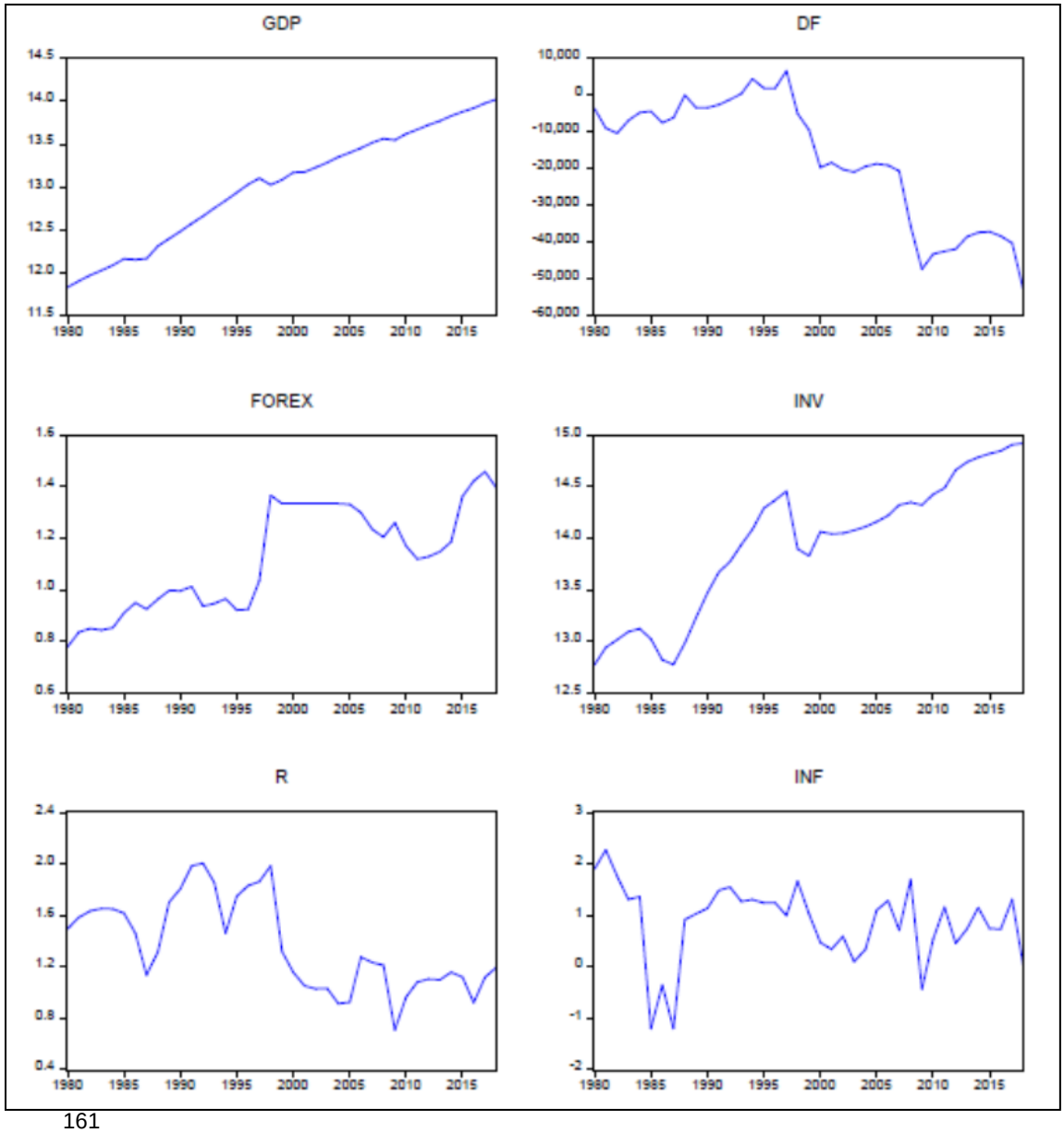
except real interest rate (positive value). All the variables showed positive Kurtosis, and not close to expected value of 3, indicates that they are not symmetrically distributed. The data does not come from a normal distribution is also confirm via Jarque-Bera test, in which all scores are more than 1.

Table 1: Desriptive statisctics on macroeconomics variables in this study

	GDP	**DF**	**FOREX**	**INV**	**R**	**INF**
Mean	13.03	9.5	1.14	13.9	1.31	0.81
Median	13.2	9.85	1.18	14.06	1.2	0.97
Maximum	14.02	10.88	1.46	14.92	2	2.27
Minimum	11.83	7.13	0.78	12.77	0.71	-1.2
Std. Dev.	0.71	1.04	0.21	0.71	0.34	0.8
Skewness	-0.3	-0.41	-0.25	-0.23	0.55	-0.79
Kurtosis	1.63	2.01	1.63	1.76	2.35	3.5
Jarque-Bera	3.16	2.36	3	2.49	2.32	3.85
Sum	442.89	323.07	38.93	472.69	44.61	27.61
Sum Sq. Dev.	16.75	35.5	1.42	16.44	3.85	21.34
N	38	38	38	38	38	38

The trend and movement of these variables are illustrated in Figure 1. GDP and domestic investment exhibited upward trend, whereas budget deficits sharply increased after 1997. Foreign exchange rate has a spiked after the 1997 Asia crisis and been stabilized with pegged system (US$1=RM3.80), supported by capital control during 1998 – 2005. Exchange rate further depreciates after 2012, in line with the collapse of global oil prices and destructed financial ratings due to increased debts. The real interest rate remains positive and demonstrated 2 spikes in year 1992 and 1998 respectively. Inflation is comparatively stable around 1%-2.5%, with some deflations during 1985-1987.

Figure 1. Trend and movement of the macroeconomics variables in this study.



Note: GDP = gross domestic product, represents national economic performance, DF = budget deficit, FOREX = real exchange rate, INV = gross domestic investment, R = real interest rate, INF = inflation rate.

a) Unit Root and Cointegration Tests

At level, all variables were unable to reject the null hypothesis of unit root. However, they have exhibited stationary pattern after the first difference, suggesting that the variables are I(1) and thus suitable to proceed with the cointegration test. To save place, the unit root test results are not presented here but available upon request. The multivariate co-integration test results are shown in Table 2. Based on the MacKinnon-Haug-Michellis (1999), the number of co-integrating vector was found at significance level of 0.05. All the five-trend assumption available in E-views were selected for the analysis. From the table of summary of all 5 trend assumptions, it is clearly show that there are more than one, mostly four co-integrating vectors between the variables, at lags 2.

Table 2. Johansen co-integration test (Summary of all 5 trend assumptions)

Data type	None	None	Linear	Linear	Quadratic
Hypotheses	**No Intercept No trend**	**Intercept No trend**	**Intercept No trend**	**Intercept Trend**	**Intercept Trend**
Trace test	4	4	4	4	3
Max-Eig test	4	4	4	5	4

**Significance level at 0.05; Critical values based on MacKinnon-Haug-Michellis (1999)*

The details of trend 3 assumption, linear deterministic trend is shown in Table 3. The null hypothesis of none co-integrating vectors is rejected as in Trace test and Maximum-Eigen test both statistics values are higher than

critical value, and probability is less than 0.05. There are more than one, which is 4 linear combination exists between the variables, over the period of 39 years, despite potential deviation from equilibrium levels in short-run.

Table 3. Co-integration Tests

Hypothesized	**Test statistics**		**Critical Values**		**Probability**	
No. of CE (s)	**Trace**	**Max-Eigen**	**Trace**	**Max-Eigen**	**Trace**	**Max-Eigen**
None *	245.08	117.71	95.75	40.08	0.00	0.00
At most 1 *	127.36	59.96	69.82	33.88	0.00	0.00
At most 2 *	67.41	30.43	47.86	27.58	0.00	0.02
At most 3 *	36.98	24.11	29.80	21.13	0.01	0.02
At most 4	12.87	12.31	15.49	14.26	0.12	0.10
At most 5	0.55	0.55	3.84	3.84	0.46	0.46

The second part of the test output is the estimation on the long-run co-integrating relations equation, shown as below:

GDP = 1.03 - 0.39 DF - 0.69 FOREX + 1.27 INV - 0.96 R + 0.05 INF

The normalized co-integrating equation indicates that the deficit in budget (DF), foreign exchange rate (FOREX), interest rate (R) are having a negative effect onto Malaysia economic growth (GDP) in long-run. Among these variables, interest rate seems to have more impact, followed by foreign exchange rate and then budget deficit. On the other hand, domestic gross investment (INV) and inflation (INF) has positive relation with GDP, with INV relation to GDP is significant.

Error correction term (ECT) is indicating the equation is corrected gradually through a series of partial short-run. ECT for DF is significant (t-statistic value 3.13), compared to the other variables. This indicates that these variables have significant short-run adjustment towards the deviation

from long-run equilibrium. The correction of 32.4% each year by the budget deficit equation, to reach long-term equilibrium in around 3 years.

Table 4. Vector Error Correction Model (VECM) Error corection Term (ECT)

	D(GDP)	D(DF)	D(FOREX)	D(INV)	D(R)	D(INF)
ECT	-0.08	3.24	-0.08	0.36	-0.44	6.73
(standard error)	(0.09)	(1.03)	(0.31)	(0.29)	(0.73)	(4.05)
[t-statistic]	[-0.96]	[3.13]	[-0.25]	[1.23]	[-0.60]	[1.66]

b) Granger Causality Test

The identification of causal relationships is vital for understanding the consequences when moving from empirical findings to actions. As the variables possess co-integrating relations, Granger causality tests within the VECM are then been conducted (at lags = 2). Granger causality does not identify a true cause-and-effect but rather indicates which variables comes ahead of the other in the time series.

Table 5. Granger causality test within VECM

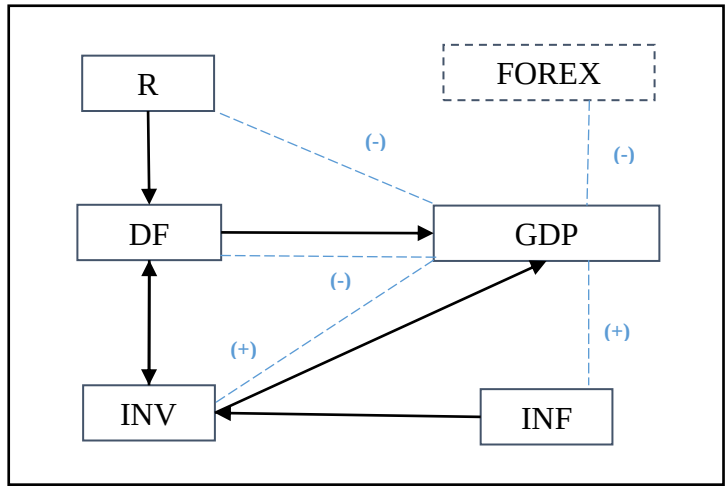
Granger Causality	Chi-sq	Prob.
DF->GDP	8.31*	0.016
INV->GDP	6.85*	0.033
INV->DF	11.75*	0.028
R->DF	8.62*	0.013
DF->INV	6.58*	0.037
INF->INV	14.84*	0.001

*Note: * significant at 5%.*

The Granger causality results are summarized in Table 5, and further illustrated in Figure 2. When p-value is <0.05, the null hypothesis of non-Granger causality is rejected, or otherwise. The Granger causality test illustrated multiple bi- and uni-directional causality relationship between the variables. Budget deficit (DF) is bi-directional causal relation with domestic

investment (INV). Both DF and INV are Granger causal to GDP. Interest rate (R) and inflation (INF) does Ganger Cause to DF and INV, respectively. Budget deficit (DF) is bi-directional causal relation with domestic investment (INV). Both DF and INV are Granger causal to GDP. Interest rate (R) and inflation (INF) does Ganger Cause DF and INV, respectively.

Figure 2. Summarized Results of Co-integration Regression and Granger Causality



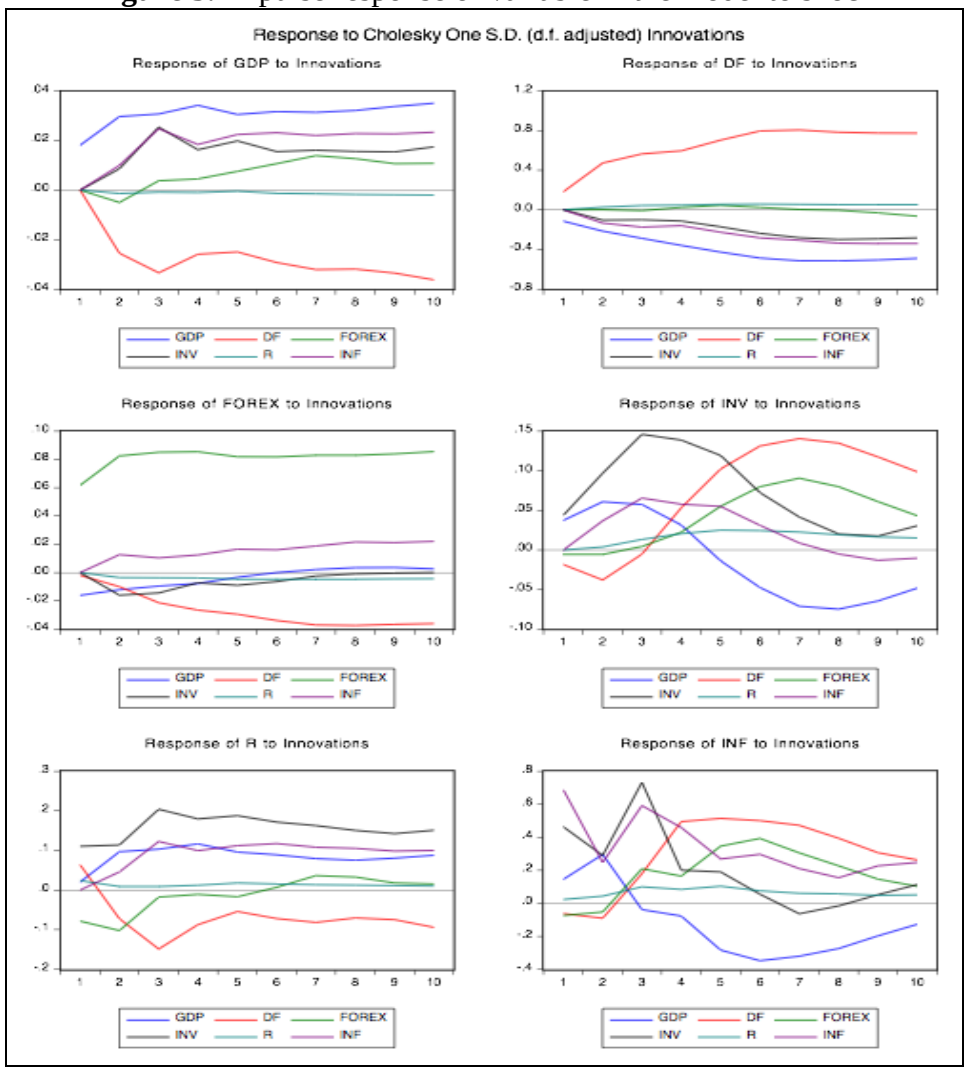
c) Impulse Response Function (IRF)

After the directional relationship information is determined in Granger causality test, the IRF test is conducted in order to provide comprehensive understanding on reaction of a variable in response to changes of the other, and how long the impacts would last. Figure 3 represents the responses of other variables given an impulse in one variable.

In the impulse-response analysis, GDP goes upward with investment and inflation, but downward with budget deficits, during the initial period.

GDP does not recover back to positive with budget deficit shock. Next plot of impulse-response of budget deficit to impulse of the others, showed gradual decline of budget deficit with GDP, investment and inflation shock. Long-term negative movement with budget deficit shock, and positive effect from inflation is illustrated in the plot of impulse-response of FOREX. The investment shock leads to spike of investment for 2 years before return to zero. Although investment goes downward with budget deficit shock, it moves to positive in long-run. The interest rate reacted negatively towards shock of budget deficit can only recover slowly but not to initial. The response of inflation to the shock of budget deficit is slow, the spiked up comes after 2 years, last for 4 years, and hardly reverse back to zero.

Figure 3. Impulse response of variable in the model to shock



d) Variance Decompositions

The variance decomposition illustrates the relative importance of each variable for fluctuations in other variables. Table 6 shows the results of

the generalized variance decomposition at different time periods. From the results, we could determine the variability extend of the dependent variables is lagged by its own variance, as well as which independent variables is more significant in the dependent variables variability over time.

Table 6: Variance decomposition analysis summarized result.

Period	S.E.	GDP	DF	FOREX	INV	R	INF
			Decomposition of GDP:				
1	0.02	100.00	0.00	0.00	0.00	0.00	0.00
2	0.05	58.68	31.68	1.21	3.55	0.10	4.79
4	0.09	42.29	31.07	0.75	12.50	0.05	13.34
6	0.11	40.06	29.92	1.74	12.32	0.04	15.91
8	0.14	38.16	31.37	3.05	11.11	0.06	16.24
10	0.16	37.51	32.76	3.15	10.34	0.07	16.17
			Decomposition of DF:				
1	0.22	28.30	71.70	0.00	0.00	0.00	0.00
2	0.59	17.23	72.91	0.00	3.05	0.23	5.20
4	1.15	20.62	70.79	0.05	2.54	0.38	5.62
6	1.76	22.35	66.68	0.11	3.85	0.37	6.65
8	2.30	23.20	63.11	0.06	5.46	0.32	7.85
10	2.72	23.31	61.37	0.11	6.14	0.30	8.76
			Decomposition of FOREX:				
1	0.06	6.40	0.10	93.51	0.00	0.00	0.00
2	0.11	3.54	0.89	91.84	2.22	0.11	1.40
4	0.17	2.00	4.52	89.97	1.85	0.14	1.52
6	0.21	1.29	7.46	87.45	1.45	0.19	2.16
8	0.25	0.95	9.86	85.05	1.05	0.21	2.88
10	0.28	0.76	10.96	83.85	0.81	0.21	3.41
			Decomposition of INV:				
1	0.06	37.66	9.30	0.88	52.16	0.00	0.00
2	0.14	25.94	9.06	0.33	57.70	0.07	6.90
4	0.18	12.31	6.09	0.77	68.22	0.81	11.80
6	0.37	8.41	23.05	7.14	50.85	1.31	9.24

Period	S.E.	GDP	DF	FOREX	INV	R	INF
8	0.45	10.87	34.02	11.91	35.56	1.31	6.32
10	0.49	11.85	38.42	12.37	30.58	1.31	5.46
			Decomposition of R:				
1	0.15	1.74	17.25	26.34	52.22	2.45	0.00
2	0.25	15.32	14.57	26.20	39.56	1.03	3.32
4	0.47	15.62	17.99	7.87	45.65	0.41	12.46
6	0.58	15.27	14.12	5.21	49.02	0.43	15.95
8	0.66	14.57	13.59	4.58	49.26	0.41	17.58
10	0.72	14.71	13.97	3.88	48.81	0.38	18.25
			Decomposition of INF:				
1	0.85	2.95	0.55	0.76	29.82	0.07	65.85
2	0.98	11.28	1.27	0.86	30.94	0.24	55.41
4	1.57	4.70	11.71	3.20	35.36	0.78	44.26
6	1.92	8.64	21.87	9.60	24.83	0.97	34.10
8	2.11	11.13	26.51	11.17	20.57	0.95	29.65
10	2.20	11.39	27.79	10.94	19.27	0.98	29.63

In short run, at year 2, GDP own shock account for high variation (58.68% from 100% at year 1), and variation is slowly reduced in long run but remained significant (37.51% at period 10). The shock to budget deficit has also caused significant variation, 31.68%, to GDP and the effect is stable for long run. Whereas shock of investment and inflation has a slowly increasing effect can be seen after year 4-6, and at year 10 to 10.34% and 16.17%, respectively. The variation caused by innovation of the FOREX to GDP is comparatively low, and almost not affected by interest rate. Therefore, GDP is strongly endogenous on itself and budget deficit in short run, and weakly endogenous to FOREX and interest rate. Budget deficit own shock leads to 71.7% at year one and maintain around 60-70% in long run.

GDP, investment and inflation are showing 23.3%, 6.1% and 8.8% effect to budget deficit at year 10 after innovation. Budget deficit is endogenous with influence from foreign exchange, investment, interest rate and inflation where the variation from year 1 to year 2 is increased, however, seems not to cause more fluctuation to budget deficit in long-run.

Variances of foreign exchange rate mostly self-explained, about 93.51% but the high variation reduce gradually in long run. Innovations of GDP accounted 6.4% and is offset in long run. Budget deficit and inflation show low innovations in short run, yet gradually increase to 11% and 3.4%, respectively, in long-run. Investment is strongly endogenous toward GDP in long-run, and the other way towards investment and inflation. Significant variation of 52.16% and 37.66% is caused by the own shock and GDP shock at year 1, the effect decay in long-run. Opposite trend in budget deficit shock and foreign exchange rate innovations. Innovations to investment cause long-run variation to interest rate, so do GDP and budget deficit innovations. Interest rate is strongly exogenous to the other variables as it has weak influence. Shock of budget deficit and foreign exchange rate cause low variation to inflation, and the variation is increasing over the time. Oppositely, the investment shock and own shock cause relatively higher variation at year 1 then gradually reduced in variation over the years. Inflation could be weakly endogenous in short run, but rather strong endogenous in long run.

Discussions and Policy Implications

The co-integration test showed three variables possess negative relations to GDP: interest rate (0.96), followed by foreign exchange rate (0.69), and deficit in budget (0.39). On the other hand, domestic gross investment (INV, 1.27) and inflation (0.05) has a significant positive relation with GDP. Budget deficit as government spend more than budgeted, and thus persistent budget deficit has caused the decrease of nation GDP for example in Ghana. And we found the same empirical evidence on relationship between GDP and budget deficit for Malaysia. Furthermore, the negative relation of FOREX, in term of RM/USD, illustrated the appreciation of Ringgit Malaysia would negatively affect the economic growth. This could be explained by the Ringgit appreciation leads to less advantage in export. In the case of our income is led by export, the appreciation could lead to negative impact on overall economics of country.

On the other hand, lower interest rate could encourage the economic situation in the country. When the interest rate is low, the burden of companies to repay the interest is lower, also may enable them to plough in more capital into operations to generate more revenue, therefore contribute to higher GDP. Thus, the low interest rate, undervalued MY/USD exchange policy would be recommended to boost Malaysia's GDP. Domestic gross investment has significant positive relationship with GDP, is consistent with Bakri (2017), as well as the "crowd-in" model. Although inflation show positive relationship with GDP, the impact is minor compared to the others.

Existence of co-integrating relations in long-run among the macroeconomic variables is determined, and the pattern of correlation (short run) is further explained via Granger causality test. Figure 2 summarizes the relationships between variables determined in both analyses above. It is clearly showing that budget deficit is directly related to macroeconomic variables GDP, interest rate and investment.

The directional relationship determined that the negative relations of interest rate, budget deficit towards GDP is uni-directional, in which interest rate cause budget deficit then the latter cause GDP. Positive relationship of the investment and inflation towards GDP also further explained by inflation does not have direct causal linkage to GDP but it is causing to investment which then investment leads to GDP. Moreover, we can see that investment is bi-directional relationship with budget deficit. However, the foreign exchange rate which showed notable positive co-integration with GDP is less significant causal linkage to the others, and it seems to disappear from the causal effect in short run.

Shock of budget deficits leads to rapid (< 3 years) downward movement of GDP, foreign exchange rate, interest rate (bounce back and stabilized in long term) and investment (highly positive in long term); stable negative effect on inflation which then strike up high and maintained for long term. The spiking of inflation was observed for Ghana as it financed the deficits by expanding its monetary base to support economic growth. Variance decomposition further allies that the effect caused by budget deficit to these variables would maintain or increasing in long term, but not re-

ducing. Both Impulse Response function and variance Decomposition showed that shocks from Budget Deficit on could be significant in long-term. It contributes almost 33%, 11%, 38%, 14% and 28% increased to GDP, foreign exchange rate, investment, interest rate, and inflation, respectively, from year 1 to year 10 interval.

On the other hand, effect of impulse of GDP, inflation and investment to budget deficit is negative. This may imply that increase of investment promotes economics productivity in term of GDP thus the increase in GDP would improve the budget deficits situation of the country. As variance decomposition showed that both GDP and budget deficit responds positively to shock of investment in long term (year 10, 10.34%, 6.14%, respectively), the effect of investment into infrastructure development for promoting economic growth is significant over the years.

This study would suggest that investment is crucial for improving budget deficit and well-balanced economic growth. Investment is shown to be volatile and sensitive to shocks of other variables, nevertheless, could return to close to zero in long-run. Therefore, interval of significant investment could be adjusted to achieve desirable results.

Conclusion

This paper examines the dynamic relationship between budget deficit-economic growth and other macroeconomic variables such as foreign exchange rate, investment, interest rate and inflation. Findings from the study showed that budget deficit, domestic investment and GDP are interre-

lated, and much dependent on each other, compared to interest rate, foreign exchange rate and inflation. Nevertheless, the latter 3 variables are also important innovations to stimulate the budget deficit and domestic investment. Lower interest rate and stronger exchange rate policy is therefore recommended, to stimulate active investment into public infrastructure and social welfare which both would be eventually promoting the economics activities. The increase of economic activities would reduce the budget deficit and ensure budget sustainability in long run. As such, a balanced and well-coordinated public finance policy is needed.

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Appendix

A. Unit root test

		t statistic					
Level	Intercept	-1.54	1.59	-1.36	-1.04	-1.85	-4.00
	Trend & Intercept	-1.29	-0.27	-2.49	-1.84	-2.60	-4.72
	None	9.24	-0.43	1.11	2.40	-0.67	-2.24
	Null hypothesis	Failed to reject	Failed to reject	Failed to reject	Failed to reject	Failed to reject	Failed to reject
First difference	Intercept	-5.35	-4.03	-4.81	-4.41	-5.80	-4.78
	Trend & Intercept	-5.51	-5.51	-4.74	-4.35	-5.71	-3.98
	None	-1.02	-4.25	-4.74	-4.08	-5.86	-4.82
	Null hypothesis	Rejected	Rejected	Rejected	Rejected	Rejected	Rejected
		Probability					
Level	Intercept	0.50	1.00	0.59	0.73	0.35	0.00
	Trend & Intercept	0.88	0.98	0.33	0.66	0.28	0.00
	None	1.00	0.52	0.93	1.00	0.42	0.03
	Null hypothesis	Failed to reject	Failed to reject	Failed to reject	Failed to reject	Failed to reject	Rejected
First difference	Intercept	0.00	0.00	0.00	0.00	0.00	0.00
	Trend & Intercept	0.00	0.00	0.00	0.01	0.00	0.02
	None	0.27	0.00	0.00	0.00	0.00	0.00
	Null hypothesis	Rejected	Rejected	Rejected	Rejected	Rejected	Rejected
	Null hypothesis	*Variable is not stationary (Variable got unit root)*					
	Alternative hypothesis	*Variable is stationary*					

B. VECM Error correction term

Error Correction:	**D(GDP)**	**D(DF)**	**D(FOREX)**	**D(INV)**	**D(R)**	**D(INF)**
ConintEq1	-0.08	3.24	-0.08	0.36	-0.44	6.73
(standard error)	0.09	1.03	0.31	0.29	0.73	4.05
[t-statistic]	-0.96	3.13	-0.25	1.23	-0.60	1.66

	C	**ECT**	**D(GDP) (-1)**	**D(GDP) (-2)**	**D(DF) (-1)**	**D(DF) (-2)**	**D(FOREX) (-1)**	**D(FOREX) (-2)**	**D(INV) (-1)**	**D(INV) (-2)**	**D(R) (-1)**	**D(R) (-2)**	**D(INF) (-1)**	**D(INF) (-2)**
β	-0.26	3.24	4.28	-3.97	-0.57	-0.91	-1.07	0.98	0.42	3.73	-0.18	-0.99	-0.05	0.08
t-stat	-1.26	**3.13**	1.50	-1.63	-1.38	**-3.86**	-0.93	0.93	0.41	**3.41**	**-2.48**	**-2.66**	-0.69	1.05

The t-statistic is the coefficient estimate divided by the standard error. The t-statistic greater than 2 (or less than -2) indicates the coefficient is significant with >95% confidence.