Jurnal Ekonomi Malaysia 52(1) 2018 67 - 76
http://dx.doi.org/10.17576/JEM-2018-5201-6

Estimating Fiscal Reaction Functions in Malaysia, Thailand and the Philippines

(Anggaran Fungsi Reaksi Fiskal di Malaysia, Thailand dan Filipina)

Evan Lau
Alvina Lee Syn-Yee
Universiti Malaysia Sarawak

ABSTRACT

As with most of the world economy, the 2008/09 global financial crisis has brought massive impacts on Southeast Asian economies. The debt/GDP ratios in most economies rose significantly, thus putting the spotlight again on fiscal sustainability. This article aims to distinguish the reaction of the primary balance/GDP to changes in the debt/GDP to assess the fiscal sustainability of Malaysia, Thailand, and the Philippines. In investigating how the respective governments react to the accumulation of debt, the article estimates the fiscal reaction function, initiated by Bohn (1998), using Ordinary Least Square (OLS) and Vector Autoregression (VAR). The empirical analysis reveals that, based on past behaviour, fiscal policy in Malaysia, Thailand, and the Philippines remains sustainable.

Keywords: Fiscal reaction functions; fiscal sustainability; Malaysia; Thailand; Philippines

ABSTRAK

Seperti kebanyakan ekonomi dunia, krisis kewangan global 2008/09 telah membawa kesan besar ke atas ekonomi Asia Tenggara. Nisbah hutang/KDNK di kebanyakan ekonomi meningkat dengan ketara, dengan itu meletakkan perhatian semula terhadap kemapanan fiskal. Artikel ini bertujuan untuk membezakan tindak balas keseimbangan primer/KDNK kepada perubahan hutang/KDNK untuk menilai kemapanan fiskal Malaysia, Thailand, dan Filipina. Dalam menyiasat bagaimana kerajaan masing-masing bertindak balas kepada pengumpulan hutang, artikel menganggarkan fungsi reaksi fiskal, yang dimulakan oleh Bohn (1998), dengan menggunakan dengan menggunakan Kuasa Kedua Terkecil Biasa (OLS) dan Vektor Autoregresi (VAR). Analisis empirikal menunjukkan bahawa, berdasarkan tingkah laku yang lepas, dasar fiskal di Malaysia, Thailand, dan Filipina kekal mampan.

Kata kunci: Fungsi reaksi fiskal; kemapanan fiskal; Malaysia; Thailand; Filipina.

INTRODUCTION

Public debt accumulation has become a topic of major concern in the broader international community since the outbreak of the sovereign debt crisis in 2009. This has raised the discussion on the issue of debt sustainability particularly after the Global Financial Crisis in 2008, which has given rise to growing concern on the fiscal stance in the world economy. The aftermath of the 2008/09 crisis caused a sharp increase in government debt in most of the advanced countries, involving the United States, Japan, Portugal, Ireland, Italy, Greece, and Spain. This is mainly caused by high exposure particularly in the domestic banking sectors to sovereign risk and inflexibility of monetary policy, which contributed to the sovereign and banking crises in the European countries mentioned above (Kawai & Morgan 2013).

Most of the emerging and developing economies weathered the global financial crisis well relative to the advanced economies, as many have implemented fiscal stimulus packages to decrease the deficits and debt and alleviate the impact of the crisis. However, it is crucial to emphasise that, despite the remarkable resilience to the financial crisis, many developing as well as emerging economies seem to have had primary (non-interest) fiscal deficits, deteriorating primary surpluses, and rising public debt levels in the years immediately prior to the crisis (Rajan, et al. 2015; Sangsubhan & Basri 2012). The subsequent deterioration of fiscal balances is rather critical for some countries. Recurrent budget deficits increase debt level, which builds up expectations of future government expenditure pattern and therefore increase future net deficits because of the need to service higher interest payments on the debt. Higher interest rates will result a rise in debt-servicing costs which increases the budgetary outlays. This leads to a wider deficit and forms a potentially vicious circle which the fiscal policy is deemed to be unsustainable. This leads to a more challenging debt management strategy. There are numerous reasons to explain this situation. When an economy reaches higher level of income, the real growth rates will slow down and raises government expenditure as a result of rapid aging. This will lead to economic dynamism and diminishing financial repression contribute to a narrowing gap between bond

yields and economic growth (Édes & Morgan 2014; Kawai & Morgan 2013).

The aftermath of the crisis has thrust the sustainability question back into the public consciousness, raising doubts about the sustainability of fiscal policy. This study examines empirically in the context of the public debt of Malaysia, Thailand, and the Philippines. We aim to establish how the governments of three economies namely Malaysia, Thailand, and the Philippines, react to their respective debt burden through the estimation of a fiscal reaction function. These three countries represent an interesting case for some reasons. First, these three countries experienced several episodes of fiscal deficits continuously such as Malaysia and Philippines. Second, the public debt of the three economies have accordingly risen well during the 1980s because the governments actively deployed fiscal policy as post-crisis countercyclical instrument to boost domestic demand during economic slowdown. Although numerous studies have been established on the sustainability of fiscal policy, less attention has been paid to these three developing countries. For this purpose, we follow Bohn's (1998) approach based on the analysis of fiscal reaction functions to examine the issue of fiscal policy sustainability in the context of Malaysia, Thailand and the Philippines.

The remainder of the paper is organized as follows. The next section reviews the fiscal situations in Malaysia, Thailand, and the Philippines. Section 3 describes the theoretical background on fiscal reaction function. Section 4 explains the stationarity issue of the debt/GDP ratio, and Section 5 identifies the data issues. Section 6 reports the empirical findings for the estimation of a fiscal reaction function. Section 7 concludes the overall findings.

FISCAL CONDITIONS IN MALAYSIA, THAILAND, AND THE PHILIPPINES

Examination of the past fiscal situation in three economies reveals that Malaysia experienced deficits for the past two decades with the exception of the years from 1993-97 (Figure 1). The substantial public debt was brought down to 32 percent of the GDP by the end of 1997 from a peak of 109 percent of GDP in 1987 (Figure 2). Following the implementation of the fiscal stimulus packages allocated to alleviate the impact of the crisis, a fiscal deficit of 1.8 percent of the GDP was reported at the end of 1998. The prudent policies employed afforded the government greater flexibility in employing expansionary measures to restore growth during the crisis years (Vijayaledchumy 2003).

On the other hand, Thailand's government experienced deficits during the 1970s to the late 1980s due to the public-sector crisis in the early 1980s. Thailand experienced fiscal surpluses from 1987 to 1996 as a result of incremental government revenue with the swing-up of economy activity, but the Asian Financial Crisis led to a decline in revenue and an increase in expenditures to stimulate the economy, as shown in Figure 1. As a consequence, the public debt rose again from 11 percent in 1996 to 58 percent of GDP in 2000, as shown in Figure 2.

In the Philippines, the government had a fairly long period of fiscal consolidation during most of the 1990s, when the government fiscal position decreased from around 3 percent of the GDP to 0.3 percent of the GDP in 1996. The fiscal position continued to worsen following the onset of the Asian Financial Crisis, and deficits grew persistently from 2.4 percent of the GDP in 1998 to 4.2 percent of the GDP in 2000 to 5 percent of the GDP in 2002 (Figure 1).

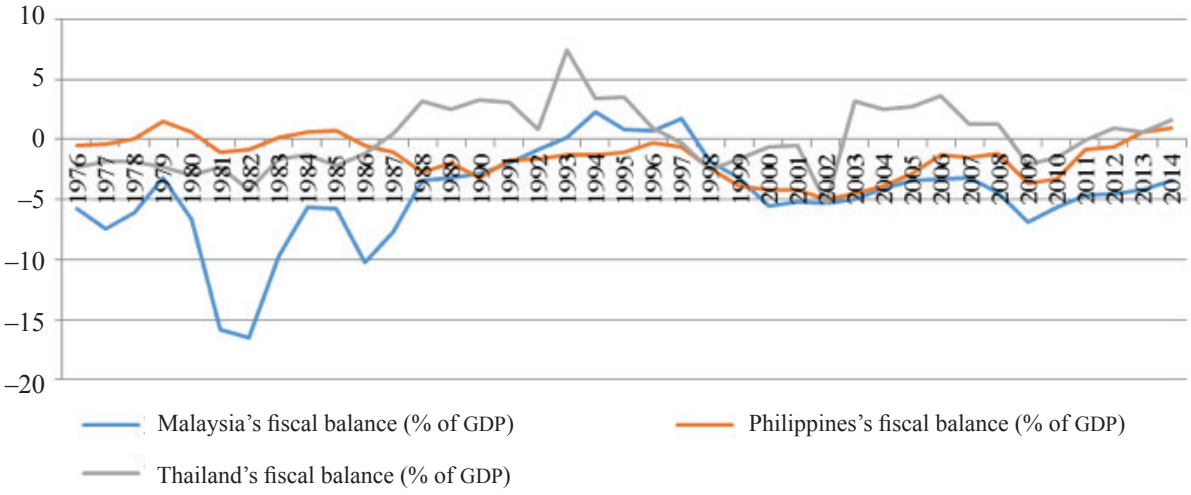

FIGURE 1. Fiscal balances (% of GDP) in Malaysia, Thailand and the Philippines, 1976-2014
Source: IMF Country Report, various issues; Ministry of Finance, 2017.

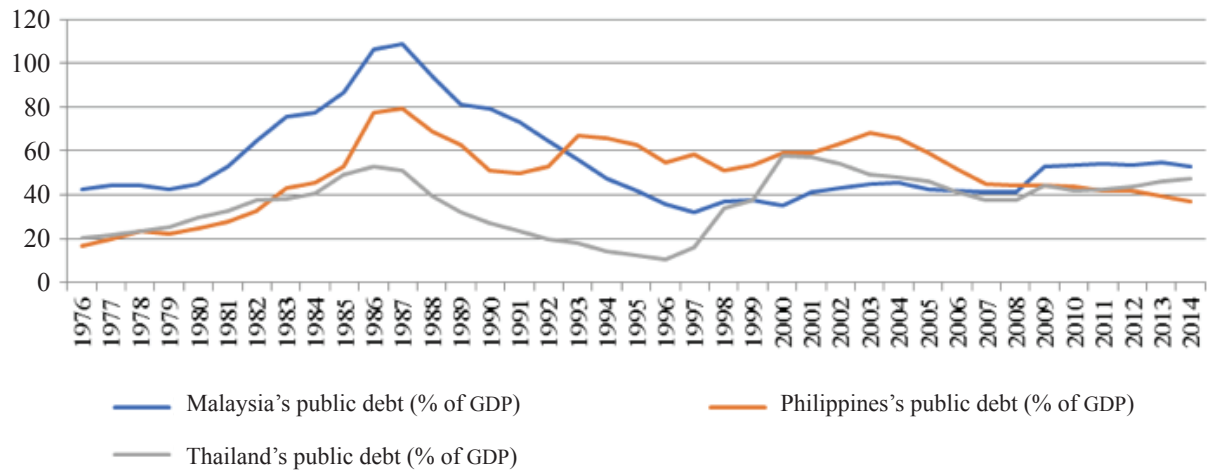

FIGURE 2. Public debt (% of GDP) in Malaysia, Thailand, and the Philippines, 1976-2014
Source: IMF Country Report, various issues; Ministry of Finance, 2017.

Therefore, there are some fiscal concerns related to the management of government expenditure and revenue in these three countries, including subsidies, age-related spending, and insufficient revenue mobilization. Notably, Malaysia and the Philippines have significant fiscal deficits as a result of high subsidy levels for food and energy (Kawai & Morgan 2013); Thailand has rapidly aging populations and will likely to encounter rising in age-related expenditure such as public pensions and healthcare welfares which can threaten fiscal sustainability in the future (IMF 2012a); and Philippines faces insufficient revenue mobilisation (IMF 2013a). This in turn will lead to weakening fiscal position, which fiscal consolidation would necessitate to offer lower oil and gas related revenues in order to deliver fiscal sustainability. Fiscal deficits raise public debt. On the other hand, public debt can be reduced when recurrent revenues exceed recurrent expenditures plus the interest payment on debt. As a persistent and large budget deficit to the GDP will raise the debt levels and bring the issue of debt sustainability, this study aims to investigate the fiscal reaction of Malaysia, Thailand, and the Philippines to their respective public debt burdens.

FISCAL REACTION FUNCTIONS

Fiscal reaction function is one of the most widespread types of sustainability tests applied, which was initiated by Bohn (1998) when he analysed the United States budget data using the method of reaction function analysis. He first tested the behaviour of the U.S. public debt and deficits by establishing how the US government reacted to the accumulation of the public debt during the period from 1916 to 1995. He showed that the U.S. government had historically responded to increases in the debt-to-GDP ratio by raising the primary surplus or, equivalently, by reducing the primary deficit. Fiscal reaction function is a behavioural function in which the government's behaviour is represented by its budget identity and budget constraint (Bohn 1995; 1998; 2007; de Mello 2005; Gali & Perotti 2003). This constraint can be specified as follows:

$$D_t = D_{t-1} + i_t D_{t-1} - B_t \quad (1)$$

where D = public debt, i = nominal interest rate on government bonds, and B = primary balance (+ surplus; – deficit). Equation (1) can be used to derive the change in the debt level measured in term of nominal GDP, where the time index is omitted from the parameters r and g to prevent clutter. This yields Equation (2)[1]:

$$\Delta(D/Y)_t = ((r_t - g_t)/(1 + g_t))(D/Y)_{t-1} - (B/Y)_t \quad (2)$$

where r = real interest rate, g = real economic growth rate, and Y = Nominal GDP. Equation (2) leads to the primary balance that will ensure that the debt/GDP ratio remains unchanged ($\Delta(D/Y)_t = 0$):

$$(B/Y)_t = ((r_t - g_t)/(1 + g_t))(D/Y)_{t-1} \quad (3)$$

Hence, Equation (3) explains the primary balance/GDP ratio that is needed to keep the public debt/GDP constant. For this to happen, the following rule can be applied:

$$(B/Y)_t^{Required} = \alpha_t^*(D/Y)_{t-1} = ((r_t - g_t)/(1 + g_t))(D/Y)_{t-1} \quad (4)$$

The coefficient α_t^*, should be on average equivalent to $(r_t - g_t)/(1 + g_t)$. Equation (4) is referred as the fiscal rule in explaining the primary balance required to keep a constant public debt level. The equation for fiscal rule (4) can be compared to the actual government behaviour which can be achieved by estimating the fiscal reaction function in the following form:

$$(B/Y)_t^{Act} = \alpha(D/Y)_{t-1} + \varepsilon_t \quad (5)$$

where superscript 'Act' specifies the actual time series, as opposed to the required primary balance or the target debt in GDP.

A lag primary balance, $(B/Y)_{t-1}$ and output gap, $\hat{y}$ are both added to the right-hand side of Equation (5). The $(B/Y)_{t-1}$ is added to allow for inertia2 in the actual government behaviour (de Mello 2005) while the output gap is included as an indication of business cycle indicator where a positive coefficient implying a countercyclical policy (Bohn 1998; de Mello 2005; Taylor 2000). Finally, a constant is also added to allow for an explicit or implicit public debt/GDP target that may not equal zero. Thus, the fiscal reaction function is given in Equation (6) below.

$$(B/Y)_t^{Act} = \alpha_1 + \alpha_2(B/Y)_{t-1}^{Act} + \alpha_3(D/Y)_{t-1}^{Act} + \alpha_4(\hat{y})_t + \varepsilon_t \quad (6)$$

where α_2 = the level of inertia, α_3 = the short-run reaction, and $\alpha_3/(1-\alpha_2)$ = the long-term reaction. To determine whether the fiscal policy is sustainable or not in the long term, the interaction between the actual and required reaction functions that is represented by Equation (6) and (4) respectively is crucial. Here, four cases are distinguished: (1) if $\alpha_3/(1-\alpha_2)$ from Equation (6) is close to α^* from Equation (4); this means that the government is attempting to stabilise its debt ratio at the realised level in the previous period. (2) if $\alpha_3/(1-\alpha_2) = \alpha^* = (r_t - g_t)/(1+g_t)$; this implies that the debt/GDP and primary balance/GDP would be stationary at first-difference. (3) if $\alpha_3/(1-\alpha_2) < \alpha^* = (r_t - g_t)/(1+g_t)$; this implies both the public debt and the primary balance to GDP ratios is on explosive paths. (4) if $\alpha_3/(1-\alpha_2) > \alpha^* = (r_t - g_t)/(1+g_t)$; this indicates that the public debt and primary balance to GDP ratios stabilise.

THE STATIONARITY OF THE DEBT/GDP RATIO

The budget identity in Equation (1) and (6) suggest that the change in the debt/GDP ratio relies on the non-debt components of the primary surplus as well as the lagged level. According to Bohn (1998), standard unit root tests have difficulty in rejecting the null hypothesis of a unit root. Refer to Equation (7), a transformed version of Equation (2):

$$(D/Y)_t = ((1+r_t)/(1+g_t))\,(D/Y)_{t-1} - (B/Y)_t \quad (7)$$

Equation (7) showed that one cannot reject the null hypothesis of a unit root even if the debt-to-GDP ratio is stationary (Bohn, 1998). For example, assume in Equation (7), $r = 3$ percent while $g = 6$ percent. Hence, $(1+r_t)/(1+g_t) = 0.97 < 1$; close to a unit root even though it is not. However, in cases in which $(1+r_t)/(1+g_t) \geq 1$, the government will set the $(B/Y)_t$ to offset the effect of $(D/Y)_{t-1}$ which this may render the debt-to-GDP ratio either level stationary or first difference stationary.

Despite the difficulty mentioned above, the debt/GDP series should be kept as stationary on economic grounds (Bohn 1998)[3]. With regard to necessity, Bohn (2007) disagrees with the necessity of difference-stationary debt and the necessity of cointegration-type relationships between government spending and revenues. In other words, the necessity of difference-stationarity of any order for the debt and deficit series is not necessary for intertemporal budget constraint (IBC), because if the relevant debt variable is stationary after any finite number of differencing, then the intertemporal budget constraint (IBC) is satisfied. Instead, Bohn (2007) argues that error-correction conditions yield sustainability without the finite-order integrated debt series. It is noteworthy that Bohn does not explicitly restrict the stationarity properties of the data in estimating fiscal reaction functions. Due to the drawback of the standard stationary tests and the nature of the primary balance and public debt series, this study will follow Bohn's where the stationarity of the public debt and primary balance in term GDP will not be distinguished. Therefore, the analysis will consider the possibility that both the primary balance and debt series are non-stationary.

DATA AND METHODOLOGY

As specified in Equation (6), fiscal reaction function is used for the analysis purpose. The fiscal reaction function as specified in Equation (6) is used for the modelling purposes below. Primary balance data and public debt for Malaysia is obtained from the *Department of Statistics Malaysia*; data for Thailand is from *Bank of Thailand,* while data for the Philippines is from the *Department of Finance Philippines*[4].The real GDP growth and real interest rate for all three economies are obtained from *World Development Indicators*. The sample period for Thailand and the Philippines is 1976-2014, while for Malaysia it is 1987-2014. Output gap in Equation (6) is constructed with Hodrick-Prescott (HP) filter[5]. This paper presents the fiscal reaction functions estimated with Ordinary Least Square (OLS) and Vector Autoregression (VAR) to capture the interactions between the variables.

EMPIRICAL RESULTS

This section presents the results of Equation (6). The results of the estimates using OLS and VAR will be reported in Table 1. For both OLS and VAR estimates, the coefficients on are statistically significant and positive in all regressions, and they are quantitatively reasonable. For example, in OLS estimates, the -value of 0.048 in Malaysia means that a marginal increase in government debt by RM100 in the preceding year increases the primary surplus in the current year by RM4.80. A positive response indicates that the government is taking actions to reduce the noninterest outlays or raise revenue, which counteract with the changes in debt. Note that the estimates for the coefficient of the lagged debt ratio, , are statistically significant only in Malaysia

TABLE 1. Fiscal reaction functions for Malaysia, Thailand, and the Philippines

Country	OLS			VAR		
	$(B/Y)_{t-1}$	$(D/Y)_{t-1}$	$\hat{y}_t$	$(B/Y)_{t-1}$	$(D/Y)_{t-1}$	$\hat{y}_t$
Malaysia (1987-2014)	0.738** (7.931)	0.048** (3.867)	19.952** (2.747)	0.739** (7.809)	0.048** (3.789)	19.361** (2.584)
Thailand (1976-2014)	0.544** (3.663)	0.048 (1.335)	10.252 (1.056)	0.542** (3.60)	0.046 (1.258)	10.080 (1.023)
Philippines (1976-2014)	0.607** (4.728)	0.019 (1.514)	–0.599 (–0.125)	0.608** (4.679)	0.019 (1.518)	–0.868 (–0.178)

Notes: ** denotes significant at the 5 percent significance level. Figures in parentheses are t-statistics.

while statistically insignificant in both Thailand and the Philippines. This indicates that for Malaysia, the fiscal policy does react to public debt developments in a stabilizing path whereas fiscal policy in Thailand and Philippines do not[6]. These results show that the governments of the three economies are systematically responding to changes in the debt/GDP ratio. It is noteworthy that the all the estimated parameter for the lag primary balance are greater than 0.5. Generally, these results show the presence of a high degree of inertia in government behaviour when the primary balance is set.

However, how do the main estimated parameters presented in Table 1 imply about fiscal sustainability? The discussion in Section 2 suggests for a fiscal policy to be sustainable, the value of $\alpha_3/(1-\alpha_2)$ has to be greater than $\alpha^* = (r_t - g_t)/(1+g_t)$. The parameter estimates can be confirmed by the findings from the comparison between the long-term reaction, $\alpha_3/(1-\alpha_2)$ and the yearly computed fiscal rule, $\alpha^* = (r_t - g_t)/(1+g_t)$ as shown in Tables 2 to 4. In Malaysia, for the entire period from 1987-2014, the long-term reaction, $\alpha_3/(1-\alpha_2)$, is greater than fiscal rule, which is $\alpha_3/(1-\alpha_2) > \alpha^*$ during the sample period of 1987-2014. It is evident to say that the fiscal condition in Malaysia is sustainable during the sample period in our study. On the other hand, in Thailand, for most of the period from 1976-2014, $\alpha_3/(1-\alpha_2) > \alpha^* = (r_t - g_t)/(1+g_t)$, except for the period of 1997-1998, which is during the Asian Financial Crisis. This is mainly because during the crisis, the fiscal policy was strongly expansionary in order to compensate for the decline in export demand. Revenue fell from 550 billion bahts in 1997 to 425 billion in 1998 and government expenditure declined from 604 billion bahts in 1997 to 500 billion bahts in 1998 (Jansen & Khannabha 2009). As government revenue deteriorate more than government expenditure, the fiscal balance turned from surpluses into deficits contributing to fiscal unsustainable during following the onset of the Asian financial crisis in 1997. As for the Philippines, most of the period of 1976-2014 was $\alpha_3/(1-\alpha_2) > \alpha^* = (r_t - g_t)/(1+g_t)$, except for the periods of 1982, 1985-1986, and 1990-1993. From the results, the Philippine economy reached a crisis situation mostly in 1980s following political and debt crises mainly in 1983 where Aquino assassination and debt moratorium took place. As a

TABLE 2. Malaysia's long-term reaction versus Sustainability Level

Year	$(r-g)/(1+g)$	Compared to the long-term reaction = 0.183 (Sustainability Level)	Year	$(r-g)/(1+g)$	Compared to the long-term reaction = 0.183 (Sustainability Level)
1987	–0.008	<	2001	0.083	<
1988	–0.041	<	2002	–0.020	<
1989	–0.044	<	2003	–0.027	<
1990	–0.039	<	2004	v0.063	<
1991	–0.036	<	2005	–0.076	<
1992	–0.012	<	2006	–0.030	<
1993	–0.037	<	2007	–0.046	<
1994	–0.042	<	2008	–0.083	<
1995	–0.045	<	2009	0.135	<
1996	–0.036	<	2010	–0.061	<
1997	–0.004	<	2011	–0.056	<
1998	0.116	<	2012	–0.014	<
1999	0.022	<	2013	–0.001	<
2000	–0.091	<	2014	–0.035	<

Note: Author's calculation.

TABLE 3. Thailand's Long-term Reaction versus Sustainability Level

Year	$(r-g)/(1+g)$	Compared to the long-term reaction = 0.105 (Sustainability Level)	Year	$(r-g)/(1+g)$	Compared to the long-term reaction = 0.105 (Sustainability Level)
1976	–0.028	<	1996	0.032	<
1977	–0.048	<	1997	0.123	>
1978	–0.083	<	1998	0.134	>
1979	–0.013	<	1999	0.086	<
1980	–0.020	<	2000	0.019	<
1981	0.021	<	2001	0.016	<
1982	0.057	<	2002	–0.001	<
1983	0.053	<	2003	–0.025	<
1984	0.089	<	2004	–0.038	<
1985	0.086	<	2005	–0.028	<
1986	0.057	<	2006	–0.028	<
1987	–0.027	<	2007	–0.019	<
1988	–0.070	<	2008	0.012	<
1989	–0.057	<	2009	0.047	<
1990	–0.027	<	2010	–0.049	<
1991	0.005	<	2011	0.017	<
1992	–0.007	<	2012	–0.015	<
1993	–0.006	<	2013	0.023	<
1994	–0.024	<	2014	0.045	<
1995	-0.008	<			

Note: Author's calculation.

TABLE 4. The Philippines' Long-term Reaction versus Sustainability Level

Year	(r-g)/(1+g)	Compared to the long-term reaction = 0.048 (Sustainability Level)	Year	(r-g)/(1+g)	Compared to the long-term reaction = 0.048 (Sustainability Level)
1976	–0.050	<	1996	0.008	<
1977	–0.020	<	1997	0.041	<
1978	–0.026	<	1998	–0.040	<
1979	–0.060	<	1999	0.017	<
1980	–0.051	<	2000	0.005	<
1981	–0.002	<	2001	0.035	<
1982	0.049	>	2002	0.011	<
1983	0.025	<	2003	0.011	<
1984	–0.098	<	2004	–0.022	<
1985	0.180	>	2005	–0.006	<
1986	0.104	>	2006	–0.006	<
1987	0.011	<	2007	–0.011	<
1988	–0.010	<	2008	–0.029	<
1989	0.030	<	2009	0.044	<
1990	0.066	>	2010	–0.040	<
1991	0.062	>	2011	–0.011	<
1992	0.103	>	2012	–0.028	<
1993	0.051	>	2013	–0.031	<
1994	0.002	<	2014	–0.036	<
1995	0.019	<			

Note: Author's calculation.

result, large and unsustainable fiscal deficits which were caused by low tax effort and large investment in public infrastructure. Therefore, for Thailand and the Philippines, with the exception of part of the episodes in which fiscal rule is above the sustainability level, the fiscal policy in both Thailand and the Philippines are deemed as sustainable.

Lastly, the study utilized Impulse Response Functions (IRFs) to assess the dynamic response of a variable due to a one-period standard deviation shock to its determinants. Visual illustrations of IRFs are shown in Figures 3a to 5a[7]. The IRFs of the three economies settle in about 25-year intervals. For Malaysia and Thailand, the IRFs clearly show that the public debt/

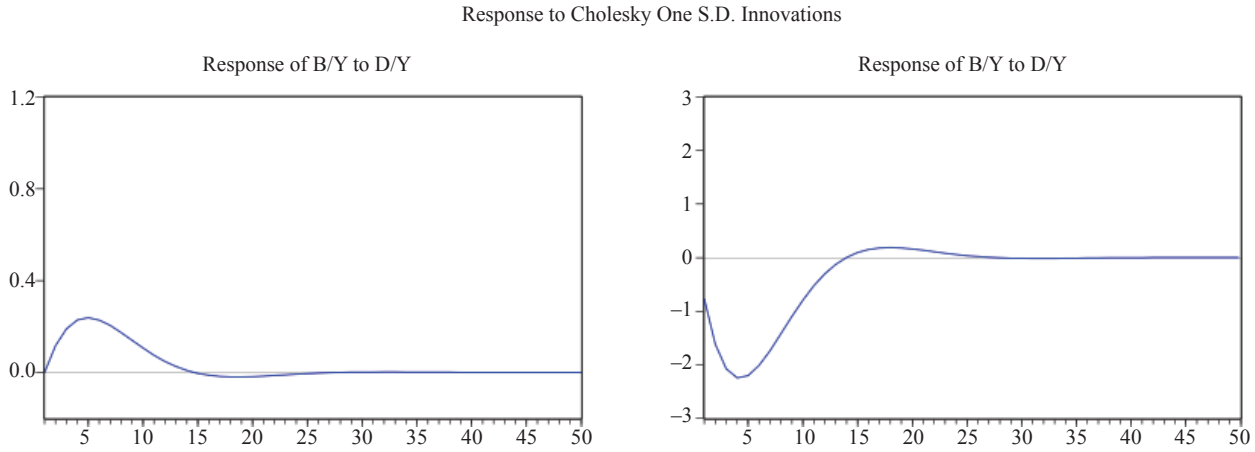

FIGURE 3a. Impulse Response Function of Malaysia's Fiscal Position (without response standard errors)

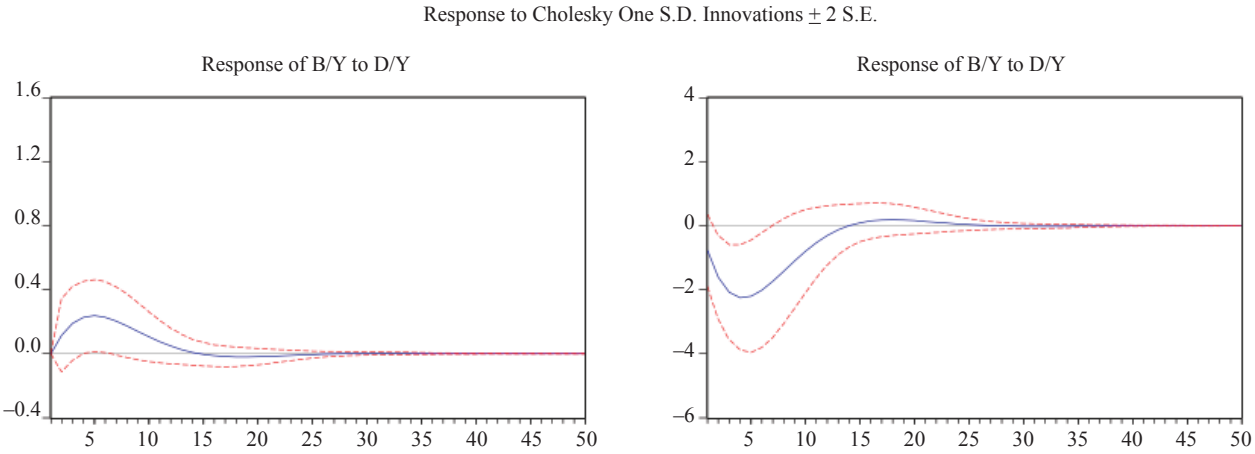

FIGURE 3b. Impulse Response Function of Malaysia's Fiscal Position (with asymptotic response standard errors)

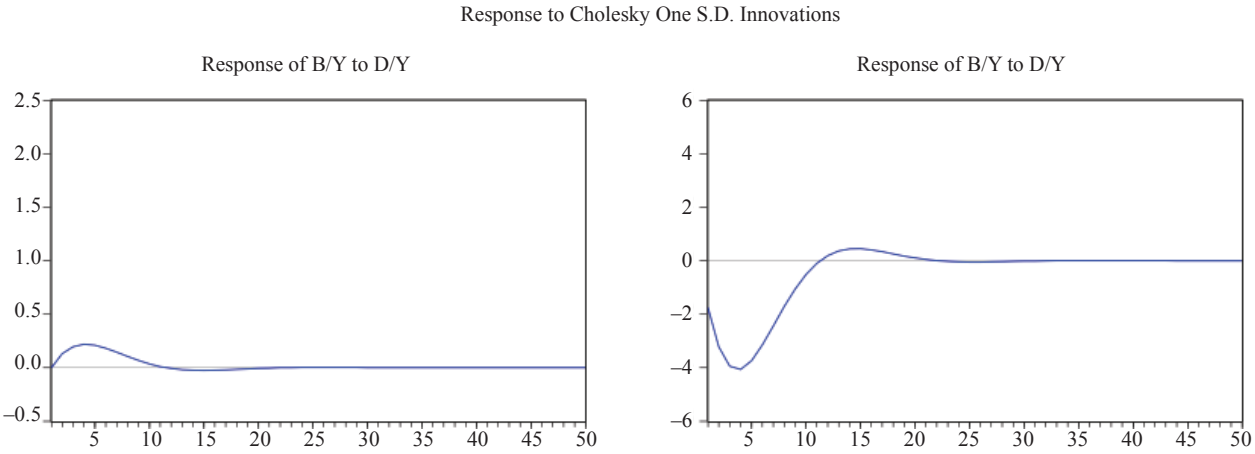

FIGURE 4a. Impulse Response Function of Thailand's Fiscal Position (without response standard errors)

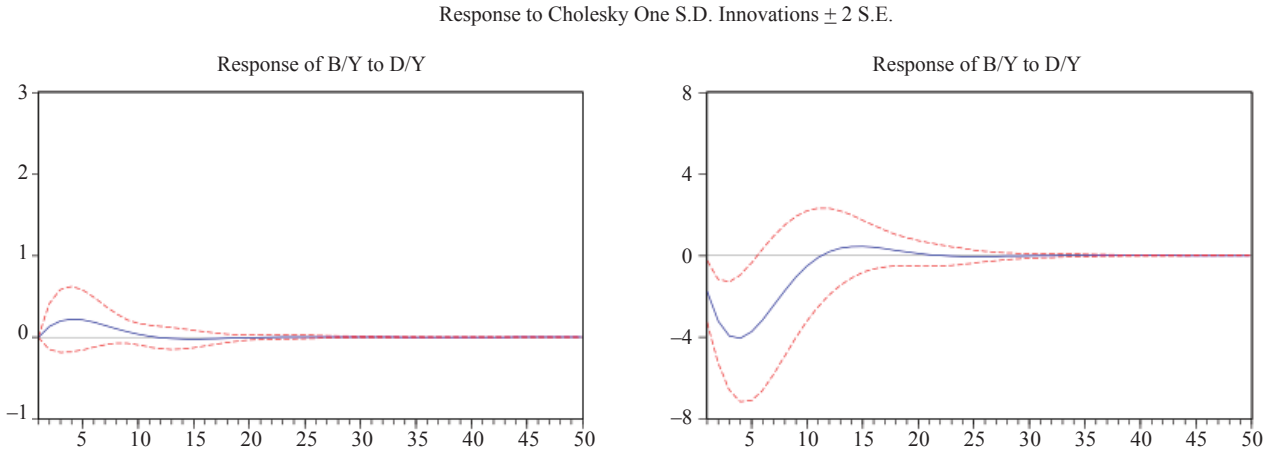

FIGURE 4b. Impulse Response Function of Thailand's Fiscal Position (with asymptotic response standard errors)

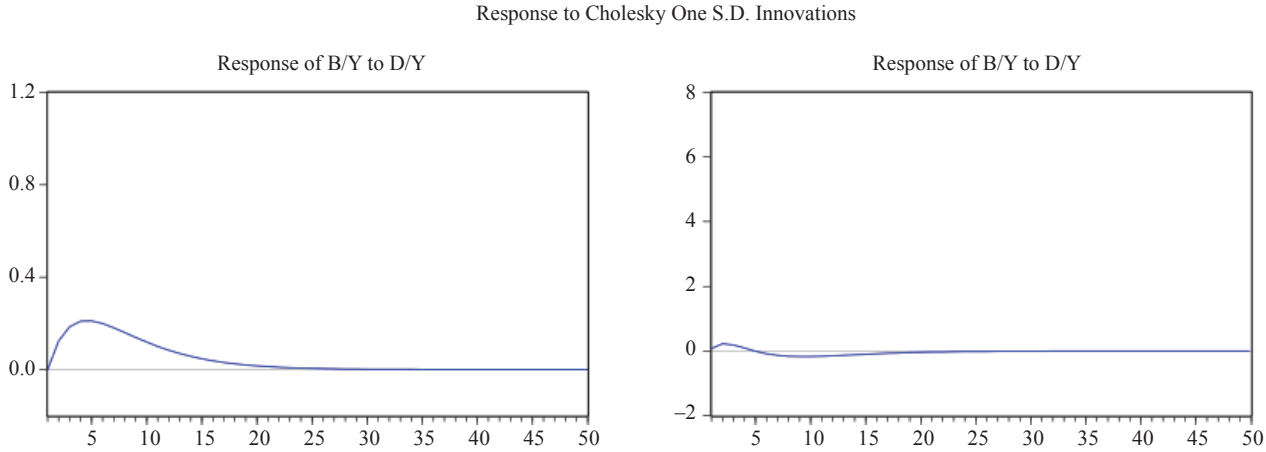

FIGURE 5a. Impulse Response Function of Philippines' Fiscal Position (without response standard errors)

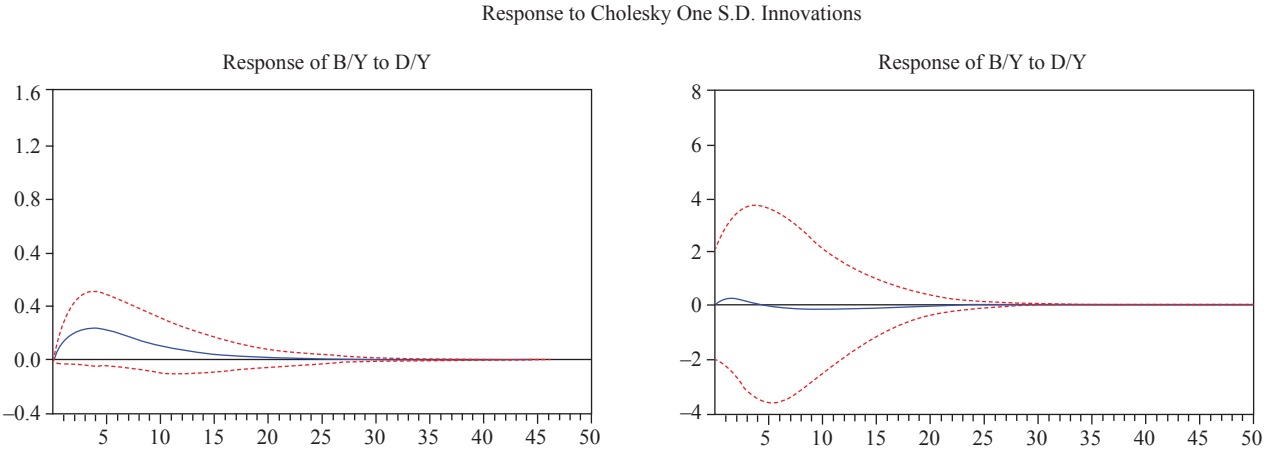

FIGURE 5b. Impulse Response Function of Philippines' Fiscal Position (with asymptotic response standard errors)

GDP (D/Y) responded negatively to primary balance/ GDP (B/Y) during the first 14- and 11-year intervals and responded positively afterwards before reverting back to equilibrium. Meanwhile for the Philippines, the response over time of (D/Y) due to shocks in (B/Y) is relatively small compared to Malaysia and Thailand, the (D/Y) responded positively to (B/Y) for the first 4-year interval and turned negative subsequently and slowly revert back to equilibrium. On the other hand, (B/Y) responded positively to the shock in (D/Y) for the first and 14- and 9-year intervals for Malaysia and Thailand respectively and responded negatively to PD afterwards before reverting back to equilibrium. As for the Philippines, the IRF showed that the (B/Y) has an immediate positive effect

response to the shock in (D/Y) implying the existence of positive relationship.

CONCLUSION

Given the reaction of the governments of Malaysia, Thailand, and the Philippines to their debt/GDP ratios, were their fiscal policies sustainable during the sample period? In Section 3, it is noted that fiscal policy is sustainable when $\alpha_3/(1-\alpha_2) > \alpha^* = (r_t - g_t)/(1+g_t)$. We first calculate the average values of real interest rate (r) and real growth rate (g) based on the GDP deflator and the real economic growth rate and both are used to compute α^*. The real interest rate and real growth rate are obtained from World Development Indicators.

Table 5 reports the summary of parameters estimated from OLS and VAR. Given the reaction of the governments of Malaysia, Thailand, and the Philippines to their respective public debt/GDP, their fiscal policies were sustainable, since in three economies cases, $\alpha_3/(1-\alpha_2) > \alpha^* = (r_t - g_t)/(1+g_t)$[8]. It is noted that α_1 is negative for all three economies, indicating that the debt/GDP ratio will stabilise at a positive value.

The paper aims to examine how the governments responded to changes in their debt level, which provides a basis for examining the fiscal sustainability of Malaysia, Thailand, and the Philippines. The results indicate that the past behaviour of fiscal policy in Malaysia, Thailand, and the Philippines is in a sustainable path during the sample period, except certain periods for Thailand and the Philippines.

The fiscal reaction function can be used as an economic tool to forecast debt path and redesign appropriate policies. There are some policies that can be implemented to ameliorate the management of public finances across government levels to reduce deficits and debt stock accumulation. Although it is evident that the fiscal policy of Malaysia, Thailand, and the Philippines have been sustainable for the respective sample period, the governments need to continue to create and expand fiscal space by establishing frameworks for allocating expenditures and revenues. In addition, governments may design fiscal rules at expenditure, revenue, or deficit levels as a fiscal surveillance to achieve fiscal policy sustainability.

ACKNOWLEDGEMENT

The authors would like to thank the two anonymous referees and the editor for their helpful comments and suggestions on an earlier draft. The authors gratefully acknowledges financial support from the Ministry of Higher Education (MOHE) Malaysia [RACE/e(2)/1101/2014(09)]. As usual, the responsibility of errors and omissions rests with the authors.

NOTES

1 To better focus on the public debt dynamics, the nominal interest rate on public debt is separated out from public debt on the right hand of Equation (1) which yields $D_t = (1+i_t)D_{t-1} - B_t$. Dividing the equation by nominal GDP (Y_t) yields $\frac{D_t}{Y_t} = \frac{(1+i_t)}{Y_t}\frac{D_{t-1}}{Y_{t-1}} - \frac{B_t}{Y_t}$ where $\frac{(1+i_t)}{Y_t} = \frac{(1+\pi_t)\,(1+r_t)}{(1+\pi_t)\,(1+g_t)}$ is the discounted interest rate (ϕ_t). Here, Equation (1) can be written as $(D/Y)_t = ((1+r_t)/(1+g_t))(D/Y)_{t-1} - (B/Y)_t$. Deducting past debt from both sides produces Equation (2).

2 A significant role of the lagged primary balance/GDP as an optimal fiscal policy inertia in which the fiscal authority aims at reaching the optimal primary deficit target in small steps due to economic uncertainty.

3 Bohn (1998) explained that, in the United States, the real interest rate paid by the government is below the growth rates in the 20th century.

TABLE 5. Long-term Reaction and Sustainability Level

	Malaysia 1987-2014		Thailand 1976-2014		Philippines 1976-2014	
	OLS	VAR	OLS	VAR	OLS	VAR
α_1	–3.542	–3.546	–1.527	–1.486	–0.102	–0.131
α_2	0.738	0.739	0.544	0.542	0.607	0.608
α_3	0.048	0.048	0.048	0.046	0.019	0.019
$\alpha_1/(1-\alpha_2)$	0.183	0.184	0.105	0.100	0.048	0.048
r	0.038		0.064		0.045	
g	0.062		0.057		0.038	
$\alpha^* = (r_t - g_t)/(1-g_t)$	–0.023		0.006		0.007	
Compare $\alpha_3/(1-\alpha_2)$ and α^*	$\alpha_3/(1-\alpha_2) > \alpha^*$		$\alpha_3/(1-\alpha_2) > \alpha^*$		$\alpha_3/(1-\alpha_2) > \alpha^*$	
Conclusion	primary balance/GDP and debt/GDP ratios stabilise		primary balance/GDP and debt/GDP ratios stabilise		primary balance/GDP and debt/GDP ratios stabilise	

Notes: α_1, α_2, and α_3 are parameter estimates from Table 1. *r* and *g* are real interest rate and real economic growth rate and computed as averages for estimating the regression.

4 We follow Bohn (1991), in which primary balance and public debt are expressed as GDP shares. This is important, since all productive activities are the basis for revenues, and the government sector is bounded by the size of the aggregate economy.

5 Analogous to Bohn (2008), this paper uses an HP filter ($\lambda = 100$) to extract the trend component of log real GDP and define the output gap as the gap between the actual value and this trend in percentage points of GDP.

6 However, following Bohn (1998), insignificant coefficient on the lagged debt ratio should not necessarily be taken as evidence that debt levels in a government increases. The debt ratio can be stable when the interest rate-growth differential is negative even if fiscal behaviour is not responsive to changes in debt.

7 For impulse response estimates, the authors presented both with and without the confidence bands. The confidence bands for impulse response estimates are often based on asymptotic normal approximation. The asymptotic interval is the computationally simplest method relies on a delta expansion of the asymptotic distribution of the impulse response estimator (Lütkepohl, 1990; Mittnik & Zadrozny 1993).

8 Both debt- and primary balance-to-GDP ratio will stabilise when $\alpha_3/(1 - \alpha_2) > \alpha^*$ (Burger 2012; Lestari 2014; Lukkezen 2012).

REFERENCES

Bohn, H. 1991. Budget Balance through Revenue or Spending Adjustments? Some Historical Evidence for the United States. *Journal of Monetary Economics 27*: 333–359.

Bohn, H. 1995. The Sustainability of Budget Deficits is a Stochastic Economy. *Journal of Money, Credit, and Banking* 27: 257–271.

Bohn, H. 1998. The Behavior of US Public Debt and Deficits. *The Quarterly Journal of Economics* 113(3): 949–963.

Bohn. H. 2007. Are Stationary and Cointegration Restrictions Really Necessary for the Intertemporal Budget Contraint? *Journal of Monetary Economics* 54(7): 1837–1847.

Bohn. H. 2008. The Sustainability of Fiscal Policy in the United States. In *Sustainability of Public Debt*, edited by R. Neck and J. Sturm, 15-49. Cambridge, London: MIT Press.

Burger, P. 2012. Fiscal Sustainability and Fiscal Reaction Functions in the US and UK. *International Business and Economics Research Journal* 11(8): 935–942.

de Mello, L. 2005. *Estimating a Fiscal Reaction Function: The Case of Debt Sustainability in Brazil*. OECD Economics Department Working Paper No. 423.

Édes, B. W., & Morgan, P. J. 2014. Managing Fiscal Sustainability and Aging in Emerging Asia. *Public Policy Review* 10(2): 319–348.

Gali, J., & Perotti, R. 2003. *Fiscal Policy and Monetary Integration in Europe.* CEPR Discussion Paper No. 3933.

Hodrick, R. J., & Prescott, E. C. 1997. Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit and Banking* 29(1): 1–16.

International Monetary Fund (IMF). 2012a. *Thailand: 2012 Article IV Consultation.* IMF Country Report No. 12/124.

International Monetary Fund (IMF). 2012b. *The Philippines: 2011 Article IV Consultation.* IMF Country Report No. 12/49.

International Monetary Fund (IMF). 2013a. *Philippines. 2013 Article Consultation.* IMF Country Report No. 13/102.

International Monetary Fund (IMF). 2013b. *Thailand: 2013 Article IV Consultation*. IMF Country Report No. 13/32.

International Monetary Fund (IMF). 2014. *Malaysia: 2013 Article IV Consultation.* IMF Country Report No. 14/80.

International Monetary Fund (IMF). 2015. *Malaysia: 2014 Article IV Consultation.* IMF Country Report No. 15/58.

International Monetary Fund (IMF). 2016. *Malaysia: 2016 Article IV Consultation.* IMF Country Report No. 16/110.

International Monetary Fund (IMF). 2017. *World Development Outlook (WEO) Database.* Washington DC: International Monetary Fund.

Jansen, K., & Khannabha, C. 2009. The Fiscal Space of Thailand. In *Fiscal Space, Policy Options for Financing Human Development*, edited by R. Roy & A. Heuty, 325–389. London: Earthscan.

Kawai, M., & Morgan, P. J. 2013. Long-term Issues for Fiscal Sustainability in Emerging Asia. *Public Policy Review* 9(4): 751-770.

Lestari, T. 2014. *Can Indonesia's Fiscal Policy be Sustained, with Exploding Debt?* Economics and Development Studies Working Paper No. 201415.

Lukkezen, J., Rojas-Romagosa, H. 2012. *When is Debt Sustainable?* CPB Discussion Paper 212.

Lütkepohl, H. 1990. Asymptotic Distributions of Impulse Response Functions and Forecast Error Variance Decompositions of Vector Autoregressive Models. *The Review of Economics and Statistics* 72: 53–78.

Ministry of Finance. 2017. *Fiscal and Economic Data.* Malaysia: Ministry of Finance.

Mittnik, S., & Zadrozny, P. A. 1993. Asymptotic Distributions of Impulse Responses, Step Responses, and Variance Decompositions of Estimated Linear Dynamic Models. *Econometrica* 61: 857–870.

Rajan, R. S., Tan, K. G., & Tan, K. Y. 2015. Fiscal Sustainability in Selected Developing ASEAN Economies. *International Journal of Public Policy* 11(4/5/6): 186–203.

Sangsubhan, K., & Basri, M. C. 2012. Global Financial Crisis and ASEAN: Fiscal Policy Response in the Case of Thailand and Indonesia. *Asian Economic Policy Review* 7: 248–269.

Taylor, J. B. 2000. Reassessing Discretionary Fiscal Policy. *Journal of Economic Perspectives* 14(3): 21–36.

Vijayaledchumy, V. 2003. *Fiscal Policy in Malaysia*. BIS Paper No. 20.

World Bank. 2016. *World Development Indicators.* Washington, DC: The World Bank.

Evan Lau*
Centre for Business, Economics and Finance Forecasting
Universiti Malaysia Sarawak
94300 Kota Samarahan, Sarawak
MALAYSIA
E-mail: lphevan@unimas.my

Alvina Lee Syn-Yee
Department of Economics, Faculty of Economics and Business
Universiti Malaysia Sarawak
94300 Kota Samarahan, Sarawak
MALAYSIA
E-mail: alvina1101@hotmail.com

*Corresponding author