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Sectoral Impact of Fiscal Policy in Malaysia

(Impak Dasar Fiskal ke atas Sektor Ekonomi di Malaysia)

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ABSTRACT

The present study examines the responses of sectoral gross domestic product to different types of government revenue and total government expenditure. The findings are useful to determine the effectiveness of fiscal policy in different economic sectors, which were ignored by previous studies. This study involves six-variable vector autoregressions with Cholesky decompositions. The results indicate that the sectoral output, especially the output in the agricultural-related sector, is sensitive to government revenue. Additionally, a standard deviation of different government revenue shock is found to have a positive effect on sectoral output in most cases. This implies that a positive economic environment causes government revenue and economic output to increase. A rise in government income creates the expectation that government expenditure and investment will increase in the future. On the other hand, the sensitivity to government expenditure is not frequently found and their impacts are mainly positive. This is in line with economic theory. Finally, the analysis of variance decompositions shows that greater portions of the sectoral output are explained by government revenues.

Keywords: Fiscal policy; Malaysia; output; vector autoregressions

ABSTRAK

Kajian ini mengkaji tindak balas keluaran dalam negeri kasar dalam pelbagai sektor ekonomi terhadap pelbagai jenis hasil kerajaan dan jumlah perbelanjaan kerajaan. Hasil kajian ini berguna untuk menentukan keberkesanan dasar fiskal di sektor-sektor ekonomi berlainan yang telah diabaikan oleh kajian-kajian sebelum ini. Kajian ini melibatkan autoregresi vektor yang terdiri daripada enam pemboleh ubah melalui penguraian Cholesky. Hasil kajian menunjukkan bahawa output dalam pelbagai sektor ekonomi, terutamanya output dalam sektor yang berkaitan pertanian adalah sensitif terhadap hasil kerajaan. Selain itu, sisihan piawai kejutan pelbagai daripada hasil kerajaan didapati mempunyai kesan positif terhadap output dalam pelbagai sektor ekonomi pada kebanyakan kes. Ini menunjukkan bahawa persekitaran ekonomi yang positif menyebabkan peningkatan hasil kerajaan dan output ekonomi. Peningkatan hasil kerajaan mewujudkan jangkaan bahawa perbelanjaan dan pelaburan kerajaan akan meningkat pada masa hadapan. Sebaliknya, sensitiviti terhadap perbelanjaan kerajaan jarang ditemui dan kebanyakan impak-impak adalah positif. Ini adalah selari dengan teori ekonomi. Akhirnya, analisis penguraian varians menunjukkan bahawa output dalam pelbagai sektor ekonomi adalah lebih banyak dijelaskan oleh hasil kerajaan.

Kata kunci: Dasar fiskal; Malaysia; output; autoregresi vektor

INTRODUCTION

In Malaysia, fiscal policy via government allocations for infrastructure development and investment is a crucial tool in managing the economy.[1] Additionally, a discretionary fiscal policy is also useful during economic crises. Vijayaledchumy (2003) highlighted that Malaysian authorities tend to use a discretionary fiscal policy in order to counter an economic slowdown. Discretionary fiscal actions include increasing government expenditure, capital expenditure and tax reduction. They further asserted that fiscal deficits do not occur due to the cumulative effects of inefficiency and long-term expenses such as wages for civil servants. In Malaysia, stimulus packages were launched during the major economic downturn, as seen in the 1997 Asian financial crisis and the more recent global economic crisis in 2008-2009. Consequently, the debt-to-gross domestic product (GDP) ratio has also risen after these discretionary fiscal decisions (Kim et al. 2014).

Indeed, Malaysia has registered a fiscal deficit since the Asian financial crisis in 1997. A series of economic turbulence has caused the fiscal deficits to be persistent. The highest deficit occurred in 2009 where the cash deficit as a percentage of GDP was 6.13%.[2] Following this, the debt-to-GDP ratio rose. Nonetheless, Kim et al. (2014) showed that financing a fiscal deficit in Malaysia has been relatively easy in recent decades. This is because of the ample domestic liquidity that allows loans to be offered at reasonable interest rates. However, this advantage could be negated if instability in the global economy and the decline in oil prices continue (given that oil a main contributor to Malaysia's fiscal revenue). Indeed, these economic challenges and a discretionary fiscal policy caused the debt-to-GDP ratio to increase from 32% in 1997 to 55% in 2013.[3]

Existing economic theories failed to offer a conclusion about the efficacy of fiscal policy. Tang et al. (2013) summarised the major conclusions about the impact of fiscal policy on outputs. Generally, they reported that a standard Keynesian model expects that government spending will create an increase in the output at a size larger than the spending. However, this size of the output's responses could be influenced by other factors, such as exchange rate regime and trade openness. Otherwise, the fiscal policy is not important in the Ricardian equivalence theory because economic agents will reduce their current consumption after an increase in government spending or a reduction in taxation. The rationale is that the economic agents will expect that the tax rate will increase in the future in order to reduce the deficit caused by an expansionary fiscal policy. The crowding out effects of fiscal policy on private investment can reduce the effectiveness of fiscal policy as well. Finally, the theory of expansionary fiscal contraction argues that an increase in fiscal spending that is coupled with increasing uncertainty and the low credibility of government could reduce the desire for current consumption, leading to negative reactions of output to expansionary fiscal policy.

There are suggestions that the reactions to the fiscal policy vary across different economic sectors. Jitsuchon (2010) mentioned that the effects of the fiscal stimulus package on different economic sectors depend on their forward and backward linkages with other industries. Kanjanatarakul and Suriya (2012) proved that the service sector has the largest reaction to an increase in government spending compared to other sectors in Thailand. Additionally, the nature of an industry could affect the impact of fiscal policy. For instance, Snell et al. (1991) proposed that interest rates increase following a rise in government spending or tax reduction. Eventually, land price will drop, leading to the purchase of agricultural land. This implies that agricultural output will increase.

In Malaysia, government expenditure is expected to influence the construction, agricultural and manufacturing sector because government expenditures emphasise on the development of infrastructure, trade and industry, and agriculture. It is, however, difficult to conclude exactly how total government revenue, direct tax, indirect tax and non-tax revenue will impact different sectors because all industries, to some degree, are subjected to these taxes.[4] For example, manufacturing sectors could react to indirect tax because they have to pay import and export duties; both duties are part of indirect tax. Besides this, service and constructions sectors could react to the non-tax revenue because these industries are subjected to licences that grant the industry players to right to conduct a property project or offer a service. The reactions are expected to be the same across different industries

In this paper, I estimate the impact of a fiscal policy shock (government expenditure and tax revenue) on the outputs of four main economic sectors in Malaysia, in addition to other control variables: the short-term interest rate, the real effective exchange rate, and the overall price level. To the best of my knowledge, this paper is the first empirical research that explores the sectoral output reactions to a fiscal policy shock in Malaysia.[5] The discussions of the literature review section show that previous relevant studies investigated the aggregate reaction of output to the fiscal policy in Malaysia. Nonetheless, it is important to understand the reaction of different economic sectors in order to maximise the benefits of fiscal policy that might vary in those economic sectors. Therefore, this paper contributes by providing more insight on these issues. Through vector autoregression (VAR) and Impulse response functions (IRFs) that measure the magnitude of the effects and time needed for the policy to be effective are plotted. In addition, variance decomposition that shows the percentage of variation of a variable due to a shock in the VAR model is also presented. The remainder of this paper is structured as follows: The next section is the discussion of the relevant literature. Section 3 shows the data descriptions and the methodology. Section 4 discusses the findings and Section 5 concludes.

LITERATURE REVIEW

Although several narrative studies supported the importance of fiscal policy in Malaysia, the effort to investigate this issue by examining the sectoral data is still scarce. In fact, most of the relevant empirical studies about Malaysia discuss the fiscal multiplier in Malaysia and the reactions of economic variables at an aggregate level to a fiscal policy shock. The impact of fiscal policy on the sectoral output was examined by Tagkalakis (2014) and Monacelli and Perotti (2008). They examined the data of traded and non-traded goods in Greece and the United States, respectively. The paper fills the gap of knowledge by examining the issue differently by investigating the GDP of five main sectors, namely the agricultural-related sector, mining and quarrying sector, manufacturing sector, construction and service sector in Malaysia.

The fiscal multiplier was examined via different methods and the most frequently applied method in recent years is the structural vector autoregression model proposed by Blanchard and Perroti (2002).[6] For example, Doraisami (2011) examined only the impact of government spending on GDP in Malaysia and concluded that GDP and government spending are positively linked during 2000:Q1 to 2008:Q4. Using the same method, Tang et al. (2013) examined a longer dataset (1999: Q1 to

2011: Q4) and showed that tax and government spending policies in Malaysia are useful in pushing the output level. Using sign-restrictions, Jha et al. (2014) found that real government expenditure and real government revenue have statistically significant positive and negative impact on the GDP of Malaysia. Nonetheless, the economic impact is rather insignificant. Moreover, the Granger causality test of Fatima and Iqbal (2003) also supports the unidirectional impact of government expenditure on Malaysia's GDP. However, this conclusion is not supported by Bekhet and Othman (2012a) who applied the vector error correction model (VECM) to show that an expansion in government spending is not helpful in increasing the output level, but will raise the amount of external debts. Ansari (2002) also argued that public spending does not have a short-run relationship with the income level in Malaysia in a VECM model. Moreover, his variance decomposition test also shows that public spending explains a marginal portion of the variation in the income level.

On the other hand, the responses of the stock market in Malaysia to a fiscal policy shock are examined by Bekhet and Othman (2012b). They used a VECM model to examine the reactions of the stock market to a fiscal policy (tax and spending) shock; they showed that fiscal policy only has a long-term impact on the stock market. Furthermore, Mohammadi and Moshrefi (2012) covered the impact of budget surplus on current accounts in five Asian economies, including Malaysia in a VECM model. For Malaysia, the statistical insignificance of the error correction terms and the analysis of IRFs suggest that the current account is not affected by a change in fiscal policy. This is in line with the argument of Ricardian theory. Finally, Rafiq (2013) used a time-varying factor augmented vector autoregression model with Cholesky decomposition restrictions to show that following to the change in the regime (1997 Asian financial crisis), the role of government spending declined due to lower credit supply and investments. In addition, the positive effect of government spending on domestic economy tends to be short-lived and marginal.

METHODOLOGY

The data of this paper span from 1991: Q1 to 2014: Q3. Table 1 shows the sources of the variables in this paper. The GDP, consumer price index (CPI), 3-month Treasury bill and real effective exchange rate (REER) are the typical indicators of a country's output, price, interest rate and the exchange rate of Malaysia, respectively. In addition to the sectoral GDP, four types of federal government revenue are examined in this paper: total revenue, direct taxes, indirect taxes (e.g. export duties of oil and gas) and non-tax revenue (e.g. royalty). The purpose of testing different types of government expenditure is to provide more detailed information about the effects of fiscal policy shocks. The data of the GDP of agricultural-related, mining and quarrying, manufacturing and construction sectors are reported in the Monthly Statistical Bulletin published by Central Bank of Malaysia. Regarding the GDP of the service sector, the subsectors under that industry are the same until 2010: Q1; in which the services that cover motor vehicles are included from there onwards. Nonetheless, the impact of the inclusion of this subsector is expected to be small because of the small contribution from that subsector to the overall GDP of service sector (3.5% of total service sector' GDP in 2014: Q3). Otherwise, the total of federal government expenditure is used to represent government expenditure.

All variables, except for the REER available after seasonal adjustment, were seasonally adjusted by using the Census X-13. These variables, except for the interest rate, were transformed into logarithm form. The seasonal adjustment and data transformation were conducted by using EViews 8.1. Additionally, three dummies were added to represent the following event: The Asian financial crisis (1997: Q3-1998: Q4), subprime mortgages crisis (2007: Q3-2009: Q1) and the temporary capital control that limits the inflows of capital in 1994 (1994: Q1-1994: Q4).

The first estimations are the examination of the unit root properties of each variable using the augmented

TABLE 1. Data descriptions

Variable	Data Sources
Gross domestic products (total and various sectors)	Monthly Statistical Bulletin, BNM
Consumer price index	Datastream (MYQ64...F)
Real effective exchange rate	Datastream (MYQ..RECE)
3-month Treasury bill	Datastream (MYGBILL3)
Government total revenue	Datastream (MYBUDREVA)
Government direct taxes revenue	Datastream (MYBUDTAXA)
Government indirect taxes revenue	Datastream (MYBUDITAA)
Government non-tax revenue	Datastream (MYBUDOTHA)
Government total expenditure	Datastream (MYBUDEXPA)

Note: The mnemonics of the data from datastream are shown in the parentheses.

Dickey-Fuller test and Kwiatkowsi-Phillips-Schmidt-Shin (KPSS) test. The augmented Dickey-Fuller is an extension of the Dickey-Fuller test that aims to investigate a simple unit root process. According to the Dickey-Fuller test, a variable is nonstationary if $\rho = 1$.

$$Y_t = \rho Y_{t-1} + u_t \quad (1)$$

However, it is possible that there are correlations among the error terms in equation (1). Hence, the augmented Dickey-Fuller overcomes this issue by including lagged dependent variables; see equation (2) for the general form of the augmented Dickey-Fuller test. In order to determine the order of integration of a variable, the null hypothesis of $\delta = 0$ is tested. The rejection of null hypothesis suggests that the variables are stationary.

$$\Delta Y_t = \beta_1 + \beta_1 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

where ε_t is a pure white noise error term. The lag lengths in the test are decided by referring to Schwarz information criterion (SIC). According to Ivanov and Kilian (2005) the SIC produces accurate IRFs compared to other lag length selection criteria if quarterly data with less than 120 observations are tested.[7]

On the other hand, the KPSS test is usually used as the confirmatory test for the ADF test because it has the null hypothesis that is opposite to that of the ADF test. According to Kwiatkowsi et al. (1992), a data can be decomposed into four parts: a deterministic trend, a random walk and a stationary error. The random walk can be expressed in equation (3) and the gist of the KPSS test is to test whether the variance of $\mu(\sigma_\mu^2)$ is equal to zero by using LM statistic. A variable is stationary if $\sigma_\mu^2 = 0$.

$$r_t = r_{t-1} + u_t \quad (3)$$

When all variables in a model are integrated of order zero, the ordinary least square estimation produces reliable results. However, if all variables are integrated of order one, the linear combination of these variables can be integrated of order zero, leading to the conclusion that these variables are cointegrated. If the variables are cointegrated, a cointegration test can be applied to determine the cointegrated relationship and the adjustment mechanism. Otherwise, first-differenced VAR are estimated to determine the short-run relationships.

It is possible that variables in a test are integrated at different order. For this case, the variables can be estimated in an autoregressive distributed lag model where bound testing is applied to determine the existence of a cointegrating and short-run relationship. Another option is to conduct the cointegration test among differenced stationary variables; the model can be estimated in a level VAR if a cointegration relationship is detected and IRFs are generated from this test. In this option, the efficiency of a regressor is undermined but its consistency is intact (Aleem 2010). Sims et al. (1990) also argued that first differencing a differenced-stationary variable is not needed because the distribution of an estimator, which is more crucial in an estimation, is unaffected by the unit root.

The dynamic among endogenous variables can be estimated by using VAR. According to Enders (2010: 298), the VAR in standard form can be expressed in the following equation

$$x_t = A_0 + A_1 x_{t-1} + e_t \quad (4)$$

Where x_t is the endogenous variable, $A_0 + A^{-1}\Gamma_0$ and e_t are reduced-form error terms and equivalent to $B^{-1}\varepsilon_t$.[8] In order to identify structural shock from the reduced-form error terms, a recursive identification scheme was deployed. The recursive identification scheme or Cholesky decomposition was selected because it is relatively easy to implement and is widely applied. Particularly, this paper assumes that the Malaysian government will plan their expenditure based on their revenue. Therefore, the position of government revenue is placed before government expenditure in the Cholesky decompositions. Both variables can move the remaining variables. Kuismanen and Kamppi (2010) also proposed similar assumptions. Additionally, the typical assumptions where the output will affect price, interest rate reacts to output and price are both imposed in the Cholesky decompositions. Finally, the exchange rate is sensitive to all shocks in the model. Although the recursive identification is a relatively easy solution, it is also criticised for imposing relatively ad hoc restrictions on the endogeneity of the variables in a model. Hence, the robustness of this test is tested by generating the generalised IRFs (GIRFs) that are insensitive to variable ordering. In order to avoid overfitting the model with too many variables, only one type of government revenue and output are included into each VAR.

Enders (2010: 308) also illustrated a compact version of IRFs, as shown below. In short, the VAR is now expressed in its moving average representation and the impulse response function is the values of ϕ at different periods. The values of ϕ show the response of the endogenous variables (x) to identified shocks (ε).

$$x_t = \mu_t + \sum_{i=0}^{\infty} \phi_i \varepsilon_{t-i} \quad (5)$$

Finally, variance decomposition is computed. Generally, the variance decomposition shows the percentage of forecast error variance that is explained by a shock. Assuming that x consists of two endogenous variables y and z and the n-period forecast error is measured as

$$x_{t+n} - E_t x_{t+n} = \sum_{i=0}^{n-1} \phi_i \varepsilon_{t+n-i} \quad (6)$$

From this equation, the n-step-ahead forecast error variance of $y(\sigma_y^2)$ is equivalent to

$$\sigma_y^2[\phi_{11}(0)^2 + \phi_{11}(1)^2 + ... + \phi_{11}(n-1)^2] + \sigma_z^2[\phi_{12}(0)^2 + \phi_{12}(1)^2 + ... + \phi_{12}(n-1)^2] \quad (7)$$

The percentages of n-step-ahead forecast error variance of $y(\sigma_y^2)$ that can be explained by z, for example, are estimated using the following formula

$$\frac{\sigma_z^2[\phi_{12}(0)^2 + \phi_{12}(1)^2 + ... + \phi_{12}(n-1)^2]}{\sigma_y^2} \quad (8)$$

Finally, the Toda-Yamamoto causality test was conducted to estimate the causality relationship between the variables of interest. Toda-Yamamoto allows the determination of granger causality relationships without the need to know the order of integration of the variables in a VAR model. This advantage is valuable when unit root tests suffer from low test power. Furthermore, Toda and Yamamoto (1995) argued that the inclusion of variables with first order of integration in a VAR model can cause invalidity of Wald test in Granger causality test because the test will be affected by nuisance parameters. To overcome these issues, Toda-Yamamoto causality test produces an over-fit VAR by augmenting the estimated VAR with the maximum order of integration of the variables (d_{max}). For example, if there are I(1) and I(0) variables in a VAR model, d_{max} is equal to one. After estimating the augmented VAR, the coefficients of the augmented lag will be ignored in the Wald test; Toda and Yamamoto show that the test statistic will have standard asymptotic distribution.

RESULTS AND DISCUSSIONS

UNIT ROOTS, COINTEGRATION AND VAR LAG LENGTH SELECTION

Table 2 shows that according to the ADF test, except for the federal government total revenue, the direct taxes, the indirect taxes and the non-tax revenue are stationary variable at level, the remaining variables are differenced-stationary. KPSS test largely supports these findings, except for government revenue and non-tax income where both variables are differenced stationary at 10% and 5% significance levels, respectively. A PP test was conducted for these two variables and the outputs are in line with the ADF test outputs. Therefore, I conclude that government revenue and non-tax income are level stationary.[9] Following to the discussion in Section 3, I conducted the Johansen cointegration test among these differenced-stationary variables.[10] The results are shown in Table 3. The main focus of this paper in estimating the Johansen cointegration test is to include the number of lag that ensures that there is no autocorrelation detected in the model. The largest number of lag to be tested is limited to eight, as to reduce the loss of degree of freedom.

The trace statistical value of the Johansen cointegration test is used to detect the cointegration relationship because this value performs better compared to the eigenvalue test. This is because the trace statistical value the bias of the Johansen cointegration test is less affected by non-normality that is caused by skewness

TABLE 2. ADF and KPSS test results

Variable	ADF test		KPSS test	
	Level	First difference	Level	First difference
LS1	-2.5771 (1)	-8.1368 (0)***	0.2063 (6)**	0.0445 (1)
LS2	-2.4249 (1)	-7.1311 (0)***	0.1751 (6)**	0.1205 (0)
LS3	-2.7621 (1)	-6.5411 (1)***	0.2883 (7)***	0.3374 (3)
LS4	-1.8438 (1)	-6.9021 (0)***	0.1657 (7)**	0.2283 (5)
LS5	-2.6953 (0)	-9.0302 (0)***	0.1408 (7)*	0.2891 (5)
LCPI	-2.6197 (1)	-7.2965 (0)***	0.1975 (7)**	0.3391 (2)
LREER	-1.8417 (1)	-6.9934 (0)***	0.2191 (7)***	0.0844 (1)
IR	-1.9500 (0)	-9.9559 (0)***	0.8703 (7)***	0.0592 (3)
LGEXP	-6.0708 (0)	-8.3801 (3)***	0.1913 (6)**	0.0780 (7)
LGREV	-5.2178 (0)***	-10.0386 (1)***	0.119 (6)*	0.0637 (9)
LDTAX	-5.3685 (0)***	-13.5278 (0)***	0.0432 (6)	0.0660 (3)
LINDTAX	-3.3316 (0)*	-10.6612 (0)***	0.0786 (6)	0.0396 (2)
LNONTAX	-6.7298 (0)***	-9.3749 (3)***	0.2149 (5)**	0.2876 (59)

Note: LS1 is the logarithm of GDP of the agricultural-related sector, LS2 is the logarithm of GDP of the mining and quarrying sector, LS3 is the logarithm of GDP of the manufacturing sector, LS4 is the logarithm of GDP of the construction sector, LS5 is the logarithm of GDP of the service sector, LCPI the logarithm of CPI, LREER is the logarithm of REER, IR is the 3-month Treasury bill rate, LGE is the logarithm of government total expenditure, LGREV is the logarithm of government total revenue, LDTAX is the logarithm of direct taxes, LINDTAX is the logarithm of indirect taxes and LNONTAX is the logarithm of non-tax revenue. The values in the parentheses are the number of lags in the ADF test. ***, ** and * represent the rejection of null hypothesis of unit root at 1%, 5% and 10%, respectively.

TABLE 3. Johansen cointegration results

Vector of variables		Trace statistic values
Case 1: LGEXP, LS1, LCPI, IR, LREER (3)	None	97.7405
	r=1	29.8688
	r=2	15.0331
	r=3	3.6505
Case 2: LGEXP, LS2, LCPI, IR, LREER (7)	None	70.658
	r=1	25.0835
	r=2	8.8326
	r=3	0.5263
Case 3: LGEXP, LS3, LCPI, IR, LREER (8)	None	109.4631
	r=1	50.6195
	r=2	18.0966
	r=3	5.7813
Case 4: LGEXP, LS4, LCPI, IR, LREER (3)	None	105.7724
	r=1	47.3872
	r=2	20.7219
	r=3	3.6352
Case 5: LGEXP, LS5, LCPI, IR, LREER (7)	None	119.3191
	r=1	62.7728
	r=2	19.0071
	r=3	2.5919

Note: The values in the parentheses in first column are the number of lag. A sufficient number of lag is selected to eliminate second- and fourth-order autocorrelation; the second and third column show the values of LM-stat at that lag with the p-values in the parentheses. The 95% critical value of the trace statistic value is 69.819, 47.8561, 29.797 and 15.495 for the cases of no cointegrating vector, r=1, r=2, r=3, respectively.

and excess kurtosis (Cheung and Lai 1993). Moreover, Rahbek, Hansen and Dennis (as cited in Belke et al. (2012)) proposed that heteroscedasticity does not undermine the determination of cointegration rank. According to Table 3, one cointegrating vector is found in Case 1, Case 2 and Case 4, and two cointegrating vectors in Case 3 and Case 5. This shows that the linear combinations of differenced-stationary variables are cointegrated. Subsequently, the following vectors of variables [Government revenue, government expenditure, output, price, interest rate, exchange rate] were estimated by using the level VAR to generate the impulse response functions. Table 4 summarises the number of lag that are included in each set of VAR in order to overcome the second- and fourth-order autocorrelation, and the maximum number of lag is eight.[11]

IMPULSE RESPONSE FUNCTIONS

For the sake of brevity, the following discussions cover the IRFs of the reactions of sectoral and total outputs that are statistically significant. The following IRFs present the 95% confidence interval. The values of the x-axis represent the time period (quarterly) while the values of the y-axis are multiplied by 100 so that the results can be interpreted as a percentage change. Figure 1 shows the IRFs of the sectoral GDP to a standard deviation shock of total government revenue and total government expenditure from the model with total government revenue. The GDPs of agricultural-related, mining and quarrying and service sectors are found to react positively to that shock and these reactions are statistically significant. For the agricultural-related sector, the statistically significant reactions occur in the second quarter following that shock and re-occur in the seventh quarter and continue. The GDP of the mining and quarrying sector only reacts to a LGREV's shock in the first four quarters. The direction of the reaction of service sector is similar to the mining and quarrying sector but the reactions are only statistically different from zero from the second quarter to the fifth quarter. With regard to the impact of total government expenditure, only the GDP of the manufacturing sector reacts negatively to the shock from the second to the fifth quarter following a standard deviation shock of LGE.

Figure 2 demonstrates the responses of the output to a standard deviation shock of direct taxation and total government expenditure from the model with direct taxation. The direct tax has a smaller influence compared

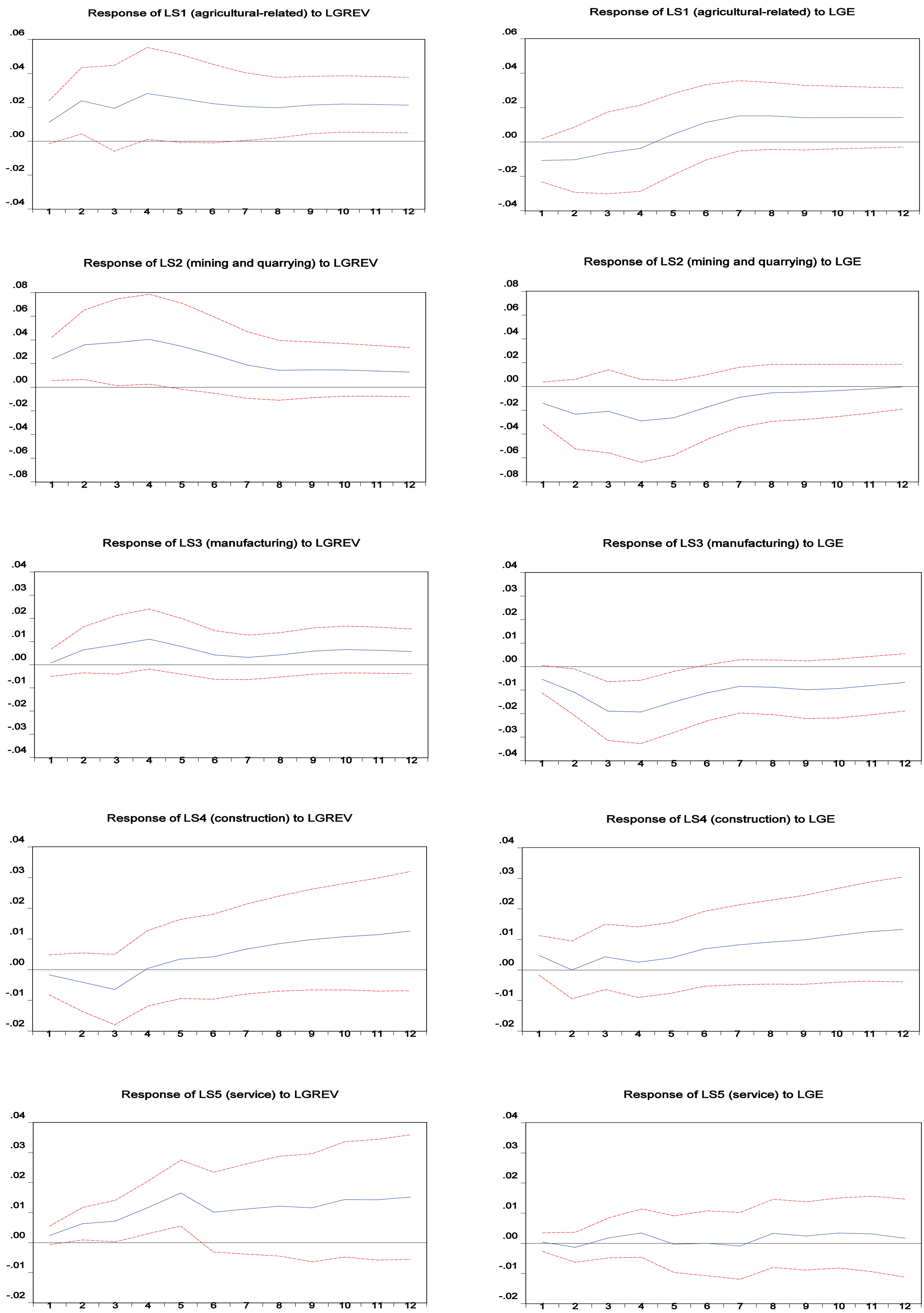

FIGURE 1. Responses of sectoral and total outputs to a standard deviation shock of LGREV and LGE.

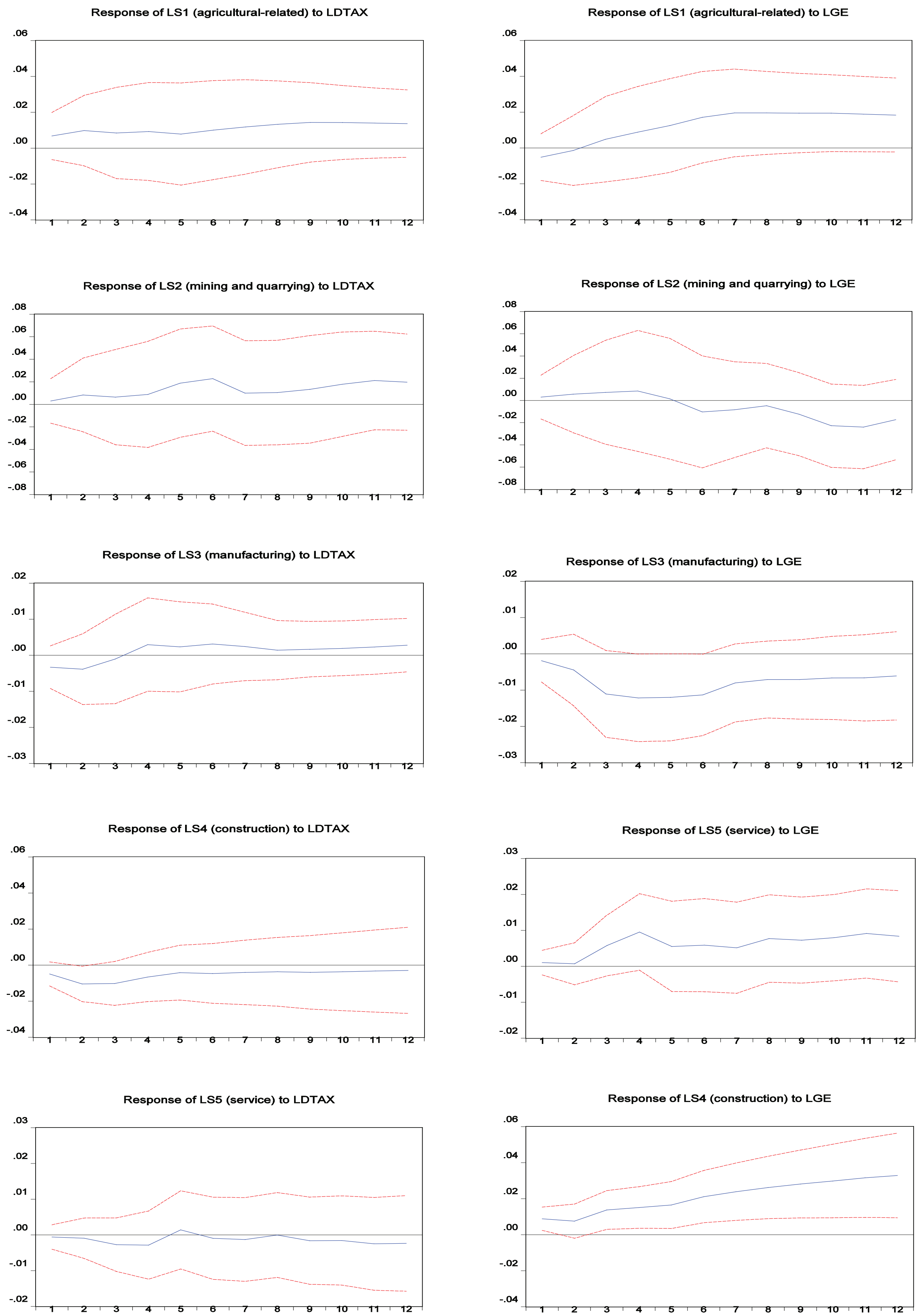

FIGURE 2. Responses of sectoral and total outputs to a standard deviation shock of LDTAX and LGE

TABLE 4. Lag length selection of vector autoregressions

LGREV	Number of Lag	AR (2)	AR (4)
LGREV,LGE,LS1,LCPI,IR,LREER	3	42.430 (0.214)	34.925 (0.520)
LGREV,LGE,LS2,LCPI,IR,LREER	3	44.737 (0.151)	25.524 (0.903)
LGREV,LGE,LS3,LCPI,IR,LREER	3	43.885 (0.172)	25.096 (0.914)
LGREV,LGE,LS4,LCPI,IR,LREER	3	38.681 (0.350)	36.303 (0.455)
LGREV,LGE,LS5,LCPI,IR,LREER	7	37.807 (0.387)	36.33 (0.454)
LDTAX	VAR lag	AR (2)	AR (4)
LDTAX,LGE,LS1,LCPI,IR,LREER	3	44.184 (0.164)	28.216 (0.819)
LDTAX,LGE,LS2,LCPI,IR,LREER	7	39.949 (0.299)	44.718 (0.151)
LDTAX,LGE,LS3,LCPI,IR,LREER	3	42.991 (0.197)	17.735 (0.995)
LDTAX,LGE,LS4,LCPI,IR,LREER	3	41.161 (0.255)	35.303 (0.502)
LDTAX,LGE,LS5,LCPI,IR,LREER	7	49.949 (0.061)	33.164 (0.604)
LINDTAX	VAR lag	AR (2)	AR (4)
LINDTAX,LGE,LS1,LCPI,IR,LREER	6	31.508 (0.682)	32.576 (0.632)
LINDTAX,LGE,LS2,LCPI,IR,LREER	5	39.345 (0.323)	31.519 (0.682)
LINDTAX,LGE,LS3,LCPI,IR,LREER	6	44.854 (0.148)	34.293 (0.549)
LINDTAX,LGE,LS4,LCPI,IR,LREER	7	40.565 (0.276)	44.613 (0.154)
LINDTAX,LGE,LS5,LCPI,IR,LREER	7	45.993 (0.123)	46.936 (0.105)
LNONTAX	VAR lag	AR (2)	AR (4)
LNONTAX,LGE,LS1,LCPI,IR,LREER	3	35.859 (0.475)	27.887 (0.831)
LNONTAX,LGE,LS2,LCPI,IR,LREER	3	42.707 (0.205)	22.296 (0.964)
LNONTAX,LGE,LS3,LCPI,IR,LREER	3	40.429 (0.281)	19.76 (0.9872)
LNONTAX,LGE,LS4,LCPI,IR,LREER	3	36.038 (0.467)	35.493 (0.493)
LNONTAX,LGE,LS5,LCPI,IR,LREER	3	44.005 (0.169)	32.346 (0.643)

Note: The number of lag in each VAR is shown in the second column. A sufficient number of lag is selected to eliminate second- and fourth-order autocorrelation in the VARs; the third and fourth column show the values of LM-stat at that lag with the p-values in the parentheses.

to the government's total revenue where only the construction sector has statistically significant reaction to a shock from direct tax. This reaction is found only in the second quarter. On the other hand, a standard deviation shock of total government expenditure has a positive impact on the output of the construction sector and that effects are detected in all examined periods except for the second quarter.

Next, the IRFs of the output's reactions to a standard deviation shock of indirect taxes taxation and total government expenditure from the model with indirect taxation are shown by Figure 3. A standard deviation shock of indirect tax will cause a reduction in the output from agricultural-related industries in the first three quarters following that shock. For the mining and quarrying sector, its output increases following the same shock between the fourth and the tenth quarters. In regard to the manufacturing sector, positive responses are found occasionally (i.e. the first, fifth and seventh quarters). Nonetheless, the size of reaction of the manufacturing sector is smaller compared to the agricultural-related industry. Again, the positive impact from total government expenditure is only found in the first quarter of the construction sector.

Figure 4 illustrates the impact from the non-tax revenue and total government expenditure from the model with non-tax revenue. Three economic sectors react positively to a shock of non-tax revenue: agricultural-related, construction and service. The statistically significant responses of the construction sector occur from the fifth quarter onwards and are more prolonged compared to the other two sectors. In the case of the agricultural-related sector, its output increases in the second and fourth quarters following that shock. The reactions of service sector to a shock of non-tax revenue start only in the seventh quarter following that shock and continue until the end of the examined period. Finally, the study's results show statistically significant responses to total government expenditure shock only in the agricultural sector; that shock is influential only during the ninth and twelve quarters.

The discussions above highlight three points. First, only in the case of total government expenditure does a standard deviation shock of total government expenditure causes the manufacturing output to drop. The positive responses in other cases are within expectation because an increase in government expenditure can increase the demand for certain sectors, resulting in more production.

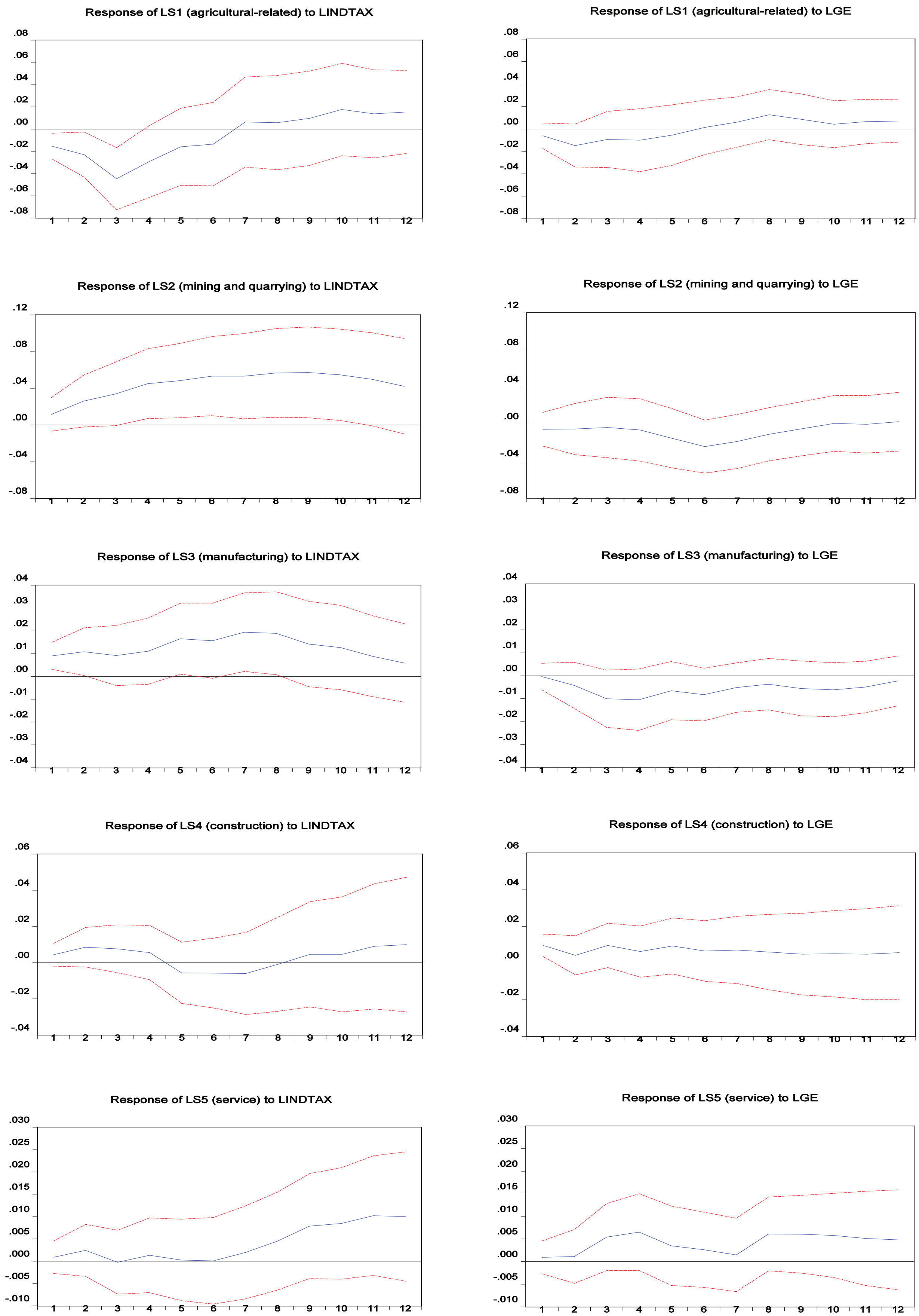

FIGURE 3. Responses of sectoral and total outputs to a standard deviation shock of LINDTAX and LGE

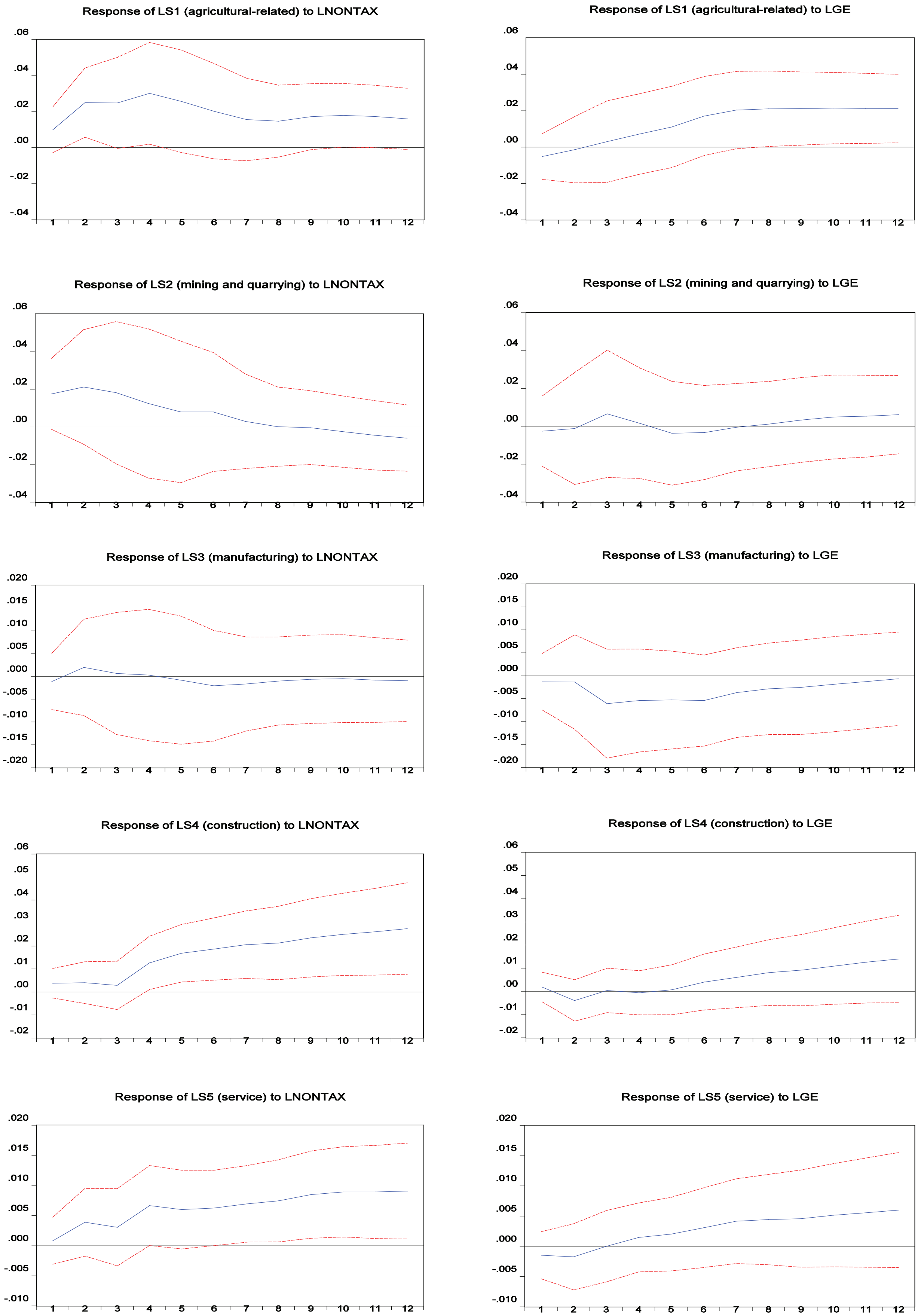

FIGURE 4. Responses of sectoral and total outputs to a standard deviation shock of LNONTAX and LGE

The significant reactions of construction, manufacturing and agricultural sectors can be due to the fact that the government expenditure for development focuses mainly on these industries. Secondly, a standard deviation shock from different types of government revenues (taxation) causes the sectoral output to increase in most cases. Most previous studies suggested that government revenues have no impact on Malaysia's GDP. This counterintuitive positive response of GDP to government revenues could be due to the favourable economic conditions that encourage growth in government income and outputs (Kuismanen and Kamppi 2010). Another possibility is an increase in government income contributes to the expectations that future government expenditure could increase and therefore contribute to an increase of current production level. This paper concludes that only the sectoral GDP of construction reacts to a shock of direct tax. This is rather surprising but it could reflect the case that when direct tax increases, the demand for construction projects will increase in order to cope with potential demand in the future. Besides, the statistically significant reactions of sectoral GDP to indirect and non-tax are largely in line with the discussion in the introduction section. Thirdly, the manufacturing sector is less sensitive to fiscal policy compared to other sectors. This suggests that high capital investments in that sector increased the inelasticity of related businesses to a fiscal policy shock.

In addition, the findings above show that the direction and size of sectoral reactions to a fiscal shock are different. This is in line with the argument of Jitsuchon (2010) and Tang et al. (2013) that different economic sectors will react differently to a variety of fiscal shocks. Additionally, compared to the study of Kanhanatarakul and Suriya (2012) that finds service sector to be more responsive to a change in government expenditure in Thailand, this paper concludes that the service sector does not react to any government spending in Malaysia.

The GIRFs are estimated to test the robustness of the finding. Generally, the robustness of the IRFs discussed is supported. The major difference is the responses of agricultural-related sectors to government expenditure in the model of direct tax. To recap, the response is statistically insignificant (Figure 2). The estimation of GIRF shows that that response is statistically significant from the ninth quarter to the twelve quarter. To conserve space, these IRFs are not shown here and are available upon request. In sum, the directions and statistical significance of the estimations are largely supported.

VARIANCE DECOMPOSITIONS

Table 5 shows the percentage of the variation in different types of output that is explained by the shock of LGREV, LDTAX, LINDTAX and LNONTAX. Panel I of Table 5 shows that the largest influence of total government revenue shocks in the second quarter is in the service sector where 10.5% of the variations are explained by these shocks. The magnitude increases to 30.8% after 12 quarters. The smallest influence is found in the output of the construction sector. Government expenditure explains roughly 19% of the movement in the GDP of manufacturing sector after 12 quarters and is larger compared to its influences in other sectors.

Next, the ability of indirect taxes income in explaining the variation in the output level is relatively weak compared with the other types of government revenue. Particularly, Panel II shows that in the second quarter, indirect taxes contribute to 6.6%, 1.7% and 1.2% of the movement in the output of construction sector, agricultural-related sector and manufacturing sector, respectively. However, its influence on agricultural-related industry rises later and after 12 quarters, it explains 5.41% of the GDP in that sector, and that is the largest compared to other sectors. Government expenditure has stronger influence on the movement of sectoral output compared to indirect taxes. For example, 30% of the variations of the output in the construction sector are caused by shocks from government expenditure. Concurrently, only 1.8% of the variations of the same output are explained by indirect taxes shocks.

According to Panel III, indirect taxes shocks explain more than 15% of the variations in the agricultural-related sector after 4 quarters. Nonetheless, its largest influence shifts to the GDP of the mining and quarrying sector after 8 quarters where it explains more than 30% of the fraction of GDP in that sector. The smallest influence is found in the construction sector. The government expenditure has greater influence on the construction sector's GDP during second and fourth quarters (5% to 7%). Later, the influence on service sector surpasses the other sector and after 12 quarters, it explains 6.5% of the variations in the GDP of service sector.

Regarding the impact of non-tax revenue, Panel IV shows that it explains 9.1% of the GDP of the agricultural-related industry after 2 quarters; and the magnitude increases to 15.5% after 6 quarters. After that, it affects the construction sector the most where after 12 quarters, 25% of the variations in the GDP of the construction sector is due to shocks from non-tax revenue. On the other hand, the largest influence of government expenditure is on the construction sector after 2 quarters (1.1%). Following 6 quarters onwards, the government expenditure shocks explain the sectoral output of agricultural-related businesses the most; it increases from 2.4% after 6 quarters to 11.4% after 12 quarters.

In sum, the shocks from the total government revenue and its components have a great impact on the movement of sectoral output in most cases except for indirect taxes. This is partially in line with the findings in the IRFs where shocks from different types of government revenue affect more categories of output. In addition, the explanatory power of government revenue on the movement of output changes more frequently over time

TABLE 5. Variance decompositions

I: Model with LGREV											
Section A: explained by LGREV						Section B: explained by LGE					
Period	Variance decomposition of					Period	Variance decomposition of				
	LS1	LS2	LS3	LS4	LS5		LS1	LS2	LS3	LS4	LS5
2	8.57	9.59	1.93	1.05	10.48	2	2.75	3.81	6.85	1.23	0.44
4	10.70	13.79	4.73	1.68	20.05	4	1.59	5.60	17.47	1.31	1.41
6	13.92	16.66	5.11	1.50	27.41	6	1.98	7.29	19.80	1.83	0.74
8	15.92	17.05	4.84	2.33	27.50	8	3.70	7.16	19.31	2.95	0.88
10	18.19	17.26	5.21	3.43	29.27	10	4.92	6.92	19.20	3.97	1.09
12	20.24	17.38	5.60	4.37	30.83	12	6.03	6.68	18.91	5.07	1.08
II: Model with LDTAX											
Section A: explained by LDTAX						Section B: explained by LGE					
Period	Variance decomposition of					Period	Variance decomposition of				
	LS1	LS2	LS3	LS4	LS5		LS1	LS2	LS3	LS4	LS5
2	1.74	0.40	1.21	6.58	0.22	2	0.35	0.21	1.10	6.65	0.27
4	1.69	0.46	0.77	6.75	0.94	4	0.74	0.38	6.36	13.22	6.96
6	2.10	2.04	0.92	4.47	0.68	6	2.64	0.52	10.21	17.71	6.57
8	3.16	2.27	0.94	3.19	0.58	8	5.46	0.65	10.92	23.0	7.49
10	4.40	2.95	0.92	2.44	0.59	10	7.78	1.73	11.01	26.97	8.78
12	5.41	4.10	1.02	1.91	0.71	12	9.62	3.00	11.1	30.01	10.09
III: Model with LINDTAX											
Section A: explained by LINDTAX						Section B: explained by LGE					
Period	Variance decomposition of					Period	Variance decomposition of				
	LS1	LS2	LS3	LS4	LS5		LS1	LS2	LS3	LS4	LS5
2	9.62	5.011	9.536	4.880	1.214	2	3.23	0.39	0.85	5.92	0.40
4	18.62	14.183	9.156	4.856	0.742	4	2.29	0.43	5.14	6.56	6.47
6	18.23	25.666	16.786	3.948	0.563	6	2.14	2.71	6.14	5.98	6.10
8	17.66	35.118	25.154	2.658	1.605	8	2.88	3.35	5.74	4.30	6.51
10	18.56	42.075	26.579	2.068	5.926	10	3.13	2.89	5.87	3.23	7.25
12	19.24	45.144	25.944	2.382	9.523	12	3.33	2.60	5.78	2.66	6.50
IV: Model with LNONTAX											
Section A: explained by LNONTAX						Section B: explained by LGE					
Period	Variance decomposition of					Period	Variance decomposition of				
	LS1	LS2	LS3	LS4	LS5		LS1	LS2	LS3	LS4	LS5
2	9.11	3.77	0.21	1.75	2.39	2	0.37	0.04	0.16	1.08	0.80
4	13.05	3.47	0.12	5.97	6.32	4	0.52	0.15	1.48	0.59	0.67
6	15.47	3.43	0.18	13.94	9.12	6	2.36	0.20	2.22	0.61	1.32
8	15.88	3.27	0.22	18.73	11.48	8	5.76	0.19	2.28	1.52	2.67
10	16.88	3.11	0.21	22.34	14.15	10	8.77	0.26	2.19	2.65	3.73
12	17.69	3.10	0.21	24.95	15.98	12	11.40	0.39	2.07	4.02	4.90

Note: Panels I, II, III and IV show the variance decompositions of the VAR model with LGREV, LDTAX, LINDTAX and LNONTAX, respectively. LS1 is the logarithm of GDP of the agricultural-related sector, LS2 is the logarithm of GDP of the mining and quarrying sector, LS3 is the logarithm of GDP of the manufacturing sector, LS4 is the logarithm of GDP of the construction sector, LS5 is the logarithm of the GDP of the service sector, LGE is the logarithm of government total expenditure, LGREV is the logarithm of government total revenue, LDTAX is the logarithm of direct taxes, LINDTAX is the logarithm of indirect taxes and LNONTAX is the logarithm of non-tax revenue.

compared with government revenues, especially in cases where indirect taxes and non-tax revenue were tested.

TODA-YAMAMOTO CAUSALITY TEST

Table 6 shows the test statistic values of Toda-Yamamoto causality test and the respective p-values. The null

TABLE 6. Toda-Yamamoto causality test

Equation: LGREV	Null hypothesis	Wald Statistic
LS1	LGREV does not granger cause LS1	3.8346 (0.2799)
	LS1 does not granger cause LGREV	2.5401 (0.4681)
	LGE does not granger cause LS1	1.2616 (0.7383)
	LS1 does not granger cause LGE	3.7517 (0.2896)
LS2	LGREV does not granger cause LS2	9.6212 (0.0221)
	LS2 does not granger cause LGREV	9.5474 (0.0228)
	LGE does not granger cause LS2	1.5293 (0.6755)
	LS2 does not granger cause LGE	10.1881 (0.0170)
LS3	LGREV does not granger cause LS3	10.0333 (0.0183)
	LS3 does not granger cause LGREV	5.2147 (0.1567)
	LGE does not granger cause LS3	9.3077 (0.0255)
	LS3 does not granger cause LGE	2.0888 (0.5542)
LS4	LGREV does not granger cause LS4	1.4945 (0.6835)
	LS4 does not granger cause LGREV	4.4429 (0.2174)
	LGE does not granger cause LS4	1.0622 (0.7862)
	LS4 does not granger cause LGE	4.7299 (0.1927)
LS5	LGREV does not granger cause LS5	4.0699 (0.7717)
	LS5 does not granger cause LGREV	22.0252 (0.0025)
	LGE does not granger cause LS5	6.9010 (0.4393)
	LS5 does not granger cause LGE	8.5098 (0.2898)
Equation: LDTAX	Null hypothesis	Wald Statistic
LS1	LDTAX does not granger cause LS1	0.1876 (0.9796)
	LS1 does not granger cause LDTAX	0.3699 (0.9464)
	LGE does not granger cause LS1	1.4220 (0.7004)
	LS1 does not granger cause LGE	4.21112 (0.2395)
LS2	LDTAX does not granger cause LS2	12.4488 (0.0867)
	LS2 does not granger cause LDTAX	1.5459 (0.9807)
	LGE does not granger cause LS2	9.8691 (0.1961)
	LS2 does not granger cause LGE	21.7483 (0.0028)
LS3	LDTAX does not granger cause LS3	3.850 (0.2774)
	LS3 does not granger cause LDTAX	0.2504 (0.9691)
	LGE does not granger cause LS3	5.3990 (0.1486)
	LS3 does not granger cause LGE	5.0510 (0.1681)
LS4	LDTAX does not granger cause LS4	5.4559 (0.1413)
	LS4 does not granger cause LDTAX	3.8240 (0.3975)
	LGE does not granger cause LS4	1.0657 (0.7854)
	LS4 does not granger cause LGE	6.3928 (0.0940)
LS5	LDTAX does not granger cause LS5	2.2174 (0.9468)
	LS5 does not granger cause LDTAX	10.5106 (0.1617)
	LGE does not granger cause LS5	4.7847 (0.6862)
	LS5 does not granger cause LGE	14.0554 (0.0502)
Equation: LINDTAX	Null hypothesis	Wald Statistic
LS1	LINDTAX does not granger cause LS1	7.3906 (0.2862)
	LS1 does not granger cause LINDTAX	3.5644 (0.7354)
	LGE does not granger cause LS1	1.0348 (0.9843)
	LS1 does not granger cause LGE	12.4472 (0.0527)

LS2	LINDTAX does not granger cause LS2	6.4204 (0.2674)
	LS2 does not granger cause LINDTAX	7.4784 (0.1874)
	LGE does not granger cause LS2	4.8275 (0.4373)
	LS2 does not granger cause LGE	16.3816 (0.0058)
LS3	LINDTAX does not granger cause LS3	7.4247 (0.2834)
	LS3 does not granger cause LINDTAX	13.3109 (0.0384)
	LGE does not granger cause LS3	4.9985 (0.5440)
	LS3 does not granger cause LGE	13.8759 (0.0311)
LS4	LINDTAX does not granger cause LS4	5.0327 (0.6560)
	LS4 does not granger cause LINDTAX	4.1776 (0.7591)
	LGE does not granger cause LS4	8.9971 (0.2529)
	LS4 does not granger cause LGE	12.3146 (0.0907)
LS5	LINDTAX does not granger cause LS5	9.4248 (0.2236)
	LS5 does not granger cause LINDTAX	11.4898 (0.1186)
	LGE does not granger cause LS5	13.4109 (0.0627)
	LS5 does not granger cause LGE	12.0167 (0.0717)
Equation: LNONTAX	Null hypothesis	Wald Statistic
LS1	LNONTAX does not granger cause LS1	5.6061 (0.1324)
	LS1 does not granger cause LNONTAX	0.9983 (0.8017)
	LGE does not granger cause LS1	1.2267 (0.7466)
	LS1 does not granger cause LGE	2.08847 (0.552)
LS2	LNONTAX does not granger cause LS2	0.2675 (0.9660)
	LS2 does not granger cause LNONTAX	7.3081 (0.0627)
	LGE does not granger cause LS2	1.1642 (0.7616)
	LS2 does not granger cause LGE	12.3980 (0.0061)
LS3	LNONTAX does not granger cause LS3	1.2067 (0.7514)
	LS3 does not granger cause LNONTAX	0.9527 (0.8127)
	LGE does not granger cause LS3	1.5507 (0.6706)
	LS3 does not granger cause LGE	3.9084 (0.2715)
LS4	LNONTAX does not granger cause LS4	2.4726 (0.4803)
	LS4 does not granger cause LNONTAX	3.2005 (0.3617)
	LGE does not granger cause LS4	1.1108 (0.7745)
	LS4 does not granger cause LGE	1.8131 (0.6121)
LS5	LNONTAX does not granger cause LS5	1.5892 (0.6618)
	LS5 does not granger cause LNONTAX	4.5311 (0.2095)
	LGE does not granger cause LS5	4.3215 (0.2288)
	LS5 does not granger cause LGE	4.4252 (0.2191)

Note: LS1 is the logarithm of GDP of the agricultural-related sector, LS2 is the logarithm of GDP of the mining and quarrying sector, LS3 is the logarithm of GDP of the manufacturing sector, LS4 is the logarithm of GDP of the construction sector, LS5 is the logarithm of the GDP of the service sector, LGE is the logarithm of government total expenditure, LGREV is the logarithm of government total revenue, LDTAX is the logarithm of direct taxes, LINDTAX is the logarithm of indirect taxes and LNONTAX is the logarithm of non-tax revenue. The values in the table are the test statistic values of Wald test and the values in the parentheses are the respective p-values.

hypothesis of the test is that there is no Granger causality between two variables. For the sake of space conservation, only the results that are related to the variables of interest are reported here. Several points can be summarised. First, most of the Granger causality relationships between government revenue (government expenditure) and sectoral output are uni-directional. Two exceptions are: (i) between LGREV and the sectoral output from mining and quarrying, and (ii) LGE and output from service sector in the model with LINDTAX. Second, among different types of government spending, Granger causality from government revenue to sectoral output is more likely to be found, although the effects are found only in mining and quarrying sector and manufacturing sector. Third, the government expenditure Granger causes sectoral output in manufacturing sector and service sector in different models. Lastly, the test fails to establish any Granger causality relationship between the variables of interest from the VAR models that measure the non-tax revenue.

CONCLUSION

This paper determines the impulse response functions of sectoral output to total government expenditure and four types of government revenue (total amount, direct taxes, indirect taxes and non-tax revenue). To the best of my knowledge, this is the first attempt to examine the reactions of sectoral output to fiscal policy shock in Malaysia. Following the detection of cointegrating relationships among the differenced-stationary variables, the models are estimated by using level VAR. The structural shocks in the VAR are identified through the Cholesky decompositions. Generally, the impact from total government expenditure is detected in the manufacturing, construction and agricultural sectors. Most of these statistically significant reactions are positive, suggesting that government expenditure plays a role in pushing the economy forward. This is in accordance with the hypothesis that greater spending will increase the demand for output. Additionally, the relatively few statistically significant impacts from government expenditure compared to government revenue is largely in accordance with the Ricardian equivalent theory. One the other hand, the government revenue, indirect tax revenue and non-tax revenue are found to have positive impacts on some sectors, such as the agricultural, mining and quarrying, and service sectors. This implies that it is possible that a positive economy contributes to higher demand for output and government revenues. Furthermore, it could due to the expectation that higher government revenue will increase the demand on domestic outputs. The robustness of the results is largely supported by the GIRFs. The variance decomposition provides general evidence that government revenue is more influential in affecting the variations of sectoral GDP compared to government expenditure. The policy implication from this study is that the Malaysian government should focus more on government revenue in order to affect sectoral GDP through fiscal policy. Moreover, the mixtures of different reactions of sectoral output to government revenue and expenditure shocks imply that any changes in fiscal policy that could negatively affect each GDP sector should come with different remedial programs for respective sectors. Moreover, the positive impacts of government revenue on most of the sectoral outputs also suggest that increasing government expenditure is more useful compared to reducing government revenue (taxes) in order to relieve economy during recessions. Finally, the Toda-Yamamoto causality test results show that in some models there are Granger causality effect from government revenue and expenditure on sectoral output in mining and quarrying sector, manufacturing sector and service sector.

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NOTES

1 There is no consensus about the role of fiscal policy as an automatic stabiliser. Budina and Tuladhar (2010) argued that the evidence to support that role is more vivid in Malaysia and Thailand. Otherwise, Jha, Mallick, Park, and Quising (2014) disagreed about this and reported that fiscal policy is more discretionary in nature.

2 The information of the cash deficit as a percentage of GDP is available in the World Bank database and is a close proxy for government total budget.

3 The debt in the ratio is referred to as the total debt of the public sector.

4 To the best of my knowledge, previous studies focused on the reactions of two sectoral outputs only, which are tradable and non-tradable outputs.

5 Bouakez et al. (2014) discussed the issue of fiscal foresight where public expectations on a fiscal policy will cause difficulty in generating fiscal innovations. However, this issue is debatable because according to Rafiq (2013), previous studies also suggested that the analytic accuracy is low in terms of the forecast of the size of a fiscal policy. In addition, the performance of Cholesky decomposition in analysing fiscal shocks is intact even that these fiscal shocks are expected.

6 The study of Blanchard and Perotti (2002) has two assumptions where the fiscal variable is exogenous to an output shock and fiscal shocks can be identified from the information about tax and transfer system. They concluded that government spending is positive on output but otherwise for government tax income.

7 Except for the REER and 3-month Treasury bill rate, the other variables were tested by assuming that there is a trend component in the variable. The intuitive reason is that there is no trend movement in the former two variables.

8 B^{-1} is the inverse of the matrix of coefficients of contemporaneous endogenous variables, Γ_0 is the matrix of constant, Γ_1 is the matrix of the coefficients of lagged endogenous variables and ε_t is structural error term.

9 The PP results are not reported here to conserve space and is available upon request.

10 Generally, the Johansen test has the following format.

$$\Delta x_t = \pi x_{t-1} + \sum_{i=1}^{p} \pi_i x_{t-1} + \varepsilon_t$$

where π is a $(n \times 1)$ vector. In order to detect any cointegrating vector, the rank or characteristic roots of π is determined. The rule is there is no cointegrating vector (long-run relationship) if the rank is zero; and if the rank is one, then there is a cointegrating vector. Trace and max eigenvalue tests were applied for this purpose. See Enders (2010) for more detail discussion about these tests.

11 This paper does not examine the normality and heteroscedasticity of the model because according to Helmut (2011), both issues do not affect the VAR significantly. Table 4 shows that there is a weak evidence of second-order autocorrelation in [LINDTAX, LGE, S5, LCPI, IR, LREER]. This paper does not increase the lag further in order to avoid further loss of degree of freedom. Therefore, the interpretation of the VAR of that model needs extra care.

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