

Assessing the Impact of Thailand's Government Consumption and Tax Shocks with a Non-recursive SVAR Model

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Abstract

In this paper, we linearly quantify the impact of government consumption and tax shocks on key aggregate variables in Thailand. A simple small-open economy SVAR model is developed and estimated with a Thai dataset covering the periods between 2001Q1 and 2023Q1. Both types of fiscal shocks are identified using a non-recursive scheme with some structural coefficients separately estimated from external information. The resulting over-identified SVAR model suggests that fiscal shocks generate short-lived impact on aggregate output and some selected types of private spending. Under the baseline specification, government consumption and tax multipliers are roughly around 0.9 times and -0.7 times, respectively. The response of private consumption to fiscal shocks closely traces the dynamic response of output, whereas private investment is rather insensitive to fiscal shocks. Our key results remain roughly in line across detrending methods applied to the data, thus providing systematically linear evidence that broad-based fiscal multipliers are, at best, moderate in Thailand.

Keywords: fiscal policy, SVAR models, non-recursive identification, business cycles, fiscal multipliers.

1. Introduction

Recent years have seen a growing number of debates over the effectiveness of fiscal policy in Thailand. The discussion has been ongoing since the outbreak of the COVID-19 pandemic when several public programs were launched to stabilize the adverse effects of the global pandemic issue. The debates are expected to be further intensified as the government is believed to launch many more fiscal programs going forward. Despite their extensive implementations thus far, few have concluded whether those policies are economically worthwhile. Instead, much of the ongoing academic work in Thailand has primarily focused on the evaluation and assessment of monetary policy. This disproportionate treatment in Thai academic literature leaves several open questions. At a minimum, assessing the aggregate effects of fiscal programs can provide a clearer framework for key policy debates, assuming distributional considerations are set aside.

In this paper, we study the quantitative implications of government consumption spending and overall taxes on Thai aggregate economic activities. The choice of selection on such fiscal spending reflects our two important standpoints. Firstly, government consumption accounts for more than 70% of the current public spending in Thailand. Understanding its implications is hence naturally important as many public policy programs can be directly and largely implemented through this item. Secondly, there are fewer controversial issues in the quantitative evaluation of the aggregate effect of government consumption spending. Unlike government investment, there has been little evidence that government consumption can impact long-term potential growth. Therefore, the aggregate effect should be evidently interpreted as its cyclical implication.

Our method of study relies on an SVAR framework with the quantitative parametrization carefully implemented to avoid any issues that may distort the inference of the linear effect on fiscal policy. A simple baseline five-variable VAR model, comprising three domestic variables and two external variables, is developed to capture the dynamic properties of the Thai macroeconomy. With the aid of controlled external factors and event-specific dummy variables, the observed innovations obtained from our baseline VAR could be interpreted as a linear combination of domestic shocks, allowing us to uncover fiscal shocks with some imposed structural restrictions. This work builds upon the identification scheme proposed in the seminal work of Blanchard and Perotti (2002) with an external information approach used to parameterize the elasticity of tax to output. In particular, the parameter is not directly estimated by an SVAR but separately estimated from an ARDL-ECM model (e.g., Hill et al., 2022). This detailed working step under a non-recursive identification scheme allows us to obtain a less distorted estimate of the dynamic outcome resulting from fiscal interventions or identified shocks, given the class of parsimonious SVAR model developed. This is the issue that may have been inadvertently overlooked in other previous studies of Thailand despite its extensive discussions and results in the literature (e.g., Merten & Ravan, 2010; Caldara & Kemps, 2017).

Our findings indicate that expansionary fiscal shocks generate a short-lived boost in real output, with effects concentrated in the first four quarters following implementation before gradually vanishing. Although the initial response is sizable, the cumulative change in output remains modest relative to the scale of the fiscal interventions. As a result, the cumulative effect on output is limited, as reflected in the estimated fiscal multipliers. Using a cumulative integral-sum

approach, we estimate that the one-year output multipliers for government consumption and tax remain below one, with their medium-term (five-year) values stabilizing at approximately 0.9 and -0.7, respectively. Robustness checks indicate that the estimated multipliers exhibit some sensitivity to the choice of detrending method, highlighting the challenges in estimating fiscal multipliers in emerging market economies. While broadly consistent with cross-country evidence, tax multipliers display greater sensitivity to trend treatment than government consumption multipliers. Nonetheless, their estimates remain low compared to those observed in advanced economies and other emerging markets (e.g., Ramey, 2016; Dime et al., 2021), reinforcing the view that fiscal policy has limited effectiveness as a countercyclical tool in Thailand.

To assess the relatively modest size of fiscal multipliers, we extend our baseline model to separately incorporate private consumption and private investment channels, thereby isolating the transmission mechanisms of fiscal shocks. Under the simple extended model, our findings indicate that private consumption multipliers closely track output multipliers, while private investment multipliers are initially negative, converging to zero over the medium term. This suggests that fiscal shocks primarily propagate through the consumption channel, with a negative crowding-out effect on private investment that attenuates the overall impact of fiscal policy. These results are consistent with empirical evidence from advanced economies showing that government spending and fiscal interventions tend to crowd out private investment (Blanchard & Perotti, 2002; Mountford & Uhlig, 2009; Ramey, 2016). Moreover, our analysis implies that both government consumption and overall taxation generate countervailing pressures on private investment across Thailand's business cycles.

Our paper builds on and contributes to a growing body of research that examines the macroeconomic effects of fiscal policy, with particular emphasis on contextual evidence from Thailand. After the 2008 global financial crisis (GFC), we have seen ongoing debates on the effectiveness of fiscal policy, and voluminous studies have been produced with plenty of international evidence extensively documented (e.g., Ramey, 2011; Batini et al., 2014). In terms of the methodological framework, the approach to quantitative fiscal study can be divided into three main strands. The first is to estimate the fiscal multiplier using a time series method, such as SVAR, or a structural factor-augmented VAR technique. Our paper falls along the line of this strand of literature and considers Blanchard and Perotti (2002) as our starting motivation, as well as many others as extensions (e.g., Yang, 2005; Mountford & Uhlig, 2009; Merten & Ravan, 2010; Caldara & Kemps, 2017). The second is to estimate the fiscal multiplier using local projections. The approach circumvents the main problem of the basic SVAR approach, where an anticipated fiscal program might be expected in advance, making it less credible to recover the structural shocks from the innovation representation (e.g., Lippi & Reichlin, 1994; Leeper et al., 2013). Oscar Jorda (2005) began the research area in this respect, and many others have followed this tradition in the context of policy studies. Dime et al. (2021) is a related example along this line, with their focus on the context of selected Asian countries. The last approach is to investigate the impact of fiscal policies in full-blown DSGE models (e.g., Zubairy, 2014; Kormilitsina & Zubairy, 2018; Sims & Wolf, 2018; Bouakez et al., 2023).

In terms of the main quantitative implications, our results are in line with Dime et al. (2021), where estimates of the fiscal multipliers of some selected Asian

countries are quite small. For a specific analysis of Thailand, debates over its effectiveness have been drawn from previous studies that either relied on a single-equation approach or SVAR models with structural shocks identified by ordering techniques guided by Granger Causality and Cholesky decomposition (Sawangsilp, 2008). While being a good starting point for subsequent work, both approaches are argued to have their own drawbacks. The former has a lack of treatment for endogeneity relationships, causing biased inferences on the effect of fiscal shocks. Meanwhile, the latter partially overcomes the endogeneity issues but renders the main difficulties in recovering the proper or credible fiscal impulses, as discussed above.

The remainder of this paper is organized as follows. In the next section, we discuss the empirical framework, describe the structure of our SVAR model, and present technical considerations about the shock-identification procedure. In Section 3, we discuss the nature of fiscal data in Thailand, consider their statistical properties, focus on the specification of the model, and present all key quantitative results obtained from our baseline study. The main highlight is the simulated impulse response functions and the estimated fiscal multipliers, both from government consumption and taxes. In Section 4, we present additional evidence of the fiscal impact on private consumption and private investment, as well as show the robustness of our main result. In the final section, we conclude our work, discuss some limitations, and envision future research agendas that could be further explored.

2. An Empirical Model of Fiscal Policy: Identified Fiscal Shocks

This section outlines a brief discussion on the identification of fiscal shocks using time series methods developed by Blanchard and Perotti (2002) and explains how to properly apply the technique in the context of Thailand. To systematically analyze this issue, we begin by considering a general specification of the SVAR model given by:

$$A_0 y_t = \sum_{i=1}^{p_y} A_i y_{t-i} + \sum_{i=0}^{p_z} B_i z_{t-i} + D u_t \quad (1)$$

where y_t represents a vector of n -endogenous variables, z_t represents a vector of m -exogenous variables, and u_t represents a vector of *i.i.d.* structural shocks. $\{A_i\}_{i=1}^{p_y}$, $\{B_i\}_{i=0}^{p_z}$ and D represent the structural coefficient matrix that governs the structural relationships in our structural VAR model.

To understand the interaction between fiscal factors and key domestic variables, we define $y_t = (G_t^c, T_t, GDP_t)'$. This vector of economic variables includes G_t^c (real government consumption), T_t (total tax revenue), and GDP_t (real GDP). It is natural to assume that a small open economy is subjected to foreign vulnerabilities. To incorporate some other independent sources of domestic fluctuations, we define z_t as event-based variables or external variables that are considered exogenous variables to the domestic economy. The general assumption given by equation (1) is a parsimonious version of an open-economy VAR model that could be used to analyze the implications of Thailand's fiscal policy.

To empirically parameterize equation (1), one usually rewrites the SVAR model in terms of its equivalent reduced-form version. The specification can be expressed as follows:

$$y_t = \sum_{i=1}^{p_y} A_i^* y_{t-i} + \sum_{i=0}^{p_z} B_i^* z_{t-i} + e_t \quad (2)$$

where $A_i^* = A_0^{-1}A_i$, $B_i^* = A_0^{-1}B_i$, and $e_t = A_0^{-1}Du_t$ is the VAR innovations.

The reduced form VAR given by equation (2) can be efficiently estimated by OLS and MLE. Given the efficient estimation techniques applied to equation (2), the reduced-form innovations e_t can be derived and is hence usable to recover the underlying structural shocks (u_t). This can be accomplished under certain identification assumptions. One procedure commonly used by many VAR studies is to assume the recursiveness among contemporaneous relationships of current-period aggregate variables and to obtain the structural shocks by the Cholesky decomposition. However, for fiscal policy analysis, the choice of such a restriction becomes inappropriate. An alternative to the common recursive identification approach is to adopt the non-recursive structural restrictions instead. In Blanchard and Perotti's (2002) notable contribution, they argued for the role of institutional features as a source to identify exogenous government spending and tax shocks. Considering the realistic features of institutional aspects, it is commonly believed that government spending typically responds to economic development with lag adjustment; meanwhile, the variations in tax revenue are contemporaneously tied to the fluctuation in real economic activities through the notion of an automatic stabilizer of fiscal and tax rules. Given these imposed institutional features, the identifying restrictions can be mathematically represented by:

$$Ae_t = Du_t \quad 3)$$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & A_{GDP}^T \\ A_{Gc}^{GDP} & A_T^{GDP} & 1 \end{bmatrix} \begin{bmatrix} e_t^{Gc} \\ e_t^T \\ e_t^{GDP} \end{bmatrix} = \begin{bmatrix} D_{Gc}^{Gc} & 0 & 0 \\ 0 & D_T^T & 0 \\ 0 & 0 & D_{GDP}^{GDP} \end{bmatrix} \begin{bmatrix} u_t^{Gc} \\ u_t^T \\ u_t^{GDP} \end{bmatrix}$$

where A_j^i captures the contemporaneous response of the i -th variable to the j -th variable, and D_j^i is the direct impact of the i -th structural shock on its corresponding innovation terms.

Because of the natural assumption on both the decision and implementation lag of fiscal spending, the representation above indicates that innovation in government consumption (e_t^{Gc}) is driven by the structural shocks of government consumption (u_t^{Gc}). Meanwhile, along with the assumption on the automatic stabilizer of tax rule, A_{GDP}^T captures the feedback interaction of innovation of tax revenue (e_t^T) to the innovation in real economic activities, i.e., real GDP (e_t^{GDP}). The expected sign of the coefficient is negative. Lastly, innovations in both government consumption (e_t^{Gc}) and tax (e_t^T) should directly affect the innovation in the real GDP (e_t^{GDP}). The expected signs of each coefficient are negative and positive, respectively.

One difficulty is to casually parameterize equation (3) under the possible confounding relationship between aggregate activities and the fiscal rules. As Blanchard and Perotti (2002) argued, parametrization of equation (3) requires some external information so that one can avoid the famous endogeneity problem, which could distort the inference on the fiscal shocks and, hence, their dynamic implications. The authors proposed an estimation of the elasticity of aggregate tax to output from the weighted average of the elasticity of disaggregated tax revenue to output. However, without as high-quality data structure as Blanchard and Perotti had, their recommended approach is then not feasible in many contexts, including ours. Many previous studies chose to pin down the coefficient with the implied estimate of the VAR system, i.e., direct inference. In most cases, the implied elasticity of tax to output was found to be surprisingly high. As in Caldara and

Kemps (2017), this problem explains the skeptical views that many studies have found with the incredibly large size of the tax multiplier on output (e.g., Batini et al., 2014; Ramey, 2016).

To carefully implement Blanchard and Perotti's method in our work, we use the second-best approach. We parameterize the elasticity of tax to output with the aggregate estimate separately obtained from an ARDL-ECM model. As suggested by Hill et al. (2022), the ARDL-ECM estimation method theoretically produces robust estimates and has been empirically found to have produced plausible ranges of tax elasticity that are less controversial to practitioners. With this strong prior information, our empirical strategy ought to produce an SVAR that becomes an over-identified system with less trouble.

3. Estimation Results

3.1 Data and Measurement

In our baseline study, we use the data set between 2001Q1 and 2023Q1. The choice of this sample period of study is rationalized for at least two reasons. First, the selected period sufficiently covers at least three to four complete phases of Thai business cycles. Second, since 2001Q1, Thailand has adopted an explicit inflation-targeting policy with a flexible exchange rate. Therefore, the selected observation period should represent the current regime of the Thai economy. Table 1 shows the complete list of aggregate variables used in the study, as well as the summary of the order of integration of each log-level series and their mnemonic.

Table 1. Data source, mnemonic, and summary of statistical properties

Data	Source and Construction methods	Order of integration*	Mnemonic	Transformation
Real GDP or Real Output	CEIC; originally collected by NESDB; seasonally adjusted by the organization.	I(1)	RGDP	Log-difference
Real Government consumption	CEIC; originally collected by NESDB; seasonally adjusted by the organization.	I(1)	RGC	Log-difference
Real Tax revenue	CEIC; Original series are compiled in nominal terms. There was a break in the measurement of government transfer data. As a result, we use the nominal gross rate as the proxy for tax revenue. We transform the data into real terms by dividing the nominal tax revenue by the GDP deflator. The obtained series are then adjusted seasonally by the X11 method.	I(1)	RGREV_SA	Log-difference
Trade-weighted GDP	Thailand's trade-weighted average log of real GDP. Data is taken from Mohaddes and Rasissi (2024).	I(1)	world_rgdg	Log-difference
Oil price	CEIC; averaged daily series in the respective quarter.	I(1)	poil_dubai	Log-difference
Real Private consumption	CEIC; originally collected by NESDB; seasonally adjusted by the organization.	I(1)	RPC	Log-difference
Real Private investment	CEIC; seasonally adjusted; originally collected by NESDB; seasonally adjusted by the organization.	I(1)	RPINV	Log-difference

Note: * We used an ADF statistic to assess each individual series' unit root property, assuming a constant and a linear trend model specification. The results in the table are based on the 5% threshold of significance.

We briefly summarize the salient features of the data used in our study. First, all series have exhibited positive trend growth. As plotted in Figure 1 and summarized in Table 2 below, the average historical growth of each series has been in line between 3% and 5%. In terms of their statistical properties, we tested for the presence of a unit root in each individual series and found that all have a unit root. Secondly, in terms of their cyclical fluctuations, one notes that both private investment and tax revenue are highly volatile. Their standard deviations are two times higher than those of the real GDP. In terms of the co-movement properties, each aggregate series is procyclical to real GDP, with a positive

correlation between real GDP growth and other aggregate indicators. However, the evidence for the procyclical behavior of government consumption is not strong. The correlation is low and statistically insignificant. Thirdly, from a long-term point of view, each series is highly likely to be cointegrated. We note that the share of each aggregate variable in real GDP has been constant over time. Considering the period between 2001 and 2023, the average share of government consumption to real GDP, as well as that of tax revenue to real GDP, are around 14.5% and 18.6%, respectively. The long-term share of private consumption and private investment in real GDP has been around 53.6% and 18.3%, respectively. While the shares have fluctuated within a small range, we note the possibility of a structural break after 2008. There is slight evidence that there has been a shift in the share of government consumption to real GDP since the 2008 GFC. The average figure marginally rose from 13.1% before the GFC to 15.4% after the GFC.

Figure 1. Historical growth of key aggregate variables



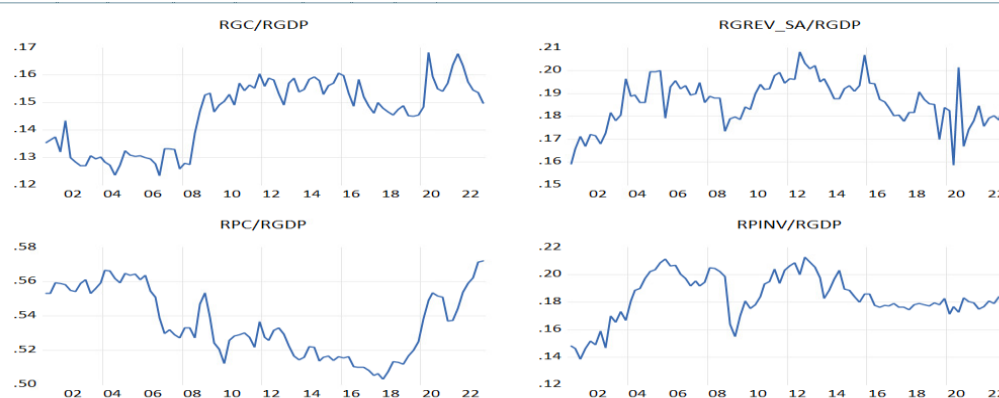
Note: (i) $D(x)$ is the first-difference of x . $DLOG(x)$ is the log-difference of $\log(x)$. The mnemonic of each variable follows the summary in Table 1. (ii) The figures plot the annualized growth.

Table 2. Summary of business cycles properties

Data	Average Annualized Growth (%)	S.D.	Cor(dlog(x), dlog(real GDP))	P-value
Real GDP or Real Output	3.22	0.020	-	-
Real Government consumption	3.62	0.029	0.120	0.258
Real Tax revenue	3.63	0.059	0.604	0.000*
Real Private consumption	3.36	0.017	0.831	0.000*
Real Private investment	4.21	0.049	0.493	0.000*
Trade-weighted real GDP	3.71	0.012	0.694	0.000*
Oil price	4.78	0.012	0.406	0.000*

Note: (i) Pairwise correlation statistic is calculated from the correlation between change in log-level of each aggregate series and change in log-level of real GDP. (ii) *, **, and *** refer to the significance level of 1%, 5%, and 10%, respectively.

Figure 2. Share of fiscal variables and GDP component to Real GDP and Average share



Variables	Measurement concept	2001–2008 (%)	2009–2023 (%)	2001–2023 (%)
RGC/RGDP	Government consumption to real GDP ratio	13.10	15.41	14.58
RGEV_SA/RGDP	Tax revenue to real GDP ratio	18.39	18.73	18.60
RPC/RGDP	Private consumption to real GDP ratio	55.17	52.73	53.61
RPIV/RGDP	Private investment to real GDP ratio	18.25	18.45	18.38

3.2 VAR Estimates and Structural Coefficients

In our baseline specifications, we use the dataset between 2001Q1 and 2023Q1 and estimate the reduced-form VAR model. As each individual series has a unit root, we then consider two specifications: the log-level estimation guided by the long-run relationship and the log-difference of log-level specification. The former model includes a simple linear time trend in each equation, while the latter model includes only constant terms. We treat trade-weighted real GDP and oil price as exogenous variables and incorporate three event-specific dummy variables into both specifications, i.e., DUM_GFC, DUM_FLOOD, and DUM_COVID. Table 3 summarizes the list of dummy variables.

Table 3. List of dummy variables

Dummy variables	Explanations	Periods
DUM_GFC	Periods under US subprime and GFC in 2007 and 2008	2007Q4–2009Q1
DUM_FLOOD	Periods under flooding situation in Thailand	2011Q3–2012Q2
DUM_COVID	Periods under lockdown and travel restrictions during the COVID-19 pandemic in Thailand	2020Q2–2021Q4

The optimal lag specification is determined using various criteria. The predicted choice of lag length varies between one lag and three lags, depending on the choice of inferential statistic. However, in the reporting analysis, we balance the choice of lag specification as suggested by the inferential statistic with the judgments over the limited sample size observation. We choose to estimate the model with two lag periods to sufficiently induce and capture the dynamic interaction among aggregate variables; the results are not significantly sensitive to the choice of lag selection.

Given the estimated reduce-form VAR, we then identify the fiscal shocks along the line of Blanchard and Perotti; one imposes restrictions on the contemporaneous coefficient matrix as indicated in Section 2 above. In our work, as motivated by Caldara and Kemps (2017), the cyclical fluctuation of tax revenue to output is imposed using external information where the elasticity of tax to output is estimated by the ARDL-ECM model (e.g., Hill et al., 2022). To do this, we first performed a bound test to check if the cointegrating relationship exists under the possible mixture of data with $I(0)$ and $I(1)$. In the baseline sample periods, the F-statistic for the bound test is 3.68, while the size-dependent 10% significance threshold for the existence of the cointegrating relationship is 3.61. Given this, the ARDL-ECM model can be appropriately applied to the data. As shown in Table 4, the estimated coefficient of the contemporaneous relationship between tax and output obtained from the ARDL-ECM model is around 1.57.

Table 4. Estimates of Elasticity of tax to output

Periods	2001Q1–2023Q1	1993Q1–2023Q1	1993Q1–2000Q4
Elasticity of tax to output (S.E)	1.57 * (0.170)	1.55 * (0.169)	0.83*** (0.48)

Note: The specification of our ARDL-ECM is given by $\Delta \log(T_t) = \alpha \cdot ECM_t + \sum_{k=0}^{k_{max}=4} \beta_k \cdot \Delta \log(GDP_{t-k}) + \epsilon_t$, with T_t and GDP_t defined as real tax revenue and real GDP. ECM_t represents the error correction component. Following Blanchard and Perotti (2002), our work chooses the contemporaneous coefficient to represent the estimate of elasticity of tax to output (β_0). For the sample period 1993Q1–2000Q4, the specification does not admit the ARDL-ECM model. The model is estimated with OLS, where we include a four-period lagged variable of change in the log of real GDP in the equation. *, **, and *** denote the significance level of 1%, 5%, and 10%, respectively.

Given the calibrated elasticity of tax-to-output, Table 5 reports the estimates of our non-recursive SVAR model. We note first that the over-identifying restriction holds; from the reporting Chi-square statistic, our data cannot reject the null hypothesis in both models. Secondly, the structural coefficients have signs consistent with the expected direction but with a statistically insignificant value of

A_{Gc}^{GDP} under the log-level specification. A guided interpretation of the coefficients reported in the table is that innovation in government consumption positively impacts innovation in output. Meanwhile, innovation in tax negatively affects innovation in output.

Table 5. Estimates of Structural coefficients under baseline specifications

Coefficients	Log-Level specification		Log-difference Specification	
	Value	Standard Error	Value	Standard Error
A_{GDP}^T	-1.57	0.170	-1.57	0.170
A_{Gc}^{GDP}	-0.03	0.024	-0.123**	0.058
A_T^{GDP}	0.1***	0.055	0.101**	0.057
D_{Gc}^{Gc}	0.065*	0.004	0.030*	0.002
D_T^T	0.033*	0.002	0.032*	0.002
D_{GDP}^{GDP}	0.015*	0.001	0.016*	0.001
Chi-square (1)	0.023 (<i>P-value: 0.6314</i>)		3.45×10^{-7} (<i>P-Value = 0.9995</i>)	

Note: (i) Each coefficient reported in the table refers to the structural coefficient matrix given by $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & A_{GDP}^T \\ A_{Gc}^{GDP} & A_T^{GDP} & 1 \end{bmatrix} \begin{bmatrix} e_t^{Gc} \\ e_t^T \\ e_t^{GDP} \end{bmatrix} = \begin{bmatrix} D_{Gc}^{Gc} & 0 & 0 \\ 0 & D_T^T & 0 \\ 0 & 0 & D_{GDP}^{GDP} \end{bmatrix} \begin{bmatrix} u_t^{Gc} \\ u_t^T \\ u_t^{GDP} \end{bmatrix}$, where all diagonal elements are normalized to one.

(ii) *, **, *** are referred to the significance level of 1%, 5%, and 10%, respectively.

(iii) The coefficient A_{GDP}^T is estimated using external information. The reporting values are taken from Table 4.

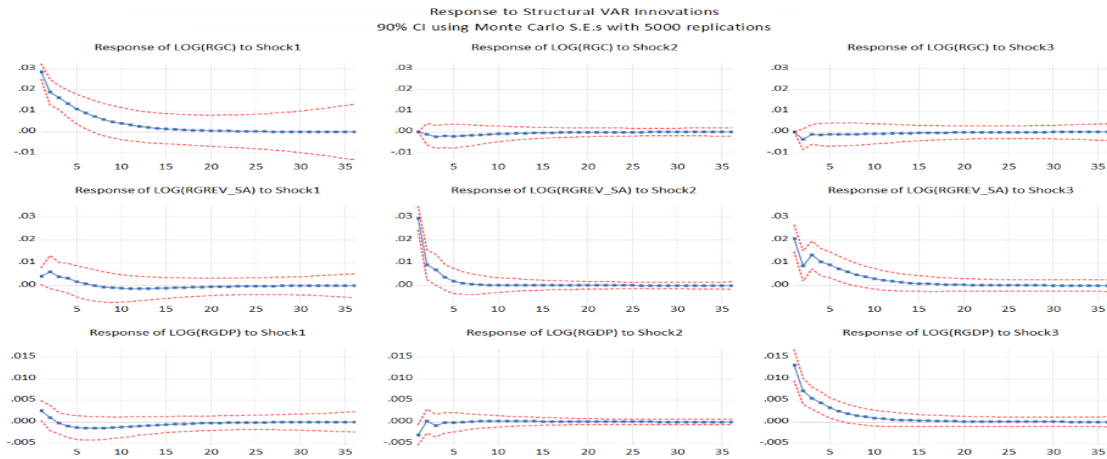
3.3 Dynamic Responses Under Identified Shocks

Following the estimated structural models presented in Section 3.2, we simulate the dynamic impulse response functions using the Monte Carlo technique. Figures 3 and 4 below show the dynamic response of key aggregate variables to the identified shocks, namely government consumption shocks, tax shocks, and business cycle shocks.

The impact of government consumption shocks and tax shocks varies according to model specifications ($\log(x)$), as well as the impact horizon periods. Under the log-level specification, government consumption shocks generate a positive impact on output during the first couple of quarters. The effect slowly disappears and becomes negative. Given the shaded area around the mean impulse response function representing the confidence interval, we argue that the impact is statistically insignificant. For tax shocks, the impact is to generate a recession. The decline in economic activities has been consistent throughout all horizon periods. Lastly, we note the evidence of strong business cycle shocks. Its impact is found to be statistically significant at 90%, generating a strongly procyclical response in tax revenue and a weakly countercyclical response to government consumption.

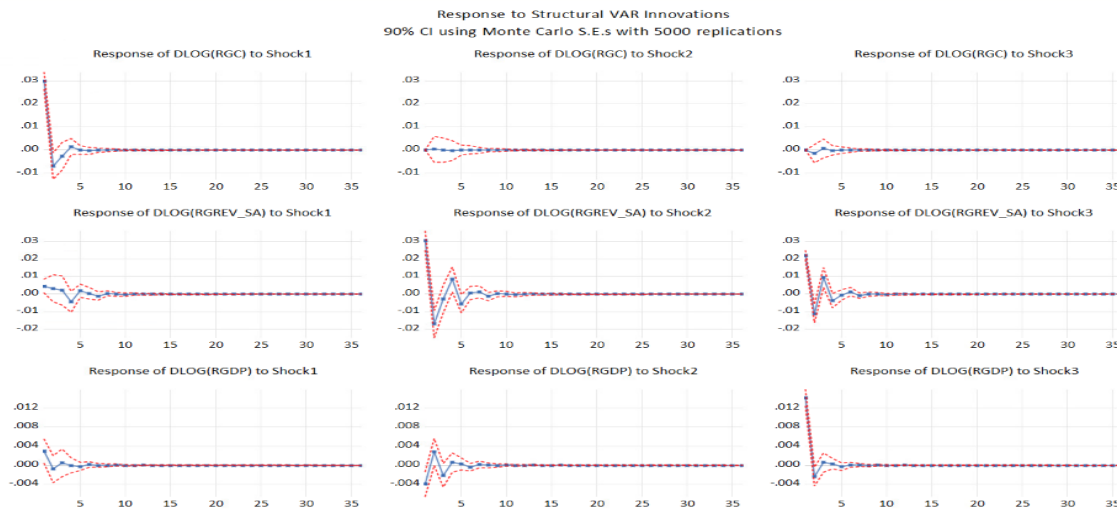
Under the log-difference specification ($\Delta\log(x)$ or $d\log(x)$), government consumption shocks positively produce a strong impact on output growth during the first two quarters. The effect then oscillates negatively and positively at the moderate level and is statistically insignificant; one can observe that certain parts of the shaded 90% confidence interval of the impulse response lie below the zero line. A similar result can be found in the case of tax shocks. That is, tax shocks negatively generate a strong impact on output growth during the very short-term period. Then, in all subsequent periods, the effect becomes weaker and statistically insignificant. In line with the findings under the log-level specification, government consumption is rather insensitive to changes in the business cycle conditions; the impulse response function is close to zero and statistically insignificant under the log-difference specification.

Figure 3. Responses of aggregate variables to identified shocks under the log-level specification



Note: Shock 1: government consumption shocks; Shock 2: tax shocks; Shock 3: output shocks. For the first row of the figure, each curve represents the dynamic response of the log of government consumption to each of the three identified shocks. For the second row, the curve represents the dynamic response of the log of tax revenue to each of the three identified shocks. The curve shown in the last row represents the dynamic response of the log of real GDP to each of the three identified shocks. The dashed lines for each impulse response provide the confidence interval band of 90% obtained from 5,000 repetitive Monte Carlo simulations.

Figure 4. Responses of aggregate variables to identified shocks under the log-difference of log-level specification

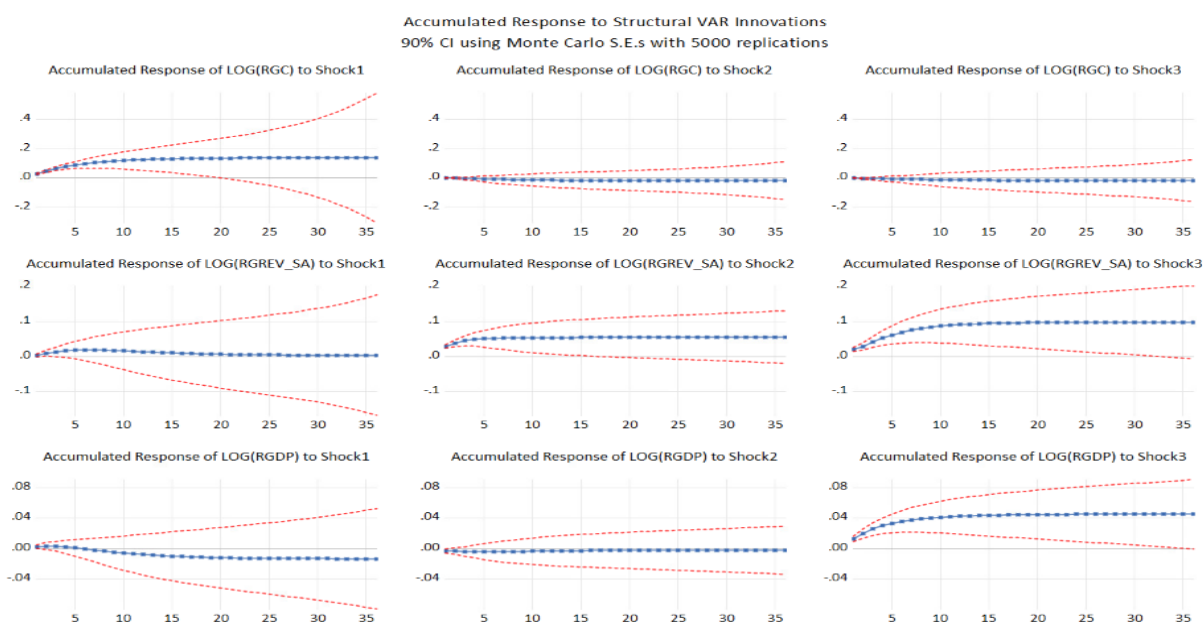


Note: Shock 1: government consumption shocks; Shock 2: tax shocks; Shock 3: output shocks. For the first row of the figure, each curve represents the dynamic response of the log of government consumption to each of the three identified shocks. For the second row, the curve represents the dynamic response of the log of tax revenue to each of the three identified shocks. The curve shown in the last row represents the dynamic response of the log of real GDP to each of the three identified shocks. The dashed lines for each impulse response provide the confidence interval band of 90% obtained from 5,000 repetitive Monte Carlo simulations.

3.4 Accumulative Effects of Fiscal Instrument Shocks

As illustrated in the previous subsection, fiscal shocks generate a persistent impact on aggregate output. To properly gauge the overall impact of each identified fiscal shock, it might be more meaningful to consider the accumulative result. Figures 5 and 6 show the dynamic path of the cumulative effect of each aggregate variable on the identified shocks. The path is constructed from Monte Carlo simulations, with dash lines covering the 90% confidence interval bands.

Figure 5. Cumulative Responses of aggregate variables to identified shocks under the log-level specification

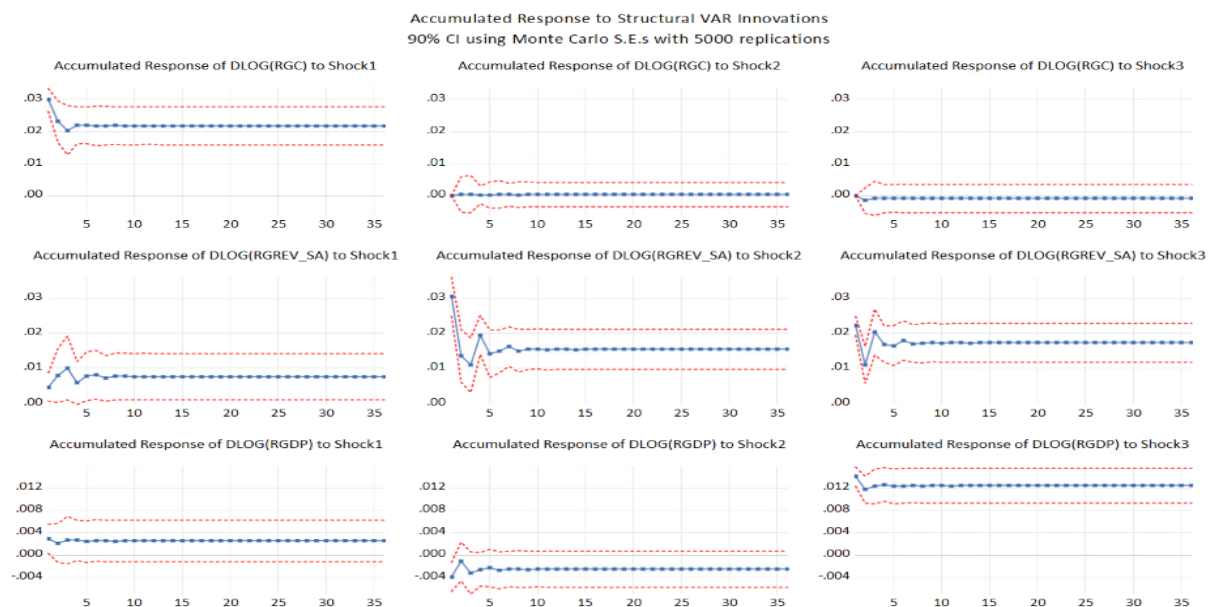


Note: Shock 1: government consumption shocks; Shock 2: tax shocks; Shock 3: output shocks. For the first row of the figure, each curve represents the dynamic response of the log of government consumption to each of the three identified shocks. For the second row, the curve represents the dynamic response of the log of tax revenue to each of the three identified shocks. The curve shown in the last row represents the dynamic response of the log of real GDP to each of the three identified shocks. The dashed lines for each impulse response provide the confidence interval band of 90% obtained from 5,000 repetitive Monte Carlo simulations.

For the log-level specification, we found the accumulative effect of fiscal shocks on output insignificant. While the figure shows the negative cumulative effect of government consumption shocks on aggregate output, one cannot reject

the hypothesis that the figure is not equal to zero. Against this backdrop, we argue that the impact of government consumption shocks is, at best, zero under the log-level specification. When applying the analysis to the tax shocks, we found similar results where the cumulative effect of tax shocks was insignificant as well. Contrary to the results under the log-difference specification, aggregate output is positively impacted by government consumption shocks but negatively responds to tax shocks. The reporting cumulative effect, as shown in the figure, is significant at the 10% level over the very short horizon and becomes nearly significant as the horizon periods get longer.

Figure 6. Cumulative Responses of aggregate variables to identified shocks under the log-difference of log-level specification



Note: Shock 1: government consumption shocks; Shock 2: tax shocks; Shock 3: output shocks. For the first row of the figure, each curve represents the dynamic response of the log of government consumption to each of the three identified shocks. For the second row, the curve represents the dynamic response of the log of tax revenue to each of the three identified shocks. The curve shown in the last row represents the dynamic response of the log of real GDP to each of the three identified shocks. The dashed lines for each impulse response provide the confidence interval band of 90% obtained from 5,000 repetitive Monte Carlo simulations.

3.5 Fiscal Multipliers

Supplementary to the accumulative dynamic response, a commonly used indicator that helps quantify the magnitude of fiscal impact is the *fiscal multiplier*. As argued by Mountford and Uhlig (2009), the impact of fiscal shocks on aggregate variables, both fiscal and non-fiscal, is typically persistent. Therefore, the fiscal multipliers should vary with the time horizon. Following the practice in ongoing literature, we define the *k-period ahead fiscal multiplier* as the ratio between the discounted sum of k-period ahead change in real GDP and the discounted sum of k-period ahead change in the fiscal instrument, both of which are attributed to each corresponding fiscal shock. This integral sum-based multiplier is argued to provide a better description of the fiscal impact than other proposed indicators do. Given the annualized real interest rate (r), the mathematical formula for the fiscal multiplier at each given impact horizon period can be given by:

$$M_{rgc}^{RGDP}(k) = \frac{\sum_{t=1}^k \frac{\Delta RGDP_t}{(1+r)^{t-1}}}{\sum_{t=1}^k \frac{\Delta RGC_t}{(1+r)^{t-1}}} \quad (4)$$

where change in real GDP ($\Delta RGDP_k$) and change in real government consumption (ΔRGC_t) are attributed to the identified government consumption shocks, and

$$M_{tax}^{RGDP}(k) = \frac{\sum_{t=1}^k \frac{\Delta RGDP_t}{(1+r)^{t-1}}}{\sum_{t=1}^k \frac{\Delta RGREV.SA_t}{(1+r)^{t-1}}} \quad (5)$$

where change in real GDP ($\Delta RGDP_t$) and change in real government tax revenue ($\Delta RGREV_SA_t$) are attributed to the identified tax shocks.¹

Table 6 reports the output multiplier of government consumption and tax shocks at each given period of impact horizons. Under the log-level specification, the output multiplier of government consumption has been positive but less than one during the first four quarters (first year). The estimated figures then become negative at the end of the second year and eventually converge to the medium-run multiplier at -0.121. As can be observed from Figure 5, the cumulative impacts are not statistically significant at 90%. For the tax shocks, the instantaneous output multiplier is -0.545, suggesting a contractionary effect on output after a surprise increase in real tax. The estimated figures have remained negative for all impact horizons, with the medium-run output multiplier of tax around -0.557.

Having turned into the log-difference specification, the output multiplier of government consumption was 0.736 in the initial period. The figure quickly reaches its peak at 1.021 in the third quarter and gradually falls in all subsequent periods. The medium-run output multiplier of government consumption is 0.893. For the effect of identified tax shocks, the output multiplier is -0.545; the figure is the same as that estimated under the log-level specification. In line with the output multiplier of government consumption, the estimated figure of the tax multiplier peaks in the third quarter and gradually falls in all subsequent periods to reach its medium-run value of -0.656.

Given the reporting values explained above, we note two important observations here. First, while the figure of the output multiplier slightly differs

¹ Appendix 1 provides a detailed method to convert the simulated impulse response function of log-level and change in log-level measurement into the cumulative multiplier of level variables.

across alternative specifications, one should view these reporting statistics as evidence against the effectiveness of fiscal actions. In all cases, the multipliers are less than one or, at best, as moderately small as one might argue instead. Second, the effect of fiscal shocks is highly concentrated in the first year. Indeed, from the reporting figures, we found that the first-year fiscal multiplier explains 80% to 90% of the overall medium-run value of the fiscal multiplier; this suggests the short-lived impact of fiscal action as a countercyclical policy.

Table 6. Output multipliers under the baseline sample period (2001Q1 until 2023Q1)

Model Specification	Impact horizon (Quarters)	1	2	3	4	8	12	16	20
Level Estimation	Gc	0.226	0.074	0.042	0.010	-0.069	-0.104	-0.116	-0.120
	Tax	-0.543	-0.363	-0.367	-0.371	-0.446	-0.511	-0.542	-0.554
Log-difference	Gc	0.736	0.759	1.021	0.881	0.890	0.894	0.893	0.893
	Tax	-0.545	-0.411	-1.057	-0.555	-0.653	-0.657	-0.656	-0.656

Note: The figures show the cumulative impact of an increase in one unit of real government consumption and one unit of tax shocks on real GDP. To convert the change in log-scaled variable into the change in level of each aggregate variable, we multiply the estimated log-scaled change with the reciprocal of the average of fiscal-variable to GDP ratio. Then, we discount the future change of each variable with a 3% interest rate to obtain the output multiplier; calculated figures are not sensitive to the assumption of the discount rate.

4. Some Extensions and Robustness Study

4.1 Impact of Fiscal Instruments on Real Private Consumption and Real Private Investment

A natural question arises: Is the impact of fiscal shocks on each disaggregate component of real GDP large or small? To answer this question, we extend the baseline model and incorporate real private consumption and real private investment into the SVAR. To work with this simple thought experiment in a

manageable fashion, each disaggregate variable is added to the original specification one at a time. Then, our imposed identification is built upon the Keynesian-cross theorem in that there exists the contemporaneous looping interaction between private spending and aggregate output.² With the simple extended model, Table 7 reports the estimated figures for private consumption and private investment multipliers.

Table 7. Real private consumption multiplier and real private investment multiplier

Multiplier for	Impact horizon (Quarter)	1	2	3	4	8	12	16	20
Private consumption	Gc	0.247	0.517	0.697	0.668	0.681	0.678	0.678	0.678
	Tax	-0.536	-0.626	-1.342	-0.523	-0.747	-0.744	-0.741	-0.741
Private Investment	Gc	0.264	-0.034	-0.001	0.165	0.110	0.104	0.105	0.105
	Tax	-0.344	-0.062	0.498	-0.125	-0.002	0.002	0.001	0.001

Note: Figures are estimated under the sample observation between 2001Q1 and 2023Q1. We only report the main result under the log-difference specification.

As one may see, the dynamic impact of fiscal shocks on private consumption closely traces the effect as found in the output multiplier. The impact of both government consumption shocks and tax shocks on private consumption reaches its peak effect within three quarters. Then, the consumption multipliers slowly decline and eventually converge to 0.678 and -0.741 on the medium-term horizon (20 quarters), respectively. Both figures are in line with those of the output multipliers. On the other hand, government consumption and tax shocks weakly impact private investment. The accumulated dynamic response is nearly indistinguishable from zero. This is consistent with the private investment

² In our simulation study, we also tried two alternative specifications, one in which the direct impact is introduced without the Keynesian-cross channel incorporated and the other when both are jointly introduced. In all three cases, we obtain comparable simulation results. The magnitude of private investment response is very small, while that of the private consumption response is comparable to that of real GDP.

multipliers. According to the calculation, the multipliers at the initial periods are smaller than those of the consumption multipliers. As time passes by, the multiplier declines slowly and converges to 0.105 and 0.001 at the medium-term horizon (20 quarters). The figures are not statistically significant at 90%. These findings suggest that government consumption and tax shocks primarily influence aggregate fluctuations by affecting private consumption. At the same time, the evidence indicates a strong crowding-out effect on private investment, which dampens the overall impact of fiscal shocks on the macroeconomy.³

4.2 Effect of Shocks Under Alternative Detrending Methods

As mentioned in Section 2, original data are classified as I(1) processes. Therefore, the empirical model can be specified in terms of level-based or detrended structure. To the latter, an appropriate method to handle trending components should be carefully considered as the statistical inference could be partially distorted or sensitive by the selected method. As a first passage to investigate this issue, we perform the robustness test to check if the results are highly sensitive to the choice of detrending method. That is, we estimate two alternative SVAR models. One is to construct the cyclical component from the HP filter, while the other is to derive the cyclical fluctuations from linearly detrended data with multiple breakpoints (e.g., Bai & Perron, 1998). The former is a non-linear filter that is commonly used in business cycle literature. However, the famous end-point problem issues could seriously affect the statistical inference of

³ These findings align with empirical evidence from advanced economies, where overall government spending has been shown to significantly crowd out private investment (e.g., Blanchard & Perotti, 2002; Mountford & Uhlig, 2009; Ramey, 2016). The crowding-out effect is particularly pronounced for government investment (e.g., Boehm, 2020). Our results provide stronger evidence that both government consumption and *overall* taxation exert a counteracting influence on private investment throughout business cycles.

the study (e.g., Hamilton, 2018). Meanwhile, the latter is to approximate the inherited non-linear effect of the changing potential growth with multiple piecewise linear-trend equations. Our choice of the latter detrending method is to admit the drawback of the HP filter while at the same time recognizing the limitation over the size of sample estimates that prevents us from selecting a more efficient technique (e.g., Muller & Watson, 2017).

Table 8 summarizes the key figures of the estimated fiscal multipliers under alternative detrending methods. In terms of the directional relationship, the results show that fiscal multipliers behave differently across two alternative detrending methods. Government consumption shocks generate a positive impact on output, while tax shocks generate a contractionary effect. The magnitude of the government consumption multiplier remains small under both alternative specifications, comparable to the figures obtained from the log-difference specification. On the other hand, the impact of tax shocks identified under a linear trend with multiple breakpoints is higher than that estimated from the other two models. While the size of the tax multiplier is greater than one, the magnitude of the medium-run effect remains moderate, around -1.45. Compared to the plausible ranges of tax multipliers found in other studies (e.g., Batini et al., 2014; Ramey, 2016), the figure is yet argued to be moderately low.⁴

⁴ To the best of our knowledge, no systematic study has comprehensively examined how detrending methods affect the estimation of fiscal multipliers. What we report in this section presents preliminary evidence on the sensitivity of fiscal multipliers to different data treatment approaches, offering a range of estimates under a point-identification framework. A rigorous evaluation of the potential bias induced by the choice of detrending method could warrant a separate study and is, therefore, beyond the scope of this paper.

Table 8. Output multipliers under two alternative specifications for detrending methods

Detrending methods	Impact horizon (Quarter)	1	2	3	4	8	12	16	20
HP Filter	Gc	0.636	0.505	0.335	0.234	0.180	0.174	0.174	0.174
	Tax	-0.525	-0.388	-0.458	-0.484	-0.542	-0.548	-0.548	-0.548
Linear Trend with multiple breakpoints	Gc	0.696	0.710	0.431	0.262	0.295	0.294	0.294	0.294
	Tax	-1.468	-1.839	-1.532	-1.452	-1.451	-1.450	-1.450	-1.450

Note: Figures are estimated under the sample observation between 2001Q1 and 2023Q1. In the first extended specification, each individual log-level series is detrended by the HP filter. Then, the deviation from the log-level trended series is used to represent the cyclical component. For the extended multiple trends break model, each individual log-level series is fitted with a linear trend break specification. Multiple breakpoints are detected by the method developed by Bai and Peron (1998). The method detected two possible break points. One covers the period since 2008, and the other covers the period since 2020.

5. Conclusions and Discussions

In this paper, we offer evidence on the linear impact of government consumption and tax shocks using a non-recursive SVAR identification method. Our work adapts the point-identified technique proposed in the seminal work of Blanchard and Perotti (2002) and applies their framework to the context of Thailand. Our main findings are not at odds with the ongoing literature. That is, we cast doubt on whether fiscal interventions can be potentially effective at the aggregate level. As measured by the discounted accumulative effect over the medium run (5-year horizon of the integral sum multiplier), both aggregate GDP and some selected components have multipliers that are moderately low. In most cases, the sizes are less than one. Overall findings provide evidence supporting the Keynesian interpretation of Thailand's macroeconomic dynamics, indicating a limited impact of fiscal actions.

Drawing on our findings, our study holds two key important policy implications for Thailand. First, when interpreting our estimated fiscal multipliers as the linear, average effect of broad-based fiscal shocks, the evidence suggests that fiscal policy is not an empirically effective countercyclical tool. Although expansionary measures can temporarily boost output and contribute to short-run stabilization, their aggregate impact remains limited in both the short and medium run. Second, because neither government consumption nor tax shocks significantly affect private investment, a prolonged fiscal expansion may introduce medium-term risks, particularly given its failure to enhance productivity. Consequently, our results imply that any broad-based fiscal expansion should be pursued with caution.

While this study has revisited the classic issue and offered some results to the recent debate on fiscal programs, there are several issues worth pursuing further to better our understanding of the implication of fiscal policy in Thailand. To our understanding, the main issue is a concern over the possibility of confounding shocks that are identified under the SVAR method. Even if the identification method is carefully designed, this confounding issue can still arise for at least two possible reasons. One is due to the insufficient number of variables included in the VAR model. The other is due to the anticipated effect of fiscal shocks, resulting in an invertibility problem between reduced-form VAR innovations and structural shocks. These are difficulties that have yet to be addressed in Thailand, even though some past research suggests that the main findings are less likely to be overturned (e.g., Merten & Ravan, 2010, 2011).

To address the concerns raised above, future studies may use one of the three approaches and further analyze the robustness. First, as argued by Yang (2005),

one may incorporate financial or fast-responding variables into the VAR specification to alleviate the identification problem as well as deepen our understanding of the extent to which financial factors may interplay with fiscal actions. Second, one might work along the lines of local projections (Jorda, 2005) to investigate both linear (unconditional) and non-linear (conditional) effects of fiscal policies. Third, recent advances in zero-sign restriction VAR methodologies (Mountford & Uhlig, 2009) offer a promising framework for deriving robust, set-identified estimates of both anticipated and unanticipated fiscal shocks. Future quantitative studies that incorporate these techniques could significantly enhance our understanding of the detailed characteristics and effectiveness of fiscal impact in Thailand.

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Appendix I. Explanatory note on the calculated fiscal multiplier

The specification of the two baseline SVAR models yields the following simulated accumulative impulse response functions,

$$M_{\log(rgc)}^{\log(RGDP)}(k) = \frac{\sum_{t=1}^k \frac{\left\{ \frac{\Delta \log(RGDP_t)}{\Delta u_{rgc,t=1}} \right\}}{(1+r)^{t-1}}}{\sum_{t=1}^k \frac{\left\{ \frac{\Delta \log(RGC_t)}{\Delta u_{rgc,t=1}} \right\}}{(1+r)^{t-1}}}$$

and

$$M_{\log(tax)}^{\log(RGDP)}(k) = \frac{\sum_{t=1}^k \frac{\left\{ \frac{\Delta \log(GDP_t)}{\Delta u_{tax,t=1}} \right\}}{(1+r)^{t-1}}}{\sum_{t=1}^k \frac{\left\{ \frac{\Delta \log(RGREV_{SA_t})}{\Delta u_{tax,t=1}} \right\}}{(1+r)^{t-1}}}$$

where $\Delta u_{rgc,t=1}$ is the underlying structural shocks on real government consumption that arise in the initial period, and $\Delta u_{tax,t=1}$ is the underlying structural shocks on real tax revenue that arise in the initial period. These two proposed concepts quantify the cumulative elasticity of real output with respect to each fiscal instrument.

As for the linearity assumption in the VAR model, we can impose, without loss of generality, that $\Delta u_{rgc,t=1} = \Delta u_{tax,t=1} = 1$. Note that the first-order Taylor's approximation yields us the following property: $\frac{\Delta \log(y)}{\Delta \log(x)} = \frac{\Delta y}{\Delta x} \times \frac{x}{y}$. By applying this result to our analysis, we can show that the fiscal multipliers at each given impact horizon—evaluated at the steady-state ratio of each fiscal variable to real GDP—can be expressed as follows:

$$M_{rgc}^{RGDP}(k) \equiv \frac{\sum_{t=1}^k \frac{\Delta RGDP_t}{(1+r)^{t-1}}}{\sum_{t=1}^k \frac{\Delta RGC_t}{(1+r)^{t-1}}} = M_{\log(rgc)}^{\log(RGDP)}(k) \times \left(\frac{1}{\frac{\overline{RGC}}{\overline{RGDP}}} \right)$$

and

$$M_{tax}^{RGDP}(k) \equiv \frac{\sum_{t=1}^k \frac{\Delta RGDP_t}{(1+r)^{t-1}}}{\sum_{t=1}^k \frac{\Delta RGREV_SA_t}{(1+r)^{t-1}}} = M_{\log(tax)}^{\log(RGDP)}(k) \times \left(\frac{1}{\frac{\overline{RGREV_SA}}{\overline{RGDP}}} \right)$$