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The Effect of Budget Deficit Shock on Government Spending: An Empirical Case in Indonesia

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Abstract

This paper aims to investigate the effect of budget deficit shock on government spending in Indonesia. For this propose, this reasearch uses an alternative error correction model based on loss function of government spending. The model assumes the short run disequilibrium, in which shock variables may play an important role. A spesific loss function model is applied to develop the long run government hypothetical model. Using data of the period 1970-2010, the empirical model shows that real GDP, tax revenue and multi period shock of budget deficit are statistically significant in determining the government spending, both for operating and development spending. In other words, this finding also shows the significant impact of unanticipated of budget deficit on the government spending. It implies a weaknes of government finance management, in which government spending has not created new tax sources.

Keywords: Fiscal, Government, Spending, Budget, Deficit, Policy.

JEL Classification: H.53; H.62; C.22

1. Introduction

Indonesian economy has experienced several stages of economic growth and stabilization since the financial crisis in 1997. During five years after the crisis, the economy recorded a negative economic growth with high inflation simultaneously. As a response, the central government applied deficit fiscal policy and encouraged central bank to tighten the monetary sector. This policy aims to maintained the price level and to increase economic growth. The other reason was that

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monetary policy did not effectively play an important role in reducing inflation. As a result, in line with increasing budget deficit, the government expenditure also increased yearly.

In the post financial crisis of 2008, the government budget management as the main instrument of fiscal policy has played an important role in supporting economic growth in ASEAN countries. Fiscal policy covers government revenue and spending decisions in order to achieve an optimum economic growth and to stabilize the economy. The impact of government sector on the economy is indicated by the effect of tax and government spending policies on the main various macroeconomic indicators. During the last ten years, the government has been experiencing sharp increases in its spending. This policy has a positive impact on output, but its consequence is that the government embarked upon a potential deficit trap. Because of the threat of economic crisis in 2008, government expenditure also rises and so does domestic agregate demand.

As a big and complex country with more than two hundred million people, a major challenge of Indonesian economic is to avoid conditions that could trigger a new economic crisis. One of the important dimensions of this challenge is to conduct fiscal policy to support a stable economic growth. Indonesian economy has gone through some early stages of economic growth and stabilization during the last ten years. Furthermore, in the last decade, the central government has applied an expansionary fiscal policy. Unfortunately, the government and the central bank fail to harmonize fiscal and monetary policies. The era of this recent development also showed insignificant impact of monetary policy on the economic growth. Interest rates, the main indicator of monetary sector, were at the high level so that investment did not increase significantly. Since then, the government has been focusing on the fiscal policy. In response to the economic recovery, the government should apply an expansive fiscal policy to develop stronger financial and banking sectors. As a result, a large budget deficit created a rapid increase in government spending. The budget deficit decreased the effective tax revenue that was paid by taxpayers for the public goods provided by the government and therefore increased the demand for those services. The relationship between budget deficit and government

spending was particularly important for Indonesia since the public sector has suffered from substantial deficits in the last five years. Analysis of such relationship provides helpful insights to reduce the government spending and restrict the size of government deficit.

The identification of the relationship between government spending and other economic variables provide insight as to how different policies might help to control the government spending growth. If the factors affecting government spending could be elaborated, then it will be important consideration for government to manage the budget deficit (Wolfson, 1995; Schuvnecht, 2000). Contrary, the impact of budget deficit including its shock on government spending growth is also a significant consideration for government to decide the budget. These are the importance of examining the government spending model on the fiscal policy implementation (Chang, et.al. 2002; Marks, 2004; Celasun, et.al. 2006). Further observation and research on the relationship between government spending and other economic variables, especially such as shock of budget deficit both in the short and the long term period, therefore, is important to be conducted. This research aims to investigate the effects of budget deficit shock on government spending for operating and development in Indonesia. For this propose, this reasearch employs an alternative error correction model based on the loss function of government spending. The model assumes a the short run disequilibrium, in which shock variables may play an important role in the model. In this case, a spesific loss function model is used to develop the long run government hypothetical model.

The reminder of this paper is organized as follows. Section 2 provides a brief review of the literature. Section 3 dicusses the empirical framework and data. Section 4 presents the results and discussions. Finally, section 5 concludes and offers policy recomendations.

2. Literature Review

Several alternative papers have explained the relationship between government spending and other economic variables, such as tax revenue, economic growth, interest rate and government budget deficit. Bohl (1999) points out that government spending and tax revenue are simultaneously determined. Merifield (2000) and Tridimas (2001)

support the hypothesis that tax revenue growth is the main factor of government spending. Catao and Terrones (2005) investigate the role of inflation in the government spending and budget deficit for developing countries with high inflation. The identification of causal relation between government expenditure and revenue provides insight as to how different policies might help control the growth of the government expenditure. If the causality runs from government revenue to expenditure, the imposition on additional taxes to restrict the size of deficit budget will increase it. Contrary, if the causal relation runs from government expenditure to revenue, then restricting government spending should restrict the budget deficit. These are the importance of examining the causality of government expenditure and revenue on the fiscal policy implementation for getting optimum economic growth.

Another research on government spending that gives a new finding was conducted by Hondroyiannis and Papapetrue (2001). They observed causal relationship of government spending and tax revenue using cointegration approach and Error Correction Model (ECM). The result shows that, the two variables have long term relationship. Other finding is that the government spending would increase government revenues. This result implies that the deficit budget policy can be much more determined by enhancing government spending. Both researchers suggest that to enhance the efficiency of government spending, the government should decrease the government spending growth.

In addition, Chang, et al. (2002) also analyzes the relationship between government spending and revenue in South Korea, Taiwan and Thailand. The results show that in South Korea, the research supports unidirectional causality from Government spending to tax supports the spend-tax hypothesis, while in Taiwan the result supports tax and spend hypotheses. The case for Thailand shows that there is no causality relationship between government spending and revenue. Finally, the conclusion is that the relationship of government spending and revenue in these two countries are mixed.

Some empirical studies have generally suggested that government spending has positive effects on tax growth. Much of recent literatures on this topic describe a non-linear relationship that is positive when the share of government in economic activity is low, but changes downward

as the relative size of government grows. In general, the government contributes to the economic growth by providing basic public goods and infrastructures. However, as government expands its scope, it will cause increasing in economic inefficiency. Higher government spending also requires an increase in tax rates, which will reduce work incentives (Berument, 1994; Rose and Hakes, 1995).

Catao and Terrones (2005) noted that it was very important role of inflation in the government spending and budget deficit for developing countries with high inflation. Using dynamic model to cover a set of macroeconomic variable, their research conducted an interesting and complex of government spending empirical model. They found a strong positive association between inflation, government spending and budget deficit. The recomend that government should optimize the level of budget deficit in order to reduce the price level. The fiscal policy will be more effective to achieve economic growth in the low inflation.

However, Celasun, et.al. (2006) proposes a probabilistic approach to public debt sustainability analysis. The researh depict the magnitude of risks upside and downside surrounding public debt projections as a result of uncertain economic (shock) conditions and policies. They propose a simulation algorithm for the path of public debt under realistic shock configurations, combining pure economic disturbances of growth, interest rates, and exchange rates, the endogenous policy response to these, and the possible shocks arising from fiscal policy. The paper emphasizes the role of fiscal behavior, as well as the structure of disturbances facing the economy and due to fiscal policy, in shaping the risk profile of public debt. Fan charts for debt are derived from the combination between the pattern of shocks on the one hand and the endogenous response of fiscal policy on the other, which are applied to Argentina, Brazil, Mexico, South Africa, and Turkey. Also important, the estimated fiscal reaction functions which connect fiscal behavior to various economic and institutional fundamentals should also be of use in guiding policymakers on how to forestall problems by pursuing reforms that will shift the distribution of public debt paths that the economy faces. Again, based on this researh, shock variabels are very important and significant in the fiscal policy formulation.

3. Empirical Framework and Data

In the last two decades, many papers applied the dynamic econometrics to elaborate the economic disequilibrium phenomena. In line with the presence of economic agents that will adjust their disequilibrium toward equilibrium point, methods of analysis in the research should accommodate this assumption (Engle and Granger, 1987; Nunes and Semitsiotis, 1995; Tridimas, 2001; Gupta and Uwilingiye, 2008). The cointegration-error correction model approach does not only encompass both level and difference in the variable which capture the short and long run properties of the model, but also provides an attractive statistical framework and represents the concept of long run relationship between two or more variables. With respect to the theory of cointegration, we need to analyze the time series properties of economic variables. It means that we have to satisfy ourselves although the underlying data processes are stationary or not. In the case that the variables in question are not stationary or cointegrated series, the regression equations related to time series data are spurious. It means that testing for unit root and cointegration can be considered as a pre-test before making a valid regression.

Unit Root Test

Application of cointegration and error correction approach for a set of several variables need three steps of analysis. The first step is to verify the unit root condition or the test for order of integration of the variables since the causality test are valid if the variables have the same order of integration. The economic time series data generally contain unit roots and are dominated by stochastic trends. Unit root tests detect non-stationary that would invalidate standard empirical analysis. Standard test for the presence of unit root among variables based on the work of Dicky and Fuller (1981) is to investigate the degree of integration of the variables used in this empirical analysis. The Akaike information criterion (AIC) determines the optimal backward lag specification.

Next, the second step is to test the existence of cointegration between variables, meanwhile testing for government expenditur empirical model will be used error correction model (ECM). According to Engle and Granger (1987), if two variables are integrated of degree I (1) and are

cointegrated then either uni-directional or bi-directional Granger causality must exist in at least I (0) variables. This temporal causality can be captured through the error correction mechanism derived from the long run cointegrating vectors (Granger, 1988). In this analysis we use the Johansen multivariate procedure (Johansen and Juselius, 1990) for testing the cointegration. The Johansen maximum likelihood allows testing multivariate frameworks and avoids some of the drawbacks of Engle-Granger (1987) cointegration approach.

Based on the Johansen and Juselius (1990), a VAR model model is fitted to the data to find the appropriate lag structure. A VAR model of order *p* of time series data can be written as follow:

$$\Delta G_t = \pi B^i G_t + \sum_{i=1}^{p-1} \theta_i B^i \Delta G_t + et \qquad (1)$$

The long run relationship in the data set is captured in the matrix π. The rank of the coefficient matrix π gives the number of cointegrating vectors. This estimation is based on the estimating the π matrix in an unrestricted form, and then test if the restrictions implied by reduced rank of π can be rejected. The rank of π is r, equals the number of cointegrating vectors, which is tested by the maximum eigenvalues (λ_{max}) and trace statistics. The critical values of these statistics are obtained from Osterwald and Lenum (1992). Finally, the third step involves utilization of the ECM modeling and testing for the relationship between dependent and independent variables. Engle and Granger (1987) exhibit that in the presence of the cointegration, there always exists a corresponding error correction representation which implies that the change in dependent variable are a function of the level of disequilibria in the cointegrating relationship, captured by error correction term (ECT), as well as changes in explanatory variables. For this purpose, in this research, the alternative ECM will be considered based on the loss function which is explained as follow.

Model Specification

A complete consideration of dynamic specification is important in construction of economic models. The dynamic analysis involves the description of endogenous and exogenous variables as a function of

some set of previous endogenous and exogenous variables (Nunes and Semitsiotis, 1995; Hondroyiannis and Papapetrue, 2001; Gupta and Uwilingiye, 2008). With respect to this issue, this section explains error correction model that is derived from the single period loss function (See also, Domowitz and Elbadawi,1987; Insukindro, 1990; Price and Insukindro, 1994). The discussion will begin with the introduction of the single period loss function followed by the explanation of estimable error correction model.

According to the widely accepted process of dynamic model spesification, to illustrate the model, the economy can be assumed in disequilibrium in the short run and equilibrium in the long run. In the case of government budget, the actual government spending for a particular year is generally different from the planned spending for that year. It may be caused by shock variables that might arise from both endogenous and exogenous sources. It is assumed that endogenous shocks come from independent variables, while exogenous shocks are assosiated with unanticipated dependent variable. Further, the government spending behavior is assumed to be based on the single period quadratic loss function (Domowitz and Elbadawi, 1987; Insukindro, 1990; Price and Insukindro, 1994).In the case of government spending (G_t), it may consider the following loss function (LF):

$$LF_t = f_1 (G_t^P - G_t^*)^2 + f_2[(1-B) (G_t^P - G_t^*)]^2 \qquad (2)$$

Where, G_t is actual government spending, G_t^P is short run planned government spending, $G_t^*$is long run desired/expected government spending. This equation assumes that $f_1 + f_2 = 1$, and $G_t^P = G_t - ES_t$. ES_t is unanticipated budget deficit or exogenous shock of budget deficit. Subtituting G_t^P into LF, then gives:

$$LF_t = f_1(G_t - ES_t - G_t^*)^2 + f_2[(1-B) (G_t - ES_t - G_t^*)]^2 \qquad (3)$$

The first component of the equation is the disequilibrium loss, and the second one is the adjustment loss. This loss function also involves optimum exogenous shock variables indicated by ES_t. Suppose that the theoretical government spending model, $Gt = F(X_{1t}, X_{2t})$, in the long run desired model it can be written as follow:

$$Gt^* = \alpha o + \alpha 1\, X_{1t} + \alpha 2\, X_{2t} + et \qquad (4)$$

Then, minimizing (3) with respect to G_t and subtituting equation (4) into equation (3) yields:

$$\Delta G_t = \eta_o + \eta_1 \Delta X_{1t} + \eta_2 \Delta X_{2t} + \eta_3 \Delta X_{1t} + \eta_4 B X_{2t} + \eta_5 \Delta ES_t + \theta_i \sum_{i=1}^{k} B_i ES_t + \eta_7 EC_t + v_t \quad (5)$$

Where, $\Delta X_t=X_t-X_{t-1}$, $BX_t=X_{t-1}$, $\alpha_o=\eta_0/\eta_7$, $\alpha_1=(\eta_3+\eta_7)/\eta_7$, $\alpha_2=(\eta_4+\eta_7)/\eta_7$. EC_t is error correction term, η_5 is short run effect of exogenous shock, θ_i is long run effect of multi period exogenous shock, and v_t is error term. ES_t, budget deficit shock variables can be estimated by applying autoregressive model (AR). Equation (5) is a short run dynamic general proposed model that not only captures a set of independet variables, but also involves short and long run effect of multi period exogenous shock. Since the model is a liniear in parameters, the OLS procedure can be applied to this model. The coefficients of long run empirical model of desired/expected government spending, α_o, α_1, and α_2, then will be calculated using coefficients from the short run empirical model as explained in the formula above.

Data

This research estimates two equations, there are government spending for operating and, for development models with each model having three independent variables, Gross Domestic Product (GDP, tax revenue (TR) and budget deficit (BD). It employs annual data which include government spending for operating (GSO) and for development (GSD), real Gross Domestic Product (GDP) in constant price at 2000, tax revenue (TR) and budget deficit (BD) for Indonesia (1970-2010), all of which are in natural logarithms. As a note, all the data are obtained from several annual reports of government budget, except data for 2010 is obtained from government budget plan.

4. Results and Discussion

Based on the budget structure, government spending consists of government spending for operating government activities and for development projects. Figure 1 reports the data of government spending for operating and for development. Government spending for operating

has increased sharply since 2002, meanwhile government spending for development projects increased in 1990 with moderate rate. Starting in 2003, government spending for operating was more than that for development, indicating that the government faced difficulties in providing public goods and services.

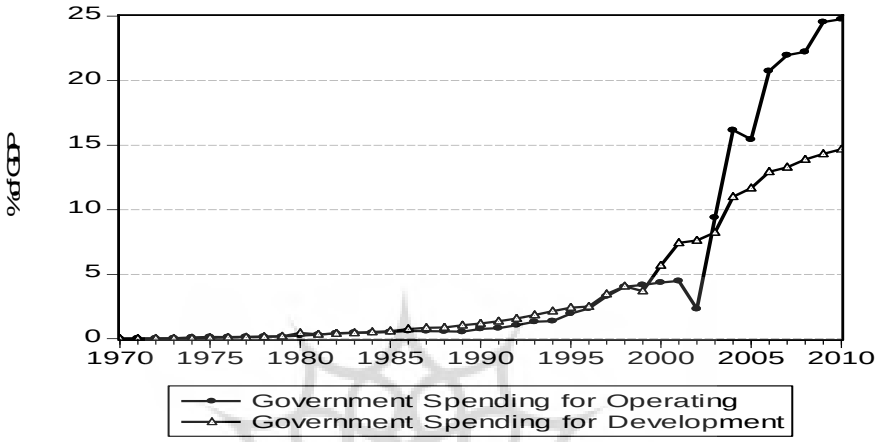

Figure 1. Government Spending for Operating, and Development, 1970-2010

The pattern of government budget is decribed in Figure 2. Government has recorded an attractive increase in both government spending and tax revenue since 1980, while government spending declined in 1998 due to the financial crisis in 1997. However, the increase in tax revenue was relatively stable during the period studied. The fact that the value of tax revenue was lower than total government spending implies that the government experienced increased budget deficit. The budget deficit was volatile until 1997, then sharply decreased in the period of 1999-2003. Due to the increase in government spending, budget deficit has increased in moderate level since 2005. In short, the data describe a strong association between budget deficits and government spendings. Tax revenue, as a key fiscal variable, shows more stable growth than other variables. Although it increases over time, the increase is smaller than that of total spending. As a result, there will be an increasing gap between spending and tax revenue in the long term. In other words, the

sustainability of the government finance will be deteriorating in the future. The government will have a smaller capacity to finance its spending both on operating and development projects.

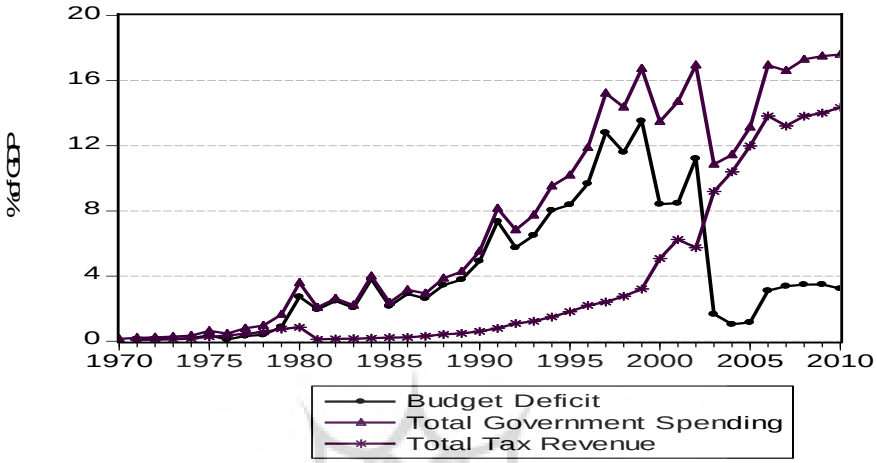

figure 2. Budget Deficit, Government Spending, and Tax Revenue, 1970-2010

In the process of analysis, several steps of estimation and testing are needed to present the empirical model. Starting with the unit root test, Table 1 presents the result of Dicky Fuller (DF) and Augmented Dicky Fuller (ADF) tests of the data series with time trend component. The null hypothesis of unit root on the level should not be rejected for all data series although at 10% level of significance. In contrast, the null hypothesis of unit root on the first difference can be rejected for all data series at least at 10% level of significance. It indicates that these series are all stationary in first difference.Due to the Engle-Granger representation theorem (1987), cointegration test will be valid if a set of series data is stationary and has the same degree of integration. Thus, cointegration test can be applied to estimate the long run relationship for two sets of among variables, namely (i) between government spending for operating, gross domestic product and tax revenue; and (ii) between government spending for development, gross domestic product and tax revenue.

Table 1. ADF Unit Root Test

Variables	Level	First Difference
	ADF	ADF
GSO	-2.453	-3.798[a]
GSD	-2.123	-3.891[a]
GDP	-2.136	-3.531[b]
TR	-2.546	-3.831[a]

Note: [a], [b] indicate 5 and 10 percent level of significances.

Cointegration approach will give information about the existing long run equilibrium among several variables. The results of cointegration test for both government sepending models are reported in Table 2. Budget deficit is not part of the cointegration model because the empirical model involves its shock variables. Using Johansen procedure and optimum lag based on Akaike's criterion, one cointegrating vector is found for both empirical equation. The results show a long run relationship between two components of government spending, gross domestic product, and tax revenue. It indicates that expansive fiscal policy is a result of increasing economic growth and tax revenue creation. This finding also suggests that error correction model may be applied for the analysis.

Table 2. Estimates of Johansen Cointegration Test

LGSO, LGDP, LTR *(VAR lag =2; linier deterministic trend)*				
Null Hypotheses	**λ-max**	**λ-max** (5%)	**λ-trace**	**λ-trace** (5%)
Ho : r = 0	26.124*	17.89	32.686*	24.31
Ho : r ≤ 1	6.571	11.44	8.261	12.53
Ho : r ≤ 2	1.690	3.84	1.690	3.84
LGSD, LGDP, LTR *(VAR lag =2; linier deterministic trend)*				
Null Hypotheses	**λ-max**			
Ho : r = 0	19.713*	17.89	30.226*	24.31
Ho : r ≤ 1	10.512	11.44	10.862	12.53
Ho : r ≤ 2	0.350	3.84	0.351	3.84

Note: LX = log (X); * indicate 5 percent level of significance

In order to estimate the empirical model of government spending, it needs a shock variable of budget deficit as an independent variable. According to Carr and Darby (1981), shocks variable might be estimated using autoregressive model. In this case, shocks variable of budget deficit is obtained from the empirical estimation of autoregressive model. Table 3 presents the result of the autoregressive estimation which has optimum lag at AR(3) based on the minimum Akaike's Information Criterion (AIC) value. Then, the data of shock variable can be obtained from the residual values of the empirical AR model.

Table 3. Estimates of Autoregressive of Budget Deficit

Independent Variables	Coefficient
Constant	1.852
AR (1)	0.56**
AR (2)	0.24*
AR (3)	0.03
F statistic	62.143
R^2 Adjusted	0.933

Note: $DLX_t = \log X_t - \log X_{t-1}$;
**, *, indicate 5 and 10 percent level of significances

Table 4 summarizes the empirical results based on error correction model (ECM) which involves exogenous shock from budget deficit with time lag 3 based on minimum AIC. Exogenous shock, that is unanticipated budget deficit which is estimated using autoregressive with time lag 3, in fact has an important effect on the two empirical models. For these models, estimates of the parameters show that error correction term are p statistically significant. These indicate that these two empirical models are valid to describe the existance of disequilibrium in the relationship between the government spending and its independent variables. The sign of all coefficient of error correction term estimated also indicates that the changes in government spending adjust in the same direction to the previous period's deviation from the equilibrium. In the first model, all independent variables are statistically significant except lag of GDP. For the second model, only lag of tax revenue is is

not statistically significant. Generally, the model explains that in the short term, a change in real GDP and tax revenue leads to an increase in government spending, while in the long term, the determinants of government spending are real GDP, tax revenue, and multi period of budget deficit shocks. This finding is in line with Hondroyiannis, and Papapetrue (2002), and Celasun, et.al. (2006) that support the relatinship between budget deficit and government spending.

Table 4. Estimates of Government Spending Empirical Models

Independent Variables	Dependent Variables	
	Government Spending for Operating	Government Spending for Development
Constant	4.72*	5.67**
ΔLGDP	0.79*	1.84**
ΔLTAX	0.64***	1.33***
LGDP (-1)	0.61	0.78**
LTAX (-1)	1.13**	1.62
ΔSHOCKBD	0.136**	0.224***
SHOCKBD (-1)	0.084**	0.071**
SHOCKBD (-2)	0.021*	0.014**
SHOCKBD (-3)	0.032	0.003*
ECT	0.261**	0.376***
F	8.343	9.138
R^2	0.781	0.840
Autocorrelation: (*Breusch-Godfrey*)	χ^2 = 1.46 (0.68)	χ^2 = 1.26 (0.45)
Heteroscedasticity (*White test*)	χ^2 = 13.04 (0.41)	χ^2 = 12.3 (0.61)
Spesification test (*Ramsey test*)	LR = 1.95 (0.16)	LR = 1.43 (0.23)

Note: $DLX_t = \log X_t - \log X_{t-1}$; ( ) indicates p-value
***, **, * indicate 1, 5 and 10 percent level of significances.

More information may be explained based on the empirical result. In the short term, a change in government spending was determined by a change in real GDP, tax revenue, and shock from budget deficit. In the long term, it also explains that government spending both for operating, and development projects not only depends on real GDP and tax

revenue, but also depends on multtiperiod shock of budget deficit with three periods of time lag. The ECT estimated coefficient is 0.261 for the first model, indicating about 26% of the government spending disequilibrium is corrected yearly, while for the second model with the same assumption is 37.6%. In addition, t-tests for all coefficients of multi period shock of budget deficit as independent variable are rejected at 5% significance level, except for time lag 3 in second model. Furthemore, it indicates that shock variable plays an importent role in the model. This implies that exogenous shocks of budget deficit should be involved in the both empirical model of government spending.

Finally, the presence of multiperiod shock variables in the model is to verify the role of unanticipated budget deficit in determining government spending, both for operating and development.The coefficient of short run effect of exogenous shock is 0.136, indicating about 13.6% of unanticipated budget deficit leads to increased government spending for operating, while for development spending achieves about 22,4% yearly. On the other hand, the long run effect of exogenous shock is about 0.137. This finding also explains that in average, 13.7% of the increase in government spending for operating in the long run comes from the increase in unanticipated budget deficit. With similar assumption, about 8.8% of unanticipated budget deficit contributes to the improvement of government spending for development projects yearly. It implies that the government has fallen into the fiscal trap in the long run, where an expansive fiscal policy has created a higher deficit.

Increasing deficit in the long term will force the government to mobilize financing sources other than taxes. In recent years, in fact the government may finance the deficit by increasing the tax rate, and borrowing from overseas or domestic by issuing bonds sold in domestic and international markets. With limited income sources, in the long term the goverment will face difficulties in fullfiling its obligations to creditors. On the other hand, printing money is not popular because they likely threaten the economic stability. Particularly, printing money generates a long-term inflation, while a tax rate increase likely slows down the overall business activities, thereby reducing the tax income in the next periods. This finding gives a sign that the fiscal sustainability

will be threatened in the long run.This result recommends that the government should manage its spending in order to minimize misallocation resources and to create new tax sources.

5. Conclusion

This paper has attempted to identify the effect of budget deficit shocks on government spending by developing an error correction model based on the loss function approach.The main purpose of this reasearch is to elaborate the existence of the effect of budget deficit shock on the growth of goverment spending. Two sparated models have been estimated: government spending for operating and government spending for development projects. The results of estimation give several information about the determinant of government spending growth both for operating and development projects in Indonesia.

The empirical model shows that real GDP, tax revenue and multi period shock of budget deficit variables are statistically significant in the two government spending models. Furthermore, the result also shows the significant impact of multi period exogenous shock of budget deficit on these two models along this period. It implies that unanticipated budget deficit is an important factor in increasing government spending, not only for operating, but also for development spending. This finding described that the government has created the fiscal trap in the long run, where an expansive fiscal policy was followed by higher deficit. This result recommends that the government allocates its spending into sectors that are more productive.

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