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A CAUSALITY RELATIONSHIP BETWEEN TAX REVENUE AND GOVERNMENT EXPENDITURE IN INDONESIA[1]

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Abstract

This paper attempts to model the relationship between tax revenue and government expenditure for Indonesia over the period 1970-2007. The empirical analysis employs tests of cointegration and Vector Error Correction Model (VECM). The empirical evidence suggests that there is a long run relationship between tax and government expenditure, but in the short term, the model explains unidirectional causality relationship, namely from tax revenue to goven ment expenditure This finding indicates that the budget deficit increase continuously, which threaten the fiscal sustainability in the long term. It suggests that the government should organize a better management on public finance policies to support the tax-spend fiscal policy.

Key words: tax, government, causality, expenditure, cointegration.
JEL Classification: H42, H59

INTRODUCTION

Indonesian economy has gone trough some early stages of economic growth and stabilization during the last ten years. Furthermore, in the last two decades, the central government has applied an expansionary fiscal policy. It aims to get the high stable economic growth and maintain the acceptable inflation rate. However, the harmonization of fiscal and monetary policies was not practiced by both the government and the central bank. The era of this recent development also showed insignificant impact of monetary policy on the economic growth. Interest rate, the main indicator of monetary sector, was at the high level so that investment did not increase significantly. Since then, the government has been focusing on the fiscal policy as an instrument to manage the economy.

After the Asian crisis in 1997, government budget management plays an important role in supporting economic growth especially in developing countries. Fiscal policy covers government revenue and expenditure decisions in order to achieve an optimum economic growth and to stabilize the economy. The impact of government sector to the economy is indicated by the effect of tax and government expenditure policies on the main various macroeconomic indicators. During the last ten years, the government has been conducting deficit budget policy to manage the economy and to stabilize the price level. This fiscal policy has led to a positive impact on output, but its consequence was that the government embarked upon a deficit trap.

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The rapid increase in government expenditure was the result of the large budget deficit. The budget deficits decreased the effective tax revenue, which is the contribution of taxpayers for the public goods provided by the government. The relationship between tax revenue and government expenditure was particularly important for Indonesia since the public sectors have suffered from substantial deficits in the last five years. Analysis of such relationship provided helpful insights to reduce the government expenditure and restrict the size of government deficit.

Further research on the causal relationship between government expenditure and tax revenue, both in short or long terms, therefore, is very important. This paper attempts to analyze the causal relationship between government expenditure and tax revenue for Indonesian data. In this analysis, we employ the econometric dynamic models, such as cointegration and vector error correction model (VECM), that have been applied in various economic researches. For this purposes, pre tests of unit root and degree of integration are important prerequisite to obtain a valid regression.

Several alternative hypotheses have been put forward to explain the relationship between government expenditure and tax revenue. Peacock and Wiseman (1979) support the spend-tax model, which means that an increase in the government expenditure threats the tax revenue. These theories are supported by Anderson et al. (1986), and Von Furstenberg (1986). The tax-spend model is formulated by Friedman (1978). Several findings support this assumption such as Manage and Marlow (1986), Ram (1988) and Blackely (1986). They suggest that expenditure adjustment is supported by the tax revenue. On other hand, Meltzer and Richard (1981) support the finding that government expenditure and tax revenue are simultaneously determined. Among those who support this theory are Bohn (1991) and Baghestoni and McNown (1994).

Another research on the causality analysis of government expenditure and revenue that provide a new finding is conducted by Hondroyiannis and Papapetrue (2002). They observed causal relation of government expenditure and tax revenue using cointegration approach and ECM (Error Correction Model). The assumption underlying these models is the equilibrium in the inter-variables relation in the long-term. The result of the research shows that, the two variables have long-term relationship. Another finding is that the government expenditure would increase government revenues. This result implies that the deficit budget policy can be much more determined by enhancing government expenditure. Both researchers suggest that to enhance the efficiency of government expenditure, the government should decrease the government expenditure growth.

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

The identification of causal relation between government expenditure and revenue provide insight as to how different policies might or might not help control the growth of 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. In the 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 in getting optimum economic growth.

Some empirical studies generally suggest that government expenditure has positive effects on the tax growth (see Diamond, 1989). Recent literature on this topic describes a non-linear relationship that is positive when the share of government in economic activity is low, and decreases 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 an increase in economic inefficiency. Higher goven ment expenditure also requires an increase in tax rates, which will reduce work incentives (Sheehey, 1993). This is also the rationale to analyze the effect of government expenditure on tax revenue.

METHODS

In general, economic theories explain long run phenomena. In line with this definition, methods of analysis used in the research should accommodate this assumption. The cointegration vector error correction model (VECM) approach does not only encompass both level and difference in the variables that 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 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 whether 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.

Testing for cointegration and causality between the two or more variables needs two 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 tests are valid if the variables have the same order of integration. Macroeconomic time series generally contain unit roots and are dominated by stochastic trends. Unit root tests detect non-stationarity 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. Let, for example G_t represent the government expenditure series, the null hypothesis of unit root is tested using the DF *t*-test. The test statistic, t_{σ_1} is the usual *t*-statistic for testing $H_0 : \sigma_1 = 0$ in the following equation:

$$\Delta \log G_t = \sigma_0 + \sigma_1 B \log G_t + \sum_{i=1}^{k} \theta_i B^i \Delta \log G_t + e_t \qquad (1)$$

where, Δ refers to first difference, B is backward lag operator, and k indicates optimal backward lag based on AIC. The distribution of t_σ does not follow a student-*t* distribution, but its empirical distribution is tabulated by McKinnon (1991). A rejection of the null hypothesis implies that the log government expenditure data is integrated of order 0, I(0), and is therefore stationary.

To allow for the possible presence of deterministic time trend, equation (1) is augmented with time trend component in

order test the presence of unit root, so the equation will be:

$$\Delta \log G_t = \sigma_0 + \sigma_1 T + \sigma_2 B \log G_t + \sum_{i=1}^{k} \theta_i B^i \Delta \log G_t + e_t \quad (2)$$

The augmented Dicky-Fuller (ADF) *t* statistic for testing the hypothesis of unit root, Ho: $\sigma_2 = 0$, is also based on the work of McKinnon (1991). If the null hypothesis of unit root in equation (2) is not rejected, the order of integration of log G_t could be one or higher. Therefore, we must proceed to test the presence of unit root for log G_t in the first difference form. The test statistic, $t_{\sigma,}$ is the usual t-statistic for testing Ho: $\sigma_1 = 0$ in the following equation:

$$\Delta^2 \log G_t = \sigma_0 + \sigma_1 B \log G_t + \sum_{i=1}^{k} \theta_i B^i \Delta^2 \log G_t + e_t \quad (3)$$

A rejection of the null hypothesis implies that the log series is in the degree of integration 1, I(1). Furthermore, we can continue with testing of cointegration among variables. Given the presence of unit roots, the question becomes whether there is some long run equilibrium cointegrating relationship between variables.

The second step is to test the existence of cointegration between variables, while testing for causality will apply vector error correction model (VECM). 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 the I(0) variables. This temporal causality can be captured through the vector error correction model (VECM) 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 methodology. Based on the Johansen and Juselius (1990), a VAR 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:

$$\Delta G_t = \pi B_i G_t + \sum_{i=1}^{p-1} \theta_i B^i \Delta G_t + e_t \quad (4)$$

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 it will be tested 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 results of the null hypothesis of at least *r* cointegrating vectors against the alternative hypothesis of full rank, based on the likelihood ratio trace test is given by (5) and the eigenvalue max is given by (6):

$$Q_r = -N \sum_{i=r+1}^{3} \log(1-\lambda_i) \quad (5)$$

$$\lambda_{\max} = -N \log(1-\lambda_i) \quad (6)$$

where $r = 0, 2, 3$ and λ_i is the i^{th} largest eigenvalue. The critical values of these statistics are obtained from Osterwald–Lenun (1992). The AIC is also used to determine the optimum lag(*p*) of equation (4). If the rank of π equals to zero or *p* ($r = 0$ or $r = p$), cointe-

gration does not exist. So, cointegration only occurs in the condition of $0 < r < p$.

The third step involves utilization of the VECM modeling and testing for causality relationship. 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 independent 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. Thus, ECT and VECM establish an additional way to examine the causality. In the same way, we will develop the model, which has an explanatory variable and error correction term (ECT) obtained from the cointegration equation. The using of VECM is not only to get a valid regression, but also to explain the effect of government expenditure on output in short run phenomena for each country. After that, we also use impulse response analysis to capture dynamic interactions and speed of adjustments.

RESULTS DISCUSSION

The paper uses annual data of government expenditure (GE) and tax revenue (REV) for Indonesia (1970-2007), which are all in natural logarithms of real terms. Data are obtained from several annual reports of International Financial Statistics, World Bank. Figure 1 reports the data of government expenditure and tax revenue, while Figure 2 describes government budget deficit for this period. Government expenditure increased sharply since 1990, as well as tax revenue. The lower value of tax revenue compared to government expenditure implies that the government experiences budget deficit. The deficit has increased sharply since year 2000 so that the government should hire the debt sources to finance it.

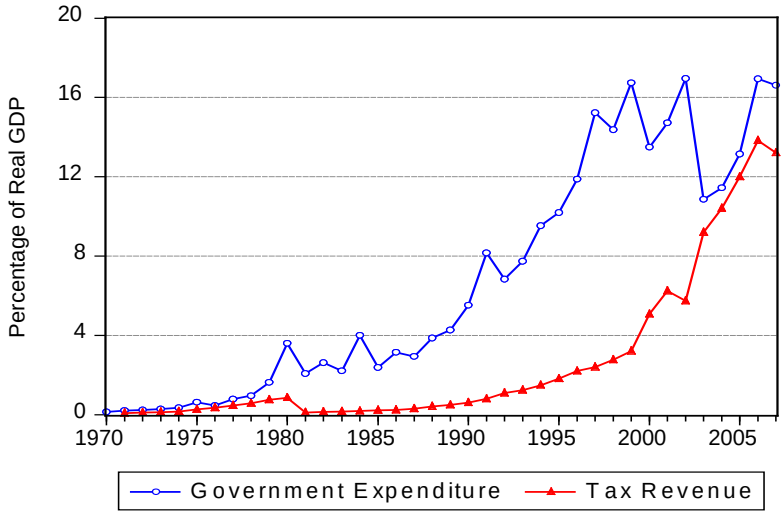

Figure 1: Government Expenditure and Tax Revenue, 1970-2007

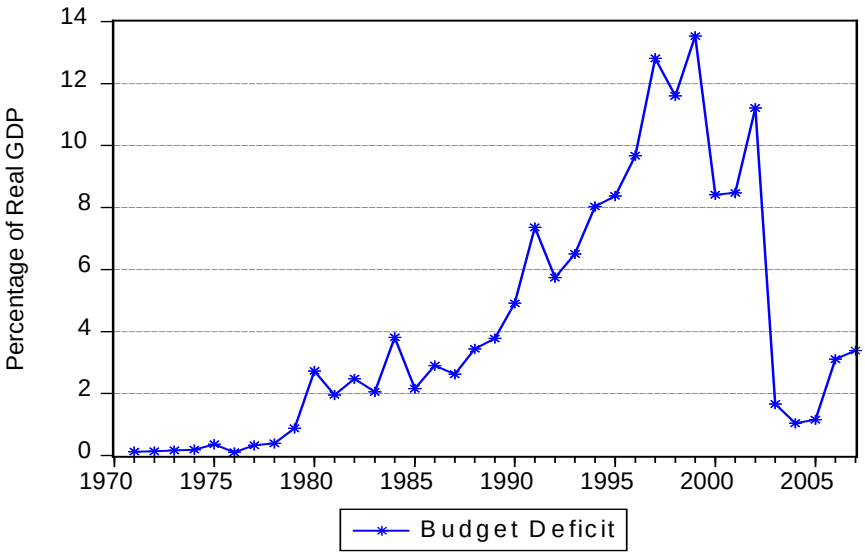

Figure 2: Budget Deficit, 1970-2007

Table 1: ADF Unit Root Test

Variables	Level		First Difference	
	DF	ADF	DF	ADF
LREV	-2.372 (2)	-2.677 (3)	-3.848 (2)**	-4.124 (2)**
LGE	-1.654 (2)	-2.323 (3)	-3.424 (2)***	-3.761 (2)***

Notes: 1: **, *** indicate 1, and 5 percent level of significances respectively.
2: Entries in parentheses are optimum lag based on AIC

Table 2: Empirical Johansen Cointegration Test

Indonesia LREV, LGE (VAR lag = 3)				
Null Hypotheses	λ - max	λ - max (5%)	Trace	Trace (5%)
Ho : r = 0	19.713*	17.89	32.216*	24.31
Ho : r ≤ 1	8.512	11.44	10.523	12.53

Note: * indicates 5 percent level of significances.

Table 1 presents the result of Dicky Fuller (DF) and Augmented Dicky Fuller (ADF) unit root 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 and hence are I(1). 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 between tax revenue and government expenditure.

The results of cointegration test are reported in Table 2. Using Johansen procedure and optimum lag based on Akaike's criterion, one cointegrating vector is found for the empirical equation. The result shows a long run relationship between tax revenue and government expenditure. It also indicates that expansive fiscal policy will be effective in supporting economic growth so that it implies tax revenue creation. These finding also suggests that vector error correction should be applied for causality analysis. Granger (1988) points out that if a set of data series is cointegrated, it implies statistical causality in at least one direction.

Table 3 summarizes the empirical results based on vector error correction approach. All intercepts for both tax revenue and government expenditure equations are not statistically significant, indicating the presence a balanced budget. It also implies that the long run budgetary equilibrium occurs for the period of analysis. Estimates of the parameters show that error correction term measuring the budgetary disequilibrium in the short term are positive and statistically significant. This implies that tax revenue move to restore equilibrium in this bivariate relationship.

The sign of all coefficient of error correction term estimated also indicates that the changes in the tax revenue and government expenditure adjust in the same direction to the previous period's deviation from the equilibrium. The estimated coefficient in the case of tax revenue equation is relatively small (0.068), indicating that about 6.8% of the budgetary disequilibrium is corrected within one year. Under this assumption, empirical government expenditure equation also shows that it moves from its disequilibrium. With the ECT estimated coefficient is 0.056, it indicates that about 5.6% of the govenment expenditure disequili brium is corrected yearly.

In addition, *F*-test for restriction test of independent variables indicate that causality relationship does not exist. The restriction test of tax revenue in government expenditure equation shows that this variable can be dropped from the model, but the government expenditure is statistically significant in the tax revenue equation. This implies only one direction relationship in the short run empirical model, that is from tax revenue to government expenditure.

Based on this empirical result, the model explains unidirectional causality relationship, which is from tax revenue to government expenditure. It also finds that an increase in government expenditure does not cause tax resources. It suggests that the expansion in government expenditure will not have a positive effect on tax revenue. On other hand, an increase in tax revenue is always followed by the increase in government expenditure. This finding is in line with Sheehey (1993), Hondroyiannis and Papapetrue (2002), and Chang et. al. (2002), that support one-way relationship in the short run from tax to government spending.

Table 3: Empirical VECM Causality Test of Tax Revenue and Government Expenditure

Dependent Variable	Intercept	F Statistic of Restriction Test		ECT Coeficient
		Δ LTAX (Lag 3)	Δ LGET (Lag 2)	
Δ LTAX	1.514	-	0.024	0.068
	(1.214)		(3.344) *	(3.147) *
Δ LGET	1.810	1.417	-	0.056
	(0.323)	(1.216)		(2.927) *
Short run model: LTAX ⟺ LGET				
Long run model: LTAX ⟺ LGET				

Notes:
1 : $\Delta LX = \log (X_t) - \log (X_{t-1})$
2 : Entries in parentheses are the *t*-statistic
3 : * indicates 5 percent level of significances

As for the tax revenue, although in general 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 public finance will be deteriorating in the future. The government will have a smaller capacity to finance its spending both on operational and development activities.

The implied expansion of fiscal deficit will force the government to mobilize financing sources other than taxes. In theory, the government may finance the deficit by increasing tax rate, printing money, or borrowing from overseas or domestic by issuing bonds. The last two measures are not popular because they likely threaten the economic stability. Particularly, printing money generates a long-term inflation, and a tax rate increase 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 in jeopardy in the long term. This phenomenon suggests that prudential contractive fiscal policy is preferable.

CONCLUSSION

The research concluded that there was a strong long run relationship between tax revenue and government expenditure in Indonesia. In the short term, the model explained unidirectional causality relationship, which was from tax revenue to government expenditure. This phenomenon increased the budget deficit. It implies that the government should make better public finance policies supporting the tax-spend fiscal policy.

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