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Optimal Size of Government Spending: Empirical Evidence from Eight Countries in Southeast Asia

Leanghak Hok* , Prapatchon Jariyapan, Piyaluk Buddhawongsa and Roengchai Tansuchat

Faculty of Economics, Chiang Mai University, Thailand
E-mail: leanghak.hok@gmail.com*

ABSTRACT

This paper explores an inverted U sharp between government spending and economic growth and optimum size of public expenditure in eight ASEAN countries from 1995 to 2011. This paper utilized Armey Curve to study this correlation. Different panel unit root tests including Levin-Lin-Chu test, Im-Pesara-Shin test, Fisher ADF test and Fisher-PP were carried out. The result showed that each variable was stationary at different order I(0) and I(1). Both mean group (MG) and pooled mean group (PMG) were suitable to test dynamics of variables, and the null hypothesis of Hausman test is that PMG is better estimator than MG. The result suggested that there was an inverted U relation between government spending and economic growth, and optimal size of government expenditure share of GDP was 28.5 percent for eight ASEAN countries.

Keywords: Government spending, economic growth, panel data, pooled mean group, mean group

JEL Classification: C80, N1, O47

1. Introduction

The financial crisis in 2008 first started in the United States of America and spread out to the world. ASEAN countries were also affected from this crisis (ASEAN, 2010). The GDP annual growth rate of the six ASEAN countries excluding Brunei and Cambodia was harmed by global financial crisis because the GDP annual growth rate of these countries was reduced after the crisis (Figure 1). The GDP annual growth rate of Malaysia, Singapore, and Thailand also significantly changed from a positive to negative rate. This crisis weakened the fiscal balance of five ASEAN countries (i.e., Indonesia, Malaysia, Philippines, Singapore, Thailand) by approximately 3 percent in 2009 (Budina and Tuladhar, 2010).

It is widely acknowledged that the fiscal policy plays an important role in strengthening the economy or stimulating economic growth in the ASEAN countries. The public spending of ASEAN countries on infrastructure is considered as a major source to boost overall investment growth and stabilized support to economic growth (Budina and Tuladhar, 2010; OECD, 2013).

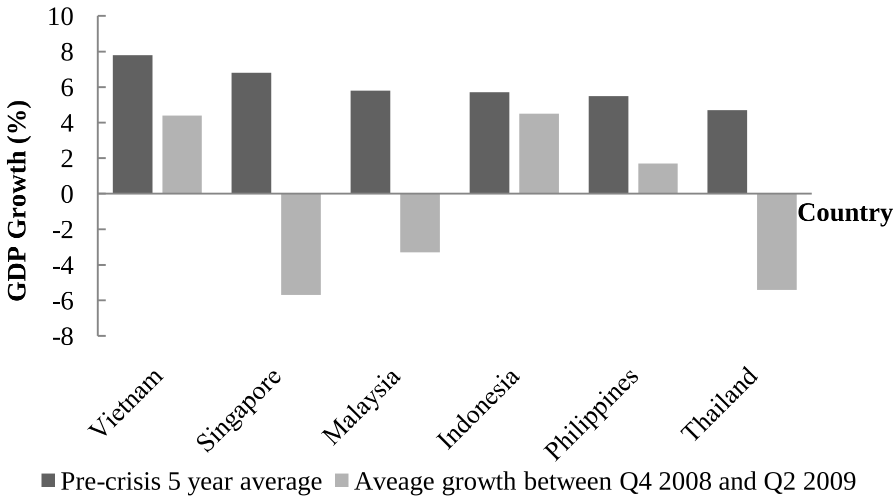

Figure 1. GDP annual growth rate in six ASEAN countries

Source: World Bank Indicator and CEIC database

By looking at another issue which public expenditure can be monitored for solution, the main goal of ASEAN countries is to create ASEAN Economic Community by 2015. Narrowing the gap between six ASEAN countries and Cambodia, Lao PDR, Myanmar, and Vietnam (CLMV) is essential for this integration. Hence, each government's spending on infrastructure, education and other factors significantly contributes to an achievement of this goal. Budina and Tuladhar (2010) also reviewed that high infrastructure investment might have a positive effect to output and economic growth if the investment is high enough. At another point, the multiplier of this investment is great for countries when a lower level of public expenditure is provided.

The average total public expenditure and total public revenue of eight ASEAN countries from 2000 to 2011 are presented in Figure 2. It is noticed that the average total public expenditure in Brunei, Cambodia, and Malaysia was approximately 9 percent higher than the total public revenues. However, other countries’ budgets were less unbalanced than the three countries mentioned above. The reason of unbalanced budget resulted from the increase in spending of these countries to recover from the crisis.

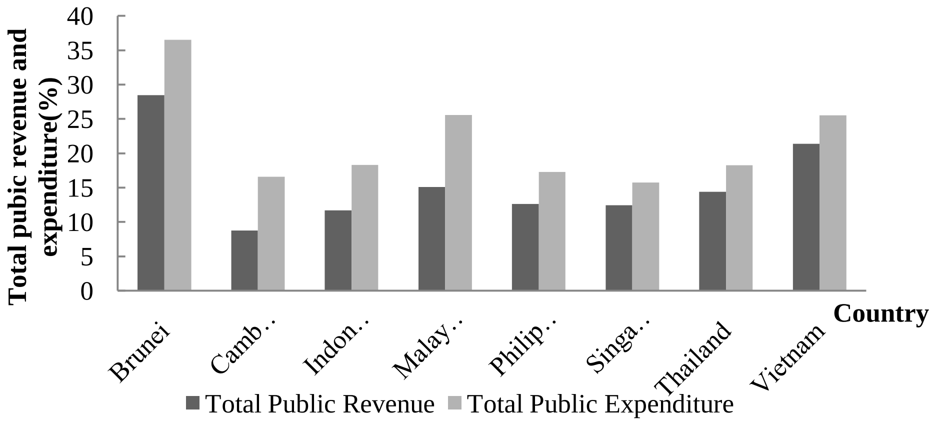

Figure 2. Average total public revenue and total public expenditure of GDP 2000-2011

Sources: CEIC 2014, ADB Key Indicators 2013 and IMF WEO database 2013

Figure 3 shows that the total government expenditure of Brunei decreased dramatically. But, the total government expenditure of other seven countries fluctuated slightly and moved in the same direction.

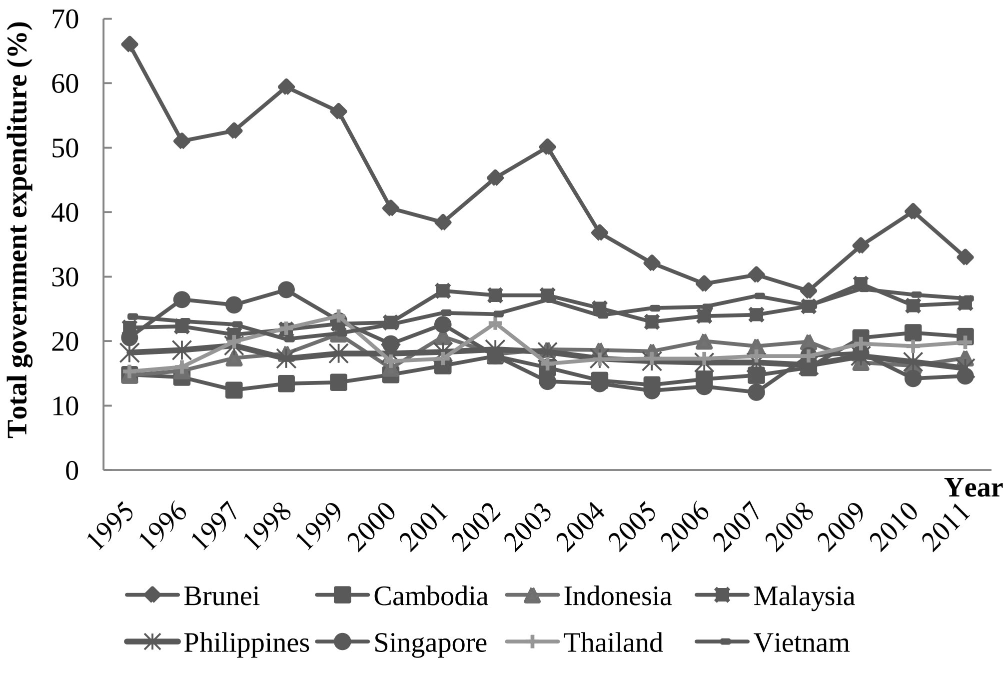

Figure 3. Total government expenditure share of GDP in eight ASEAN

Source: ADB key indicator 2013 and IMF WEO database 2013

The real GDP per capita of eight ASEAN countries is shown in figure 4. It is observed that the real GDP per capita of Singapore raised significantly. It highlighted result of the dramatic development effort. In spite of Brunei, the real GDP per capita decreased remarkably. It reflected a reduction in oil and gas production which is a major component of Brunei's economy. The real GDP per capita of the other countries fluctuated slightly and shifted in the same direction.

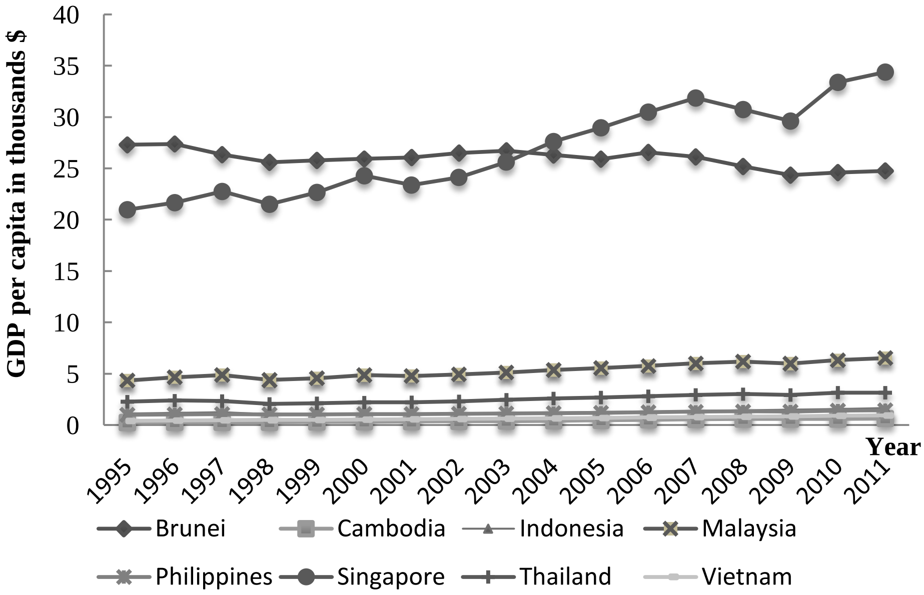

Figure 4. GDP per capita of eight ASEAN countries

Source: World Bank indicator 2013

By looking at the total government expenditure and the real GDP per capita together, it can be seen that the government expenditure and the GDP per capita moved in the same direction for most ASEAN countries except for Singapore which moved in the opposite direction.

Various studies on linear impact of public expenditure on economic growth including Landau (1983), Engen and Skinner (1992), Fölster and Henrekson (2001), and Dar and AmirKhalkhali (2002) indicated a negative relationship between public expenditure and economic growth. These studies emphasized that the impact of government spending on economic growth was diminished when the government extended its own expenditure. The large expenditure causes disincentive to private investment due to inefficient allocation of resources. In other words, the government increases tax rate to support the expenditure; consequently, it detrimentally affects economy. On the other hand, Gould (1983), Ram (1986), Kormendi and Meguire (1986), and Lee and Lin (1994) found a fairly positive effect of public expenditure on economic growth. These studies believe that public expenditure evolves private property which encourages private investment because the government opens private sector to get involved with public property and to invest in public goods that leads improvement in investment environment. Hence, this expenditure boosts economic growth.

Empirical studies mentioned above show that public expenditure can support and delay economic growth. The objective of this paper is to test the inverted U relation of government spending on economic growth in eight ASEAN countries and to determine the optimal size of government expenditure. The remains of this paper are followed by section 2 that describes theory and related studies, section 3 that presents model and econometric method, section 4 that shows data collection, section 5 that reports the empirical results, section 6 that presents discussion and section 7 that is conclusions.

2. Literature Review

Classical growth model is first developed by Solow-Swan pointing out that inputs, labors and capitals, stimulate economic growth (Masoud, 2013). The pleasant notion of the non-linear relation between government expenditure and economic growth is supported. Barros (1990) points out that economy has no transitional dynamic, and all of inputs steadily increase the same rate in steady-state position. There are two directions which government expenditure share of

GDP impacts on economic growth. Raising taxes turns down the growth rate because of disincentive impact while the government is large. However, increasing government expenditure boosts marginal productivity of capital leading economic growth when the government is small. The optimal level of government expenditure is computed by differentiating growth rate equation with respect to the public spending share of GDP. The optimum point occurs while marginal product equals unity.

Army (1995) utilized Laffer curve to apply for the relation of government spending on economic growth. The Army Curve was developed to show concept of optimal size of government expenditure. The situation of no government, rule of law and property right is argued because it does not ensure each individual protection. As a consequence, it causes the production to go down due to no incentive for investing and saving. GDP per capita is lower than both government-managed and private sector if the government only controls input and output. Fairly small government should increase the expenditure to insure protection for private property which incentivizes private investment. The country's productive capacity is developed. As a result, the public expenditure stimulates the economic growth. In contrast, the economic growth diminishes when the expenditure is larger and larger because the government borrows or increases taxes to finance. The unbalance budget which is occurred in its budget causes risk to the economy. The optimal size of government spending is a point which provide marginal benefit equal zero.

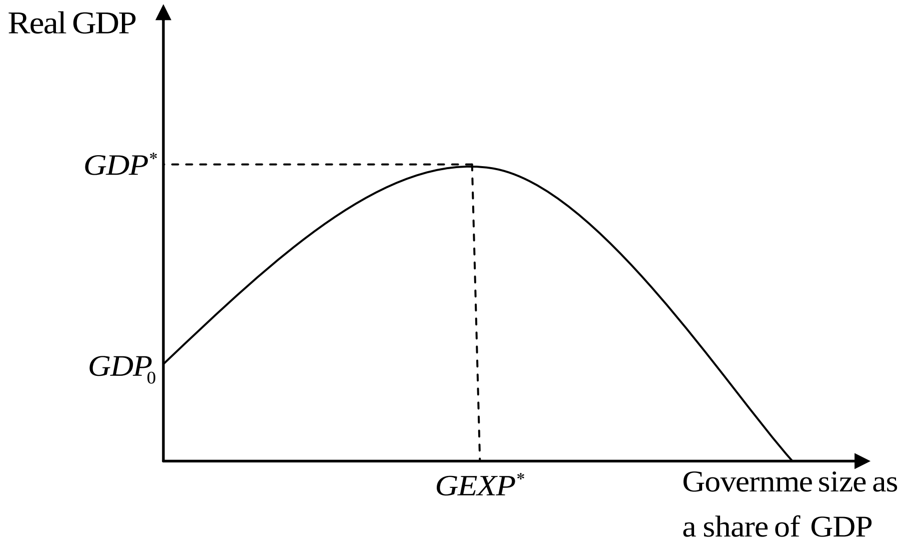

Figure 5. Government spending and the economy (Armey Curve)

Figure 5 shows that real GDP is a quadratic function of government spending, and the curve consists of maximum point.

Chao and Grubel (1998) studied optimal level of public spending and taxation in Canada in period from 1926 to 1996 and used ordinary least square to estimate the co-integration between real GDP growth rate and independent variables (i.e., government spending, taxation share of GDP). They found that optimal spending and taxation were about 34 percent of GDP. Vedder and Gallaway (1998) studied the government size and economic growth in United State of America (USA) and covered the period from 1947 to 1997. Ordinary least square (OLS) was employed to test whether USA exited the Armey Curve or not. The variables included in the analysis were real GDP, government spending, unemployment, and time trend. The result showed that the relation between government spending and real GDP was an inverted U sharp, and the curve peak of government spending was 17.5 percent of GDP. In the same way, Chen and Lee (2005) studied government size and economic growth in Taiwan in period from 1980 to

2002. Bootstrapping model was utilized to test non-linear relation between government spending and economic growth. They found that Armey Curve's non-linear correlation between government expenditure and real GDP growth rate occurred in Taiwan, and 22.8, 7.3 and 15 percent of GDP were optimal size of total government expenditure, government investment expenditure and government consumption expenditure, respectively.

Inside of European countries, Mavron (2007) studied the size of government spending and rate of economic growth in Bulgaria in the period from 1990 to 2004. OLS method was employed to test existence of Armey Curve, and government spending and growth rate of GDP were variables. The result showed that the relation between government spending and economic growth was an inverted U sharp, and optimal size of government expenditure was 41.4 percent of GDP. Altunc and Aydm (2013) utilized Armey Cure, economic growth which is a quadratic function of government spending with optimal point, to discover the relationship between maximum size of government spending and economic growth in Turkey, Romania and Bulgaria 1995-2011. ARDL method was employed to find correlation between rate of real GDP growth and independent variables (i.e., government expenditure share of GDP, unemployment rate). Time series was used to analyze each country separately. The result showed that the optimal size of government expenditure was 25.2, 20.4, and 22.5 percent of GDP for Turkey, Romania, and Bulgaria, respectively. In the same way, Facchini and Melki (2013) followed Veddera and Gallaway (1998), Pevcin (2004), Chen and Lee (2005), Mavrov (2007), and Chobanov and Mladenova (2009), to explore efficient government spending in France from 1986 to 2008. Fully modified ordinary least square (FMOLS) method was employed to estimate dynamics between real GDP and independent variables (i.e., public expenditure, economy openness, total population, taxation). The result showed that 30 percent of GDP was optimal size of public expenditure.

For the other studies which were conducted in panel data, Pevcin (2004) studied whether optimal size of government expenditure occurred in 12 OECD countries from 1950 to 1996 or not. Three models (i.e., fixed effect model (FXM), lease square dummy variable (LSDV), error components model (ECM)) were employed in estimation. The results indicated that optimal government spending of these countries was 36.5, 40 and 42.1 percent of GDP estimated by FXM, LSDV, and ECM, respectively. Similarly, Chobanov and Mladenova (2009) utilized Scully model to search for what was optimum size of government expenditure in 28 OECD countries from 1970 to 2007. Generalized least square (GLS) method was employed to estimate dynamics between real GDP and explanatory variables (i.e., government spending, total tax rate). It was found that optimal size of overall government expenditure was 25 percent of GDP.

These results of the related studies revealed that there was the inverted U relationship between government expenditure and economic growth. These studies were mostly conducted in the developed countries such as European countries, Canada, and USA. The optimum of government spending was different from a research to another due to methods, observations, or the situation of covered countries in their studies. The maximum of public expenditure ranged from 17.5 percent to 40 percent of GDP.

3. Methodology

3.1 Specific model

Armey Curve indicates that real GDP is quadratic function of government expenditure, and production function is assumed as Cobb-Douglas function. Therefore, the production function can be widened into:

$$GDP_{it} = \exp\left(\beta_0 + \beta_1 GEXP_{it} + \beta_2 GEXP_{it}^2\right)\left(L_{it}\right)^{\beta_3}\left(K_{it}\right)^{\beta_4}\left(X_{it}\right)^{\beta_5} \tag{1}$$

where $\exp$ is exponential operator. GDP_{it}, $GEXP_{it}$, $GEXP_{it}^{2}$, L_{it}, K_{it}, and X_{it} denote real GDP, government expenditure share of GDP, square of government expenditure, labor input, capital input, and total export for country i at time t, respectively.

Taking the natural logarithm into the equation (1), the derived equation for this study is:

$$\ln GDP_{it} = \beta_0 + \beta_1 GEXP_{it} + \beta_2 GEXP_{it}^2 + \beta_3 \ln L_{it} + \beta_4 \ln K_{it} + \beta_5 \ln X_{it} + \varepsilon_{it} \tag{2}$$

where $\ln GDP_{it}$ is the natural logarithm of real GDP in country i at time t while denotes $GEXP_{it}$ government expenditure share of GDP in country i at time t. Furthermore, $\ln L_{it}$ is the natural logarithm of labor in country i at time t and $\ln K_{it}$ is the natural logarithm of capital in country i at time t. $\ln X_{it}$ is the natural logarithm of total export in country i at time t. ε_{it} also denotes independently distributed random error term with zero mean and constant variance in country i at time t.

3.2 Estimation

The unit root test was first utilized to check the data stationary or non-stationary at level I(0) or first derivative I(1) before co-integration was tested. The unit root tests including Levin-Lin-Chu test, Im-Pesara-Shin test, Fisher-ADF, and Fisher-PP were employed to analyze panel data's stationary in this study. Variables are expected to be stationary at different level I(0) or I(1). Thus, mean group (MG) and pooled mean group (PMG) were suitable methods used to study dynamic panel data. MG allows both variance and coefficients for long-run difference from cross country, so the slope is considered as heterogeneity (Pesaran and Smith, 1995). PMG imposes restriction of long-run homogenous coefficients across countries but allows to vary in short-run coefficients and speed of adjustment across countries (Pesaran et al., 1999). Hausman test confirms that MG or PMG is better method, and null hypothesis of this test is that PMG is better method than MG. These methods are fairly appropriate for large number of cross-sectional observation and time-series observations (Quah, 1993). For instance, Muhammad et al. (2012) studied automobile sale and macroeconomic variables in five ASEAN countries (i.e., Indonesia, Malaysia, Philippines, Singapore, Thailand) and employed PMG method; furthermore, annual data were from 1996 to 2010. MG and PMG require selecting the appropriate number of lags selected by AIC and SBC.

While each variable was stationary at level I(0) or I(1), autoregressive distribution lags ($p, q_1, q_2, q_3, q_4, q_5$) method which was employed to study the dynamic process followed the form:

$$\begin{aligned}\ln GDP_{it} = {} & \sum_{j=1}^{p} \lambda_{ij} \ln GDP_{i,t-j} + \sum_{j=0}^{q_1} \beta_{1i,j} GEXP_{i,t-j} + \sum_{j=0}^{q_2} \beta_{2i,j} GEXP_{i,t-j}^{2} \\ & + \sum_{j=0}^{q_3} \beta_{3i,j} \ln L_{i,t-j} + \sum_{j=0}^{q_4} \beta_{4i,j} \ln K_{i,t-j} + \sum_{j=0}^{q_5} \beta_{5i,j} \ln X_{i,t-j} + \mu_i + \varepsilon_{it}\end{aligned} \tag{3}$$

where $i = 1, 2, ..., 8$ is a number of countries

$t = 1995, ..., 2011$ is time

$j = p, q_1, q_2, q_3, q_4,$ or q_5 is a number of lags

A. Mean Group Estimator

The long-run parameters of country i are:

$$\beta_{1i} = \left(\sum_{j=0}^{q_1}\beta_{1i,j}\right) / \left(1-\sum_{j=1}^{p}\lambda_{ij}\right) \quad \beta_{2i} = \left(\sum_{j=0}^{q_2}\beta_{2i,j}\right) / \left(1-\sum_{j=1}^{p}\lambda_{ij}\right) \quad \beta_{3i} = \left(\sum_{j=0}^{q_3}\beta_{3i,j}\right) / \left(1-\sum_{j=1}^{p}\lambda_{ij}\right)$$

$$\beta_{4i} = \left(\sum_{j=0}^{q_4}\beta_{4i,j}\right) / \left(1-\sum_{j=1}^{p}\lambda_{ij}\right) \quad \beta_{5i} = \left(\sum_{j=0}^{q_5}\beta_{5i,j}\right) / \left(1-\sum_{j=1}^{p}\lambda_{ij}\right)$$

As a result of estimation using MG method, the long-run parameters are:

$$\beta_1 = \frac{1}{8}\sum_{i=1}^{8}\beta_{1i} \quad \beta_2 = \frac{1}{8}\sum_{i=1}^{8}\beta_{2i} \quad \beta_3 = \frac{1}{8}\sum_{i=1}^{8}\beta_{3i} \quad \beta_4 = \frac{1}{8}\sum_{i=1}^{8}\beta_{4i} \quad \beta_5 = \frac{1}{8}\sum_{i=1}^{8}\beta_{5i}$$

B. Pooled Mean Group Estimator

The ARDL model can be re-parameterized in the vector error correction model term:

$$\begin{aligned}\Delta \ln GDP_{it} &= \phi_i\left(\ln GDP_{i,t-1} - \beta_1 GEXP_{it} - \beta_2 GEXP_{it}^2 - \beta_3 \ln L_{it} - \beta_4 \ln K_{it} - \beta_5 \ln X_{it}\right) \\ &+\sum_{j=1}^{p-1}\gamma_{ij}\ln GDP_{i,t-1} + \sum_{j=0}^{q_1-1}\alpha_{1i,j}\Delta GEXP_{i,t-j} + \sum_{j=0}^{q_2-1}\alpha_{2i,j}\Delta GEXP_{i,t-j}^2 \\ &+\sum_{j=0}^{q_3-1}\alpha_{3i,j}\Delta \ln L_{i,t-j} + \sum_{j=0}^{q_4-1}\alpha_{4i,j}\Delta \ln K_{i,t-j} + \sum_{j=0}^{q_5-1}\alpha_{5i,j}\Delta \ln X_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (4)\end{aligned}$$

where phi (ϕ_i) is speed of adjustment. Generally, it is a negative sign because the economy faces the crisis, so that the economy will converge to long-run equilibrium by following the speed of adjustment (ϕ_i). If phi is zero, it indicates that there is no evidence in long-run relationship.

The pooled mean group denotes slops of each variable and speed of adjustment as follows:

$$\phi_i = -\left(1-\sum\nolimits_{j=1}^{p}\lambda_{ij}\right) \qquad \beta_1 = \sum\nolimits_{j=0}^{q_1}\beta_{1i,j} / \left(1-\sum\nolimits_{j=1}^{p}\lambda_{ij}\right)$$

$$\beta_2 = \sum\nolimits_{j=0}^{q_2}\beta_{2i,j} / \left(1-\sum\nolimits_{j=1}^{p}\lambda_{ij}\right) \qquad \beta_3 = \sum\nolimits_{j=0}^{q_3}\beta_{3i,j} / \left(1-\sum\nolimits_{j=1}^{p}\lambda_{ij}\right)$$

$$\beta_4 = \sum\nolimits_{j=0}^{q_4}\beta_{4i,j} / \left(1-\sum\nolimits_{j=1}^{p}\lambda_{ij}\right) \qquad \beta_5 = \sum\nolimits_{j=0}^{q_5}\beta_{5i,j} / \left(1-\sum\nolimits_{j=1}^{p}\lambda_{ij}\right)$$

$$\gamma_{ij} = -\sum\nolimits_{m=j+1}^{p}\lambda_{im} \;\; j=1,2,...,p-1 \qquad \alpha_{1i,j} = -\sum\nolimits_{m=j+1}^{q_1}\beta_{1i,m} \;\; j=1,2,...,q_1-1$$

$$\alpha_{2i,j} = -\sum\nolimits_{m=j+1}^{q_2}\beta_{2i,m} \;\; j=1,2,...,q_2-1 \qquad \alpha_{3i,j} = -\sum\nolimits_{m=j+1}^{q_3}\beta_{3i,m} \;\; j=1,2,...,q_3-1$$

$$\alpha_{4i,j} = -\sum\nolimits_{m=j+1}^{q_4}\beta_{4i,m} \;\; j=1,2,...,q_4-1 \qquad \alpha_{5i,j} = -\sum\nolimits_{m=j+1}^{q_5}\beta_{5i,m} \;\; j=1,2,...,q_5-1$$

3.3 The calculation of the optimal size of government expenditure

The maximum value is computed by differentiation of equation (2) with respect to public spending (GEXP), and this expression is put equal to zero. That is:

$$\frac{\partial \ln GDP}{\partial GEXP} = \beta_1 + 2\beta_2 GEXP = 0 \Rightarrow GEXP = -\frac{\beta_1}{2\beta_2} \quad \beta_1 > 0, \beta_2 < 0 \qquad (5)$$

In deciding sensibly optimum value, second derivative of equation (2) is made. That is:

$$\frac{\partial^2 \ln GDP}{\partial GEXP.\partial GEXP} = 2\beta_2 < 0 \qquad \beta_2 < 0 \tag{6}$$

The equation (5) shows the maximum of public expenditure share of GDP.

4. Data Collection

This study covered eight ASEAN countries (i.e., Brunei Darussalam, Cambodia, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam). Lao PDR and Myanmar were not covered in this study because it was difficult to find the reliable and sufficient data. The period of each variable was from 1995 to 2011. This study mostly used annual data measured U.S dollar in constant price 2005 with exception of the total population and government expenditure which were measured in person and share of GDP, respectively. The dependent variable was real GDP per capita obtaining from World Bank indicator 2013, proxy for real GDP. Similarly, the main independent variable was government expenditure share of GDP obtaining from ADB indicator 2013, but Singapore data were obtained from IMF WEO 2013 database. The other independent variables were total population, gross fixed capital formation, and total export goods and services obtaining from World Bank indicator 2013, proxies for labor, capital, and total export, respectively.

5. Empirical Results

5.1 Panel unit root tests

The statistic test in term of natural logarithm of GDP per capita, labor force, capital, and total export was taken; exceptionally, government spending and square of government spending were not in term of natural logarithm. The result showed that three variables (i.e., lnGDP, lnK, lnX) among of all variables were stationary since the tests were statistically significant (Table 1). The other variables (i.e., GEXP, $GEXP^2$, lnL) were non-stationary since the null hypothesis non-stationary was not rejected at the 5 percent significant level. After that, the test of a first difference in variables which were non-stationary at integration of order zero I(0) offered credible evidence of stationary I(1). Consequently, each variable was stationary at a different level I(0) and I(1).

Table 1: Unit root tests

	Levin-Lin-Chu	Im-Pesaran-Shin	Fisher-ADF	Fisher-PP
	Adjusted t	w-t-bar	ADF statistics	PP statistics
Ln GDP	0.552	3.287	-1.229	-2.510
GEXP	-3.006**	-1.649*	5.508**	2.360**
$GEXP^2$	-3.191**	-1.813*	5.544**	2.823**
Ln L	-3.200**	1.320	10.311**	60.588**
Ln K	0.129	2.113	1.866*	-1.479
Ln X	-3.515**	0.133	2.772**	-0.761
Δ Ln GDP	-2.321*	-5.654**	12.108**	11.179**
ΔLn K	-2.355**	-4.329**	10.687**	16.195**
ΔLn X	-10.596**	-8.734**	6.851**	25.108**

Note: Δ and GEXP are the first derivative and government spending, respectively. * and ** denote the significant level at 5 percent and 1 percent, respectively. Three among these tests indicate stationary, so the variable is concluded as stationary.

5.2 Penal long-run elasticity

All variables were stationary with different orders I(0) and I(1), so MG and PMG methods were appropriate to estimate dynamics of regressors on regressand because both methods do not require each variable to be stationary at the same level. The obtainable results of MG and PMG from ARDL (2, 2, 2, 1, 1, 1) are presented in Table 2. The outcome of Hausman test did not reject the null hypothesis at significant level of 5 percent. According to Guggenberger (2008), the result of Hausman test does not reject null hypothesis while probability is equal to one or close to one. Each coefficient's standard error in PMG was smaller than MG when standard error was observed. From PMG estimate, the error correction coefficient ($\phi = -0.364$) was statistically different from zero. Thus, this evidence proved that there was the long-run co-integration of these variables. The result of testing the long-run coefficients of all variables was statistically significant. The equation of this relation could be written.

$$\ln GDP = -4.189 + 0.04792 GEXP - 0.00084 GEXP^2 + 0.179 \ln L + 0.278 \ln K + 0.355 \ln X \tag{7}$$

From equation (7), all long-run slopes were correct signs along with expected hypothesis and theory. Consequently, it is evident that labor force, capital, and total export strongly promoted economic growth. By looking at another explanatory variable, government spending in Southeast Asian countries was absolutely confirmed that there was an inverted U shape with economic growth. This means that the higher size of public expenditure causes to the lower economic growth. Therefore, higher government spending than threshold hurts the economy.

The maximum value was computed by differentiation of equation (7) with respect to public spending (GEXP), and this expression was put equal to zero. As a result, the maximum government spending was 28.5 percent of GDP.

TABLE 2. Pooled mean group and mean group for panel long-run elasticity

	PMG estimate	MG estimate	Hausman test
Long- run coefficient			
$GEXP_{it}$	0.04792**	-0.13668	1.00
	(0.01183)	(0.28774)	
$GEXP^2_{it}$	-0.00084**	0.00502	
	(0.00024)	(0.00722)	
LnL_{it}	0.17947**	-1.45533	
	(0.05382)	(2.92391)	
LnK_{it}	0.27811**	0.31485	
	(0.00889)	(0.27996)	
LnX_{it}	0.35521**	0.63873	
	(0.02317)	(0.57624)	
Error correction coefficient			
phi	-0.36401*	-0.59131	
	(0.17018)	(0.37462)	
Short-run coefficient			
$\Delta LnGDP_{i,t-1}$	-0.08989	-0.65131	
	(0.08870)	(0.49582)	
$\Delta GEXP_{it}$	0.02902	-0.04885	
	(0.01754)	(0.16491)	
$\Delta GEXP_{i,t-1}$	0.04924*	-0.02284	
	(0.02393)	(0.15106)	
$\Delta GEXP^2_{it}$	-0.00091*	-0.00028	
	(0.00045)	(0.00400)	
$\Delta GEXP^2_{i,t-1}$	-0.00136*	0.00020	
	(0.00068)	(0.00401)	
ΔLnL_{it}	-1.42933	-49.15012	
	(1.75441)	(35.22801)	

ΔLnK_{it}	0.07819	-0.13264
	(0.04882)	(0.21897)
ΔLnX_{it}	0.04022	0.18627
	(0.05326)	(0.21140)
Constant	-4.189011*	-24.26301
	(2.00235)	(25.51246)

Note: The maximum period and groups are T=17; N=8. AIC and SBC are employed to select lags for each variable. Standard error in parentheses; * and ** denote the significant level at 5 percent and 1 percent, respectively.

6. Discussions

6.1 Convergence to other researches

There have been many studies focusing on the non-linear relation between government spending and economic growth. The present study indicated that optimal government expenditure was 28.5 percent of GDP. This outcome could be higher than real optimum of government spending in each ASEAN country because panel data, data of each entry or country which is combined into a dataset to analyze, were occupied. In another way, to reduce a number of observations might cause the smaller value than this outcome if the time-series data, data for each country, with the same period are utilized to analyze separately. Friedman (1997) pointed out the optimal size of total public spending ranged from 15 percent to 50 percent. This finding was higher than maximum of government spending of 25.2, 20.4 and 22.5 percent for Turkey, Romania and Bulgaria, respectively (Altunc and Aydm, 2013; Mavrow, 2007). The possible explanation could be that they studied in time-series data, so there was the small number of observations even within the same period. The history of government expenditure shows data trend. If the short period is covered, the shock which causes sudden increase or decrease of the expenditure to stable economy during that time affects the estimated result. The outcome might be higher or lower than the real optimum of government expenditure. Thus, the optimal size of government spending is different from one country to another or one research to another depending on period and observations. Chao and Bubel (1998), Vender and Gallawn (1998), Pevin (2004), and Facchini and Melki (2013) occupied the OLS method requiring that all variables observed in their studies are stationary with the same order. In preset study, pooled mean group (PMG) was utilized, and it does not demand integrated variables with the same order. The trend of original data is indicated by the stationary order, so it leads selection of an appropriate estimate method that delivers the credible result. Consequently, PMG is more flexible to estimate each slope of variables.

This finding was remarkably consistent with numerous studies using different time series from individual country (Chao and Gubel, 1998; Vendder and Gallaway, 1998; Chen and Lee, 2005; Mavrov, 2007; Altunc and Aydm, 2013; Facchini and Melki, 2013) and panel countries (Pevcin, 2004; Chobanov and Mladenov, 2009). Particularly, the OECD countries were mostly studied in panel data, and the results showed that optimal size of government expenditure was 40 percent (Pevin, 2004) and 25 percent (Chobanov and, 2009). Difference between estimated maximum size of public spending and the real optimum could occur in our study because of limited data of each country.

6.2 Convergence to theory

The result showed the inverted U shape of relationship between government expenditure and economic growth; even though, there were limited observations or data. The finding indicates that a low government size causes a large multiplier for economy while this gradually increased spending leads to diminishing multiplier. If increasing government expenditure is in excess of the point which multiplier is zero, it also causes the negative impact on the economy. Therefore, both the neo-classical theory expressing the negative effect and Keynesian theory pointing out the highly positive impact are correct. The reason is that Neo-classical theory fully trusts in a balanced budget that is primary goal of fiscal policy. If the government takes on loan to boost economy, they will increase taxes to repay or print more money into the system. In the case of the tax raise, it seems that the government borrows from a person to pay back the person whom the government owes. Another way is print more bank notes that will lead to higher and higher inflation; thus, the economy is hurt. On the other hand, Keynesian always believes that general employment has positive correlation with the aggregate demand for consumer goods because consumers' need is always greater than producers' capacity at the appropriate price. Thus, a government should intervene in the economy to keep up aggregate demand and full employment and borrow money to spend if the government does not have enough money. In the bargain, this result completely agrees with Barro (1990) raising that there is not monotonic direction of government spending on economic growth, and Armey (1995) stating that growth has diminishing of return while the government expenditure is larger and larger. However, the optimal government expenditure occurs in different levels for each country because of the period or unobservable variables included in the present study. From other reasons, the political environment and different history of total government expenditure also causes a difference in optimal government spending. While each ASEAN country clearly knows the efficient government expenditure, it provides personal benefit for policy makers who properly manage their expenditure.

7. Conclusions

The study presented empirical estimation of relation between government spending and economic growth for panel data of eight ASEAN countries and covered period from 1995 to 2011. By looking at an method, PMG method could be employed to estimate slopes of each variable which was stationary with different order I(0) or I(1). These eight countries are hurt by crisis in 2008 and considered as developing countries. They have needed the government expenditure to recover and to stimulate the economy. Furthermore, ASEAN countries are going to integrate into the ASEAN Economic Community by 2015 to increase ability in production and to extent the market into the world. To achieve this goal, government intervention plays a crucial role in narrowing among ASEAN countries.

This finding emphasized that there was strongly long-run co-integration between economic growth and independent variables (i.e., government expenditure, labor force, capital, total export). Increasing labor force, capital and total export significantly stimulated the real GDP along with Solow-Swan theory. In addition, there was absolutely inverted U relation of government expenditure with economic growth in eight ASEAN countries. The result suggested that the optimal size of government spending in eight ASEAN countries represented 28.5 percent of GDP. For the advantage of this outcome, the government in each ASEAN country may manage efficiently its total expenditure, so it does not cause the detrimental impact on economic growth.

Further studies are necessary to confirm experimentally the effect of public spending on economic growth by carrying on the inverted U relation of public spending with economic growth. Extending time series as well as analysis of an individual country for their study or modifying for all parts of public expenditure such as military, education, and agriculture expenditure should be monitored.

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