Government Expenditure And National Income: Causality Tests For Five South East Asian Countries

Ergun Dogan, (E-mail: ergun.dogan@buseco.monash.edu.my), Monash University, Malaysia
Tuck Cheong Tang, Monash University, Malaysia

ABSTRACT

This study aims to determine the direction of causality between national income and government expenditures for Indonesia, Malaysia, Philippines, Singapore, and Thailand. Granger causality tests are used to investigate the causal links between the two variables. Times series data covering last four decades are used. Support for the hypothesis that causality runs from government expenditures to national income has been found only in the case of Philippines. There is no evidence for this hypothesis and its reverse for the other countries.

INTRODUCTION

This study examines the causality direction between government expenditure and economic growth for Indonesia, Malaysia, Philippines, Singapore, and Thailand. The issue of whether increasing government expenditures are the cause of economic growth or economic growth is the cause of increasing government expenditures is especially important for developing countries where the public sector absorbs a relatively large share of society's economic resources.

We use time series data to examine the direction of causality between government expenditures and growth. We first examine the statistical properties of the data, such as stationarity, and try to determine whether or not there is a long-term relationship between the two variables by using cointegration methods. Then we use the methodology developed by Granger to test two hypotheses. The first hypothesis we test is that the government expenditure is endogenous, an outcome of growth of national income (usually known as Wagner's law). The second hypothesis is that government expenditure is an exogenous factor that can influence growth.

The remainder of the paper is organized as follows: The next section introduces the analytical framework, and also includes a brief review of the related literature. Section 3 describes the data and methods used in the analysis. Empirical findings are reported in Section 4, and conclusions are discussed in the final section.

Analytical Framework and Previous Literature

In this section we introduce Wagner's law in detail. As mentioned above Wagner views public spending as an endogenous factor, which is determined by the growth of national income (Wagner, 1890). The relationship he postulated between the government expenditures and national income in the late 19th century has come to be known as Wagner's "law", which basically states that as per capita income increases, public sector's importance will grow (Bird, 1971, p.2). Wagner proposed three reasons why the share of government spending GDP would increase in importance as an economy grows. First, as industrialization progresses public sector activity will substitute for private sector activity because state's administrative and protective functions would increase in importance during the industrialization process. State's role in maintaining law and order as well as its role in activities related to economic regulation is likely to become more pronounced due to the increasing complexity of economic life and urbanization, which occur during industrialization. Furthermore, public spending on cultural and welfare services (including education and income redistribution) would also increase as a country industrializes due to the high income elasticity

of demand for these services - an implicit assumption in Wagner's work. This means that as per capita income increases demand for the services mentioned above, which are usually provided by the government increases rapidly, raising the share of public sector expenditure in GDP. Finally, technological change and growing scale of firms would tend to create monopolies whose effects the state will have to offset.

Another rationale for the law can be found in public choice models, such as the one analyzed by Meltzer and Richard (1981). In their model government spending is undertaken to satisfy the median voter, which would generate a relationship between economic growth and government expenditure if the position of the decisive median voter in the income distribution shifts towards the lower end. For example, as economy grows incomes of skilled workers might increase much more than the incomes of unskilled workers, leading to increased inequality. In the Meltzer-Richard model this would imply more votes for redistribution, and eventually a higher level of government spending (Oxley, 1994, p.288).

Next, we review some of the related studies. Islam (2001) in his re-examination of Wagner's hypothesis for the USA found that the relative size of government expenditures and real Gross National Product per capita are cointegrated by using Johansen-Juselius's cointegration approach. Moreover, Wagner's hypothesis is strongly supported by the result of Engle-Granger (1987) error correction approach. The study used annual data for the period of 1929-1996. Ansari et al (1997) attempt to determine the direction of causality between government expenditure and national income for three African countries Ghana, Kenya, and South Africa, using standard Granger testing procedures and the Holmes-Hutton (1990) causality test, which is a modified version of the Granger test. The study uses annual data on per capita government expenditure and national income for the period from 1957 to 1990. Both variables were deflated by using the GDP deflator for each country. The study finds that in Ghana, Kenya and South Africa there is no long run equilibrium relationship exists between government expenditure and national income over the sample period. For these countries, there is no evidence of Wagner's hypothesis or the reverse being supported in the short run, except for Ghana where Wagner's law is supported. Abizadeh and Yousefi (1998) use South Korean data to test Wagner's law. They first conduct Granger type causality tests, and then estimate a growth equation and a government expenditure growth equation by using annual data for the period of 1961-1992. They exclude government expenditures from the GDP to obtain the private sector GDP, and use this in their tests. After comparing the results from the estimations authors conclude that government expenditures did not contributed to economic growth in Korea. Singh and Sahni (1984) use the Granger causality test to determine the causality direction between national income and public expenditures in India. Total (aggregate) as well as disaggregate expenditure data for the period of 1950-1981 were used. Data used in the study were annual and deflated by using implicit national income deflator. The study finds no causal process confirming the Wagnerian or the opposite view.

METHODOLOGY

This paper uses Granger type causality methodology to determine the causality direction between the two variables we are concerned with in this study. The simplest Granger causality test (Granger, 1969) is:

$$\ln Y_t = b'_0 + \sum_{i=1}^{n} b'_{1i} \ln Y_{t-i} + \sum_{i=1}^{n} b'_{2i} \ln G_{t-i} + e'_t \quad (1)$$

$$\ln G_t = \delta'_0 + \sum_{i=1}^{n} \delta'_{1i} \ln G_{t-i} + \sum_{i=1}^{n} \delta'_{2i} \ln Y_{t-i} + u'_t \quad (2)$$

where ln Y_t is the natural logarithm of real per capita GDP, and ln G_t is the natural logarithm of real per capita total government expenditure. e'_t and u'_t are white noise error terms. The null hypothesis for equation 1 is that 'ln G does not Granger cause ln Y'. This hypothesis would be rejected if the coefficients of the lagged Gs (summation of b'_{2i} as a group) are found to be jointly significant (different from zero). The null hypothesis for equation 2 is that 'ln Y does not Granger cause ln G'. This hypothesis would be rejected if the coefficients of the lagged Ys (summation of δ'_{2i} as a group) are found to be jointly significant. If both of these null hypotheses are rejected, then a bi-directional

relationship is said to exist between the two variables (G and Y in this case). The standard Granger causality test procedure is valid for only stationary series, I(0). A series would be stationary if it had a tendency to move to a fixed mean over time. For those series that are not stationary a cointegration test must be done first. If the series are cointegrated error correction model has to be used to test for the causality instead of the standard Granger test. We use the cointegration method developed by Johansen and Juselius (1990). The details of this method are not reported here since it is well-documented and widely used in the literature.

In the error correction model, the relevant error-correction terms (EC_{t-1}) [1] are included in the standard Granger causality procedure after all variables have been made stationary by differencing, which yields equations 3 and 4.

$$\Delta \ln Y_t = b_0 + \sum_{i=1}^{n} b_{1i} \Delta \ln Y_{t-i} + \sum_{i=1}^{n} b_{2i} \Delta \ln G_{t-i} - b_3 EC_{t-1} + e_t \quad (3)$$

$$\Delta \ln G_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i} \Delta \ln G_{t-i} + \sum_{i=1}^{n} \delta_{2i} \Delta \ln Y_{t-i} - \delta_3 EC_{t-1} + u_t \quad (4)$$

where Δ is first difference operator, e_t and u_t are white noise error terms. The independent variables are said to 'cause' the dependent variable if the error correction term (EC_{t-1}) is significant (b_3 or δ_3 are nonzero) *or* the coefficients of the lagged independent variables (summation of b_{2i} in equation 3 or summation of δ_{2i} in equation 4) are jointly significant. However, if the series are not cointegrated, Granger test is carried out without the error correction terms.

DATA AND EMPIRICAL RESULTS

The data on annual Gross Domestic Product, Total Government Expenditure[2], and population of each country come from *World Tables,* World Bank (dXtime, version 4).

Using annual data is appropriate here because government spending is not very sensitive to seasonal and cyclical fluctuations. This makes the relationship between the two variables of interest (national income and government expenditure) very stable over different quarters in a year. (Singh and Sahni, 1984) Hakkio and Rush (1991) argue that increasing the number of observations by using monthly or quarterly data do not add any robustness to the results in tests of cointegration. What matters more is the length of the period under consideration. The period of study for each country covers 1960 to 2002. We use real *per capita* Government expenditure (G), and real *per capita* GDP (Y), both measured in natural logarithms.

The plots in the Appendix indicate that there is an increasing trend in real per capita GDP (Y) and real per capita Government expenditures (G) for the five countries. Also evident from the plots is the positive association between the two variables.[3] Our goal in this section is to find out whether this positive association implies that more government spending causes higher income or higher income leads to more spending. It is also possible that the association between the two variables is not causal in any direction, but just coincidental.

[1] The error-correction terms are once lagged residuals obtained from the cointegrating regressions.

[2] In *World Tables* publications General Government Consumption, is defined as follows: "General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditure on national defence and security, but excludes government military expenditures that are part of government capital formation." (World Bank, http://www.worldbank.org/data/working/def7.html)

[3] Correlation coefficients between real per capita GDP and Government Expenditure for each country over the sample period are 0.9376 (Indonesia), 0.9543 (Malaysia), 0.8679 (the Philippines), 0.988 (Singapore), and 0.985 (Thailand).

We start with identifying the order of integration, I(d), of both series. Phillips-Perron (1988) unit root test (PP) approach was adopted for this purpose. The PP test is designed to be robust for the presence of autocorrelation and heteroscedasticity. The regression equation for the PP [AR(1) process] is given by:

$$\Delta Y_t = a + bY_{t-1} + \varepsilon_t \quad (5)$$

where ε_t is the regression error assumed to be stationary with zero mean and constant variance. The tests are carried out to reject the null hypothesis of a unit root ($b = 1$).

Table 1 reports the test results for the presence of unit root in the two series that we use in this study. The PP statistics indicate that the series of real per capita GDP and real per capita government expenditure for all sampled countries, the Philippines, Thailand, Indonesia, Malaysia, and Singapore are non-stationary I(1).

Table 1. Philip-Perron Unit Root Results

Country	Variable	Unit root Statistic Level	First Difference	Degree of integration
Indonesia	ln Y	-2.200(3)	-4.454(1)*	I(1)
	ln G	-2.934(4)	-8.273(2)*	I(1)
Malaysia	ln Y	-2.237(3)	-5.321(2)*	I(1)
	ln G	-2.857(6)	-7.377(6)*	I(1)
The Philippines	ln Y	-1.732(1)	-3.611(3)*	I(1)
	ln G	-2.097(2)	-4.291(2)*	I(1)
Singapore	ln Y	-0.242(2)	-5.052(3)*	I(1)
	ln G	-1.854(2)	-5.254(0)*	I(1)
Thailand	ln Y	-1.872(3)	-3.965(0)*	I(1)
	ln G	-2.285(1)	-4.600(1)*	I(1)

Notes: * denotes 1% significant level based on MacKinnon's critical values.
In levels regressions constant and time trend were included into Unit root regression.
In the regressions with first difference only the constant was included.
(.) is the truncation lag included as suggested by Newey-West method, $q = 4(T/100)^{2/9}$.
ln Y is the natural logarithm of real per capita GDP.
ln G is the natural logarithm of real per capita total Government expenditure.

Since the variables used in all the cases are non-stationary, I(1), we perform a cointegration test to find out whether a linear combination of these series converge to an equilibrium or not. Two series (variables) are said to be cointegrated if they each are non-stationary, at least I(1), and if their linear combination converges to an equilibrium. (Engle and Granger, 1987) This means that cointegrated variables have a long term equilibrium relationship. Johansen and Juselius's (1990) cointegration method was used for cointegration analysis. The cointegration and causality tests were carried out only on the first-difference stationary variables, I(1). Johansen and Juselius, procedure test results are presented in table 2 (the order of lag-length was determined by Schwarz Information Criterion (SIC) and Akaike Information Criterion (AIC).

The test statistics fail to reject the null hypothesis of no cointegrating relation at 10 per cent significance level, except in the case of Indonesia (See the trace test and the maximal-eigenvalue statistics for cointegration test in Table 2). This indicates that in these four countries there is no long run relationship between real per capita national income and real per capita government expenditures over the sample period. However, the two variables are found to be cointegrated in the case of Indonesia's data.

Table 2: Johansen And Juselius's Cointegration Test Results

Countries	VAR(d)	Null hypothesis	Maximal-eigenvalue statistic	90% critical value	Trace statistic	90% critical value
Singapore	VAR(1) based on AIC & SIC	r = 1	4.3621	16.28	4.4024	21.23
		r at most 1	0.0403	9.75	0.0403	9.75
Malaysia	VAR(1) based on AIC & SIC	r = 1	10.1967	16.28	14.8548	21.23
		r at most 1	4.6581	9.75	4.6581	9.75
Thailand	VAR(2) based on AIC	r = 1	11.5583	16.28	18.856	21.23
		r at most 1	7.2977	9.75	7.2977	9.75
	VAR(1) based on SIC	r = 1	5.7991	16.28	9.4614	21.23
		r at most 1	3.6623	9.75	3.6623	9.75
Indonesia	VAR(1) based on AIC & SIC	r = 1	17.775*	16.28	25.6285*	21.23
		r at most 1	7.8535	9.75	7.8535	9.75
The Philippines	VAR(2) based on AIC & SIC	r = 1	14.1719	16.28	17.5939	21.23
		r at most 1	3.422	9.75	3.422	9.75

Notes: * denotes rejection of the null hypothesis at 10% level. The critical values are from Pesaran, et al., (2000). The maximum lag length of three years were included due to the conventional practice that the data used is yearly in nature.

Next, we report the Granger causality test results obtained by vector auto regression (VAR) approach for Singapore, Thailand, the Philippines, and Malaysia. The VAR regressions do not include error correction terms since we find that the variables are not cointegrated for these countries. Due to the use of annual data, the lag order of VAR of 1, 2, and 3 years are estimated. Results are reported in Table 3.

The Wagner's hypothesis is not supported for these countries. There is no evidence supporting the reverse hypothesis for Singapore, Thailand, and Malaysia. However, interestingly, reverse hypothesis is empirically supported by the Philippines' data. The hypothesis that growth of real per capita government expenditure does not Granger cause growth of real per capita GDP is rejected at 5 per cent significant level.

Since in the case of Indonesia the two series converge in the long run, that is lnG and lnY are cointegrated, standard Granger causality approach (VAR approach) can not be used to yield approximate results. So we do the Granger test with error correction terms from the cointegrating equations included in a regression that also includes once-differenced variables (Δln Y and Δln G). (See equations 3 and 4 for the error correction model.) Results are reported in table 4. Surprisingly, both Wald tests and t-tests (for error correct term) are found to be insignificant even at 10 per cent level over the three different lag lengths of 1, 2 and 3 years. This means that there is no evidence of supporting either the Wagner's hypothesis or the reverse in the case of Indonesia.

Table 3: Granger Causality Test Results via VAR

Lag length of VAR	1	2	3
Null Hypothesis:	F-Statistic	F-Statistic	F-Statistic
Singapore			
DlnG does not Granger Cause DlnY	0.034	0.115	0.157
	(0.854)	(0.892)	(0.924)
DlnY does not Granger Cause DlnG	1.635		0.732
	(0.209)	0.963 (0.391)	(0.541)
Thailand			
DlnG does not Granger Cause DlnY	0.412	0.322	0.327
	(0.525)	(0.727)	(0.806)
DlnY does not Granger Cause DlnG	0.036	1.466	0.941
	(0.851)	(0.245)	(0.432)
The Philippines			
DlnG does not Granger Cause DlnY	10.118	4.922	3.304
	(**0.003**)	**(0.013)**	**(0.033)**
DlnY does not Granger Cause DlnG	0.905	0.317	0.824
	(0.348)	(0.730)	(0.490)
Malaysia			
DlnG does not Granger Cause DlnY	0.193	2.129	1.606
	(0.663)	(0.134)	(0.207)
DlnY does not Granger Cause DlnG	0.200	0.118	0.759
	(0.657)	(0.889)	(0.525)

Notes: D is first different operator. (.) is the p-value

Table 4. Granger Causality Test Results via Error Correction Model – Indonesia

Lag:-	1		2		3	
Dependent variable:-	$DlnX_{t-1}$ t-ratio	ECT, t-ratio	Wald test, F-statistic	ECT, t-ratio	Wald test, F-statistic	ECT, t-ratio
DlnY	0.2103	-1.311	0.662	-1.488	1.7016	-1.515
	(0.835)	(0.1979)	(0.7179)	(0.1458)	(0.6366)	(0.1398)
DlnG	0.7794	-1.6566	0.40988	-0.9222	2.1306	-0.67157
	(0.441)	(0.106)	(0.8147)	(0.3629)	(0.5457)	(0.5068)

Notes: ECT stands for error-correction term. (.) is p-value. X is Y or G.

Our finding that there is no causality link, one-way or two-way, between government expenditures and national income (except for the Philippines where the reverse of the Wagner's hypothesis is supported) might be due to the deficiencies in data and methodological problems. For instance, there might be a bias introduced by using aggregate government expenditure data. It is possible that different components of expenditure affect real income in different ways, but when aggregate expenditure data are used these effects might be difficult to detect. If this is the case, further study of the same issues with disaggregate government expenditure data would be necessary.

Our results will be biased if there are local or global structural breaks in the data such as the one caused by 1970 oil shock. We have used a Chow test to check whether or not there was a structural change due to 1970 oil shock. The results (not reported here, but available upon request) do not indicate that there was a structural break in 1970.

The findings of this study may be interpreted in several ways. We start with the Wagner's hypothesis. To detect the hypothesized causal relationship between national income and government spending, rate of increase of the latter must be greater than that of the former, so that the share of government spending in national income increases over time. However, for some reason, if spending keeps on increasing at a slower pace than the pace national income grows at; hypothesized causal link between the two will be weakened, making it more difficult to detect the link in the

data. According to Ansari et al (1997) spending pattern could be smoother because of the debt financing obligations (perhaps to the international bodies), that a government might have.

Inability of the government to increase taxes beyond a certain level would also prevent government spending from keeping pace with national income since how much the government can increase its expenditures is determined by its revenues. This argument is not new. For instance, Peacock and Wiseman (1967) argue that tax rates are fixed due to political and social forces, and the behavior towards tax rates would only change in a severe crisis such as war (Bird, 1971).[4] In the absence of such a crisis or shock government spending will not increase unless the demand for public sector services is highly income-elastic.

Another way in which economic growth or industrialization could reduce the rate of increase in tax revenues, thereby making it more difficult to detect a possible link between industrialization and government spending has been noted in Ferris and West (1996). Authors, following Kau and Rubin (1981), point out that due to economic growth a larger proportion of the labor force in a country might get transferred to less visible earnings and be able to avoid paying taxes. A specific example of a process that would generate such a transfer is urbanization, which in Kau and Rubin's framework is "a measure of the larger set of opportunities available to closely located taxpayers to avoid formal markets (through such activities as barter). This, it is argued, will increase the cost to government and allow individuals some escape from taxation" (Ferris and West, 1996, p.542) .

More research, perhaps in the form of detailed case studies, is needed to determine whether there were external shocks strong enough to displace the inertia over tax rates or urbanization have had any impact on the collection of tax revenues in the five countries this study covers. Since there have been large-scale rural-urban migration in most of the developing countries at least the latter hypothesis is likely to hold in the five countries we study.

As for the reverse hypothesis, standard crowding out process might be in operation in the countries under study. By this we refer to well known negative effect of increasing government expenditures on private consumption and investment via an increase in the real interest rate. This would be the case if a government deficit arises, and the deficit is financed by domestic debt. Debt financing might lead to a credit squeeze, and a subsequent increase in real interest rates. The result, at least, theoretically, is the crowding out of private consumption and investment. For our purposes, that is, to explain the lack of any causal link from government spending to national income, crowding out must be at such a level that at the end there is no effect on aggregate expenditures and the national income, i.e. one for one crowding out.

CONCLUSIONS

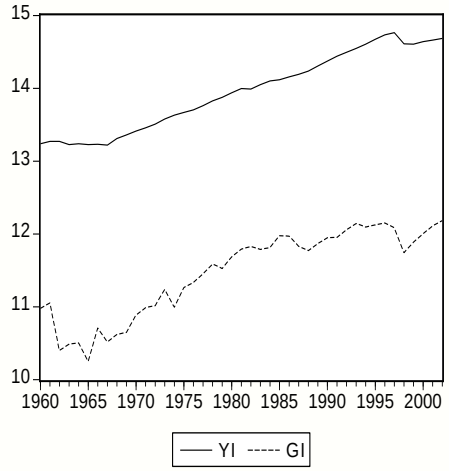
The objective of the paper is to investigate the causality relation between government expenditures and national income by testing for the Wagner's hypothesis and its reverse for five South East Asian countries: Indonesia, Malaysia, Singapore, the Philippines, and Thailand.

We use Johansen-Juselius cointegration method to detect a long term relationship between real per capita national income and real per capita government expenditure in all sample countries, but do not detect any such relationship, except for Indonesia.

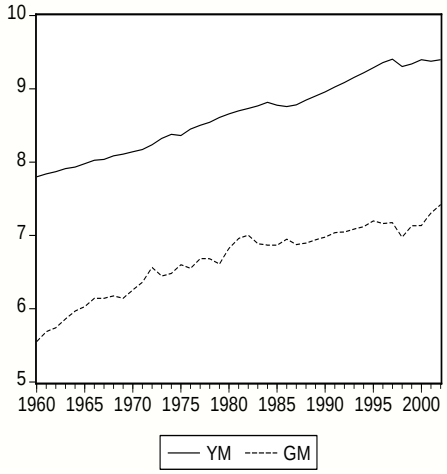
The results of Granger causality tests indicate that Wagner's law is not supported by the data of five countries in our sample. This means no causal link runs from real per capita income to real per capita Government expenditure. The Granger causality tests indicate that the reverse hypothesis is supported only by the Philippines's data, suggesting that the direction of causality is from government expenditure to national income. Our findings also indicate that government expenditures do not play a significant role in promoting economic growth in the four countries in our study (the Philippines is the exception). This is surprising because it is widely believed that government has played an important role in the development of these countries.

[4] This is known as displacement hypothesis.

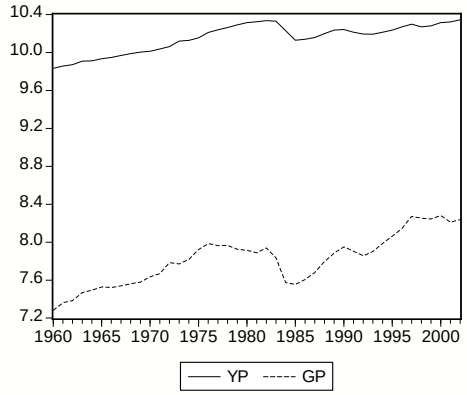
APPENDIX 1: Plots of Series of Real per capita GDP (Y) and Real per capita Government Expenditure (G) (in natural logarithm)



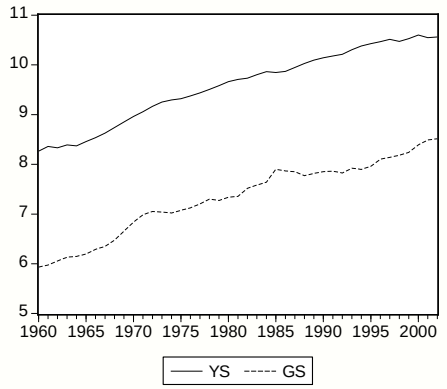
Indonesia 1960-2002



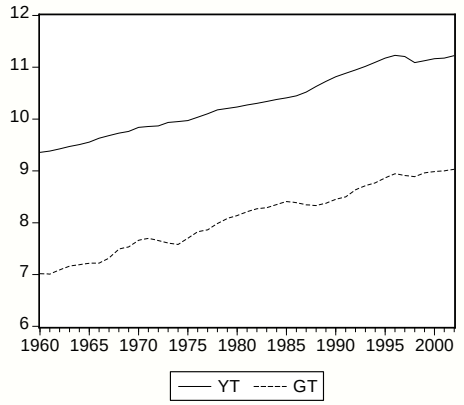
Malaysia 1960-2002



The Phillipines 1960-2002



Singapore 1960-2002



Thailand 1960-2002

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