Further Evidence on Public Spending and Economic Growth in East Asian Countries

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Abstract

This article examines Wagner's Law for East Asian countries (China, Hong Kong, Japan, Taiwan and South Korea) for the period 1960 to 2007. Using the Gregory and Hansen (1996a & b) structural break techniques, we find a cointegrating relationship between real government spending and real income. Our preferred Gregory and Hansen models are with the level shift for Hong Kong and Taiwan and regime shift (change in intercept and slope coefficients) for China, Japan and South Korea. The income elasticity of government spending ranges from 0.756 to 1.155. With these findings, we infer that Wagner's Law does hold for these countries, except for Hong Kong where the income elasticity is not highly statistically significant.

Keywords: Real Government Spending, Real Income, Gregory and Hansen Structural Break Techniques.

JEL: C22; H50

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1. Introduction

The link between public spending and economic growth has been examined vastly in the empirical literature. In the original study, Wagner (1883) formulated his famous law in which he argued, on the basis of several developed countries, that there is a positive long run relationship between public spending and national income. The public spending in Wagner's Law is treated as an endogenous factor, that is, in the long run causality runs from national income to government spending. The basic Wagnerian assumption is that public spending increases at a faster rate than the growth of national income. From this perspective, Wagner quote this as "the law of increasing expansion of public, and particularly state, activities' becomes for the fiscal economy the law of the increasing expansion of fiscal requirements..." (Gemmell 1993, pp.104 and Muhlis and Hakan 2003, pp.58). Alternatively, Keynes (1936) postulates that fiscal policies boosts economic growth during a recession. In other words, causality runs from government spending to national income.

The relationship between government spending and national income is important for policy issues over the short to medium term. First, the current unprecedented worldwide recession has strained many central authorities to amplify spending on required sectors. In this case, the empirical results based on Wagner's Law permits the respective governments to formulate a benchmark against which to evaluate the stance of expenditure policy and by and large fiscal policy.[1] Second, this relation is relevant for the debate on the sustainability of public finances, especially during the phase when governments struggle to restrain the unwarranted spending. Therefore, this relation provides a framework to formulate appropriate budgetary adjustment plans with an outlook to attaining medium term budgetary objectives and/or reducing prolonged deficits. Because of these important policy implications, the validity of Wagner's Law should be tested within an adequate methodological framework. One of the problems identified by Abizadeh and Gray (1985) and Ram (1987) is the availability of public finance data. This law, in spite of a number of empirical investigations with alternative specifications and estimation techniques, still remains popular. Recent key empirical studies on Wagner's Law have been critically surveyed by Peacock and Scott (2000). They conclude that majority of these studies contain misspecification bias and intensively use sophisticated estimation techniques that over-elaborate the results.

In light of the above observations it would be imprudent to argue that our present paper is the final in examining the Wagner's Law. The main purpose of this paper is to show how the Wagner's Law can be analysed with a technique that allows for structural breaks in the cointegrating relationship. We examine the Wagner's Law for East Asian countries (China, Hong Kong, Japan, Taiwan and South Korea) with the well-known Gregory and Hansen (1996a & b) techniques for the period 1960-2007. The balance of this paper is organized as follows: Section 2 briefly provides an overview of the literature. Section 3 discusses the specification and methodology. Section 4 details empirical results and Section 5 concludes.

2. Brief Overview of the Literature

Wagner's Law has been tested empirically for various countries using cross-section, time series and panel data methods, and results vary considerably from country to country with

[1] Arpaia and Turrini (2008) explicitly outlines the importance and application of Wagner's law in the context of EU countries.

some supportive and some opposing evidence. The main findings of a few selected studies are summarized in Table-1. Essentially these studies estimate one or more of the following equations.

$$\ln G_{it} = \alpha_i + \beta_i \ln Y_{it} + \varepsilon_{it} \quad (1)$$

$$\ln G_{it} = \alpha_i + \beta_i \ln PCY_{it} + \varepsilon_{it} \quad (2)$$

$$\ln PCE_{it} = \alpha_i + \beta_i \ln PCY_{it} + \varepsilon_{it} \quad (3)$$

$$\ln GY_{it} = \alpha_i + \beta_i \ln PCY_{it} + \varepsilon_{it} \quad (4)$$

$$\ln GY_{it} = \alpha_i + \beta_i \ln Y_{it} + \varepsilon_{it} \quad (5)$$

where $G =$ real total government spending, $Y =$ real GDP, $PCY =$ real GDP per capita, $PCE =$ real total government spending per capita, $GY =$ ratio of real total government spending to real GDP, i and t are country and time subscripts and $\varepsilon_{it} \sim N(0,\sigma)$ for all i and t.

{Table 1 about here}

As presented in Table 1, studies such as Cotsomitis *et al.* (1996), Ahsan *et al.* (1996), Abizadeh and Yousefi (1998), Kolluri *et al.* (2000), Islam (2001), Chang *et al.* (2004) and Sideris (2007) produced evidence in favor of Wagner's Law.[2] Alternatively, studies such as Courakis *et al.* (1993), Ansari *et al.* (1997), Chow *et al.* (2002), Burney (2002), Muhlis and Hakan (2003), Huang (2006), Sinha (2007) and Narayan *et al.* (2007) find little support for Wagner's Law. For a comprehensive literature survey, see Peacock and Scott (2000). Most importantly, none of these studies has examined the possibility of a structural break in the long run cointegrating relationship. Therefore, in what follows, we start with a clean slate and examine the Wagner's Law in East Asian countries with the recently developed Gregory and Hansen (1996a & b) structural break techniques.

3. Specification and Methodology

3.1. Model Selection

The central issue in testing Wagner's Law is the choice of appropriate model specification. Initially, we tested equations (1) to (5) for cointegration using Gregory and Hansen techniques. We find meaningful results with only (1).[3] Therefore we will use equation (1) to examine the validity of Wagner's Law in East Asian countries. A similar specification was also used by Peacock and Wiseman (1961), Bird (1971), Gandhi (1971), Ram (1992), Courakis *et al*. (1993) and Oxley (1994). If Wagner's Law holds, the coefficient on real income will be significant and positive. We use annual time series data for the period 1960-2007 and these can be sourced from the International Financial Statistics CD-ROM (IFS, 2008) and World Development Indicators (WDI, 2008).

3.2 Cointegration with Structural Breaks

Gregory and Hansen (1996a & b) has developed a unique structural break test which accommodates a single endogenous break in an underlying cointegrating relationship. This technique is an extension of Zivot and Andrews (1992). Gregory and Hansen (GH

[2] Chang *et al*. (2004) and Abizadeh and Yousefi (1998) has produced some mixed results.

[3] The null hypothesis of no cointegration was not rejected in equations (2) to (5). These results are not reported to conserve space.

henceforth) has proposed the following four models with alternative assumptions about structural breaks.

Model-I: Level shift

$$\ln G_t = \mu_1 + \mu_2\,\delta_{tp} + \alpha_1\,\ln Y_t + \varepsilon_t \tag{6}$$

Model-II: Level shift with trend

$$\ln G_t = \mu_1 + \mu_2\,\delta_{tp} + \beta_1 t + \alpha_1\,\ln Y_t + \varepsilon_t \tag{7}$$

Model-III: Regime shift where intercept and slope coefficients change

$$\ln G_t = \mu_1 + \mu_2\,\delta_{tp} + \beta_1 t + \alpha_1\,\ln Y_t + \alpha_{11}\,\ln Y_t\,\delta_{tp} + \varepsilon_t \tag{8}$$

Model-IV: Regime shift where intercept, slope coefficients and trend change

$$\ln G_t = \mu_1 + \mu_2\,\delta_{tp} + \beta_1 t + \beta_2 t\delta_{tp} + \alpha_1\,\ln Y_t + \alpha_{11}\,\ln Y_t\,\delta_{tp} + \varepsilon_t \tag{9}$$

where t is time subscript, p is the break date, δ is a dummy variable and ε is an error term, such that:

$$\delta_{tp} = 0 \quad \text{if} \quad t \leq p \quad \text{and} \quad \delta_{tp} = 1 \quad \text{if} \quad t > p \tag{10}$$

The GH tests the null hypothesis of no cointegration with structural breaks against the alternative of cointegration. The break date is found by estimating the cointegration equations for all possible break dates in the sample. We select a break date where the test statistic is the minimum or in other words the absolute ADF test statistic is at its maximum. GH have tabulated the critical values by modifying the MacKinnon (1991) procedure for testing cointegration in the Engle-Granger method for unknown breaks.

4. Empirical Results

4.1. Unit root tests

We first test for stationarity properties of the variables. Specifically, we use the Augmented Dicky Fuller (*ADF*) and Phillips Perron (*PP*) tests and the results are reported in Table-2. The *ADF* tests have been applied for both levels and their first differences with an intercept and trend. The *ADF* and *PP* statistics for the level variables (government spending and income) do not exceed the critical values (in absolute terms). However, when we take the first difference of each of the variables, the *ADF* and *PP* statistics are higher than the respective critical values (in absolute terms). Therefore, in all cases the level variables are $I(1)$ and their first differences are stationary.

{Table 2 about here}

4.2 Gregory and Hansen Tests

In what follows, we report our *GH* results. The four models in Equations (6) to (9) are estimated from 1960-2007 and the results are presented in Table-3.

{Table 3 about here}

The null hypothesis of no cointegration is rejected for China because the GH test statistic (absolute) is higher than 5 percent critical value (absolute) in models 2 and 3. For Hong Kong and Taiwan, Model I rejects the null hypothesis while in case of Japan and South Korea its model III. These results imply that there exists a long run relationship between real government spending and real GDP in the East Asian countries. The endogenously determined break date is 1997 or 1998 in these models.[4] The break date in the sample at 1997/98 is plausible because this period highlights the Asian financial crises. The financial crises gripped much of East Asia during 1997/98 and raised fears of a worldwide economic meltdown due to financial contagion.[5]

Next we have used Engle Granger technique to estimate the cointegrating equations for the models in which cointegration exists. These results are reported in Table-4. We disregard the estimates of model II for China because the income elasticity is insignificant with unexpected negative sign. However, our results with model III for China are plausible and therefore we select this as the optimal model. For Hong Kong the income elasticity is significant only at 10 percent level. For other three countries, viz. Japan, Taiwan and South Korea, all the estimated coefficients are significant at 5 percent level. The income elasticity of government spending ranges from 0.756 to 1.155. This imply that a 1 percent increase in income leads to around 0.756 to 1.155 percent increase in government spending in these countries. With these findings, we infer that Wagner's Law does hold for the East Asian economies, albeit weak evidence in Hong Kong.

{Table 4 about here}

5. Conclusion

In this article, we examined the Wagner's Law for East Asian countries (China, Hong Kong, Japan, Taiwan and South Korea) using Gregory and Hansen (1996a & b) structural break techniques for the period 1960 to 2007. Our preferred Gregory and Hansen models are the level shift for Hong Kong and Taiwan and regime shift where intercept and slope coefficients change for China, Japan and South Korea. The break date in these models is either 1997 or 1998 and this is plausible because this period draws attention to the East Asian financial turmoil. The income elasticity of government spending is significant at 5 percent level for all these countries, except Hong Kong at 10 percent level. The income elasticity ranges from 0.756 to 1.155 implying that a 1 percent increase in income leads to around 0.756 to 1.155 percent increase in government spending. Thus, we conclude that Wagner's Law does hold for these East Asian countries, except for Hong Kong where the income elasticity is not highly statistically significant.

Our study does have limitations. First, we used a simple specification of Wagner's Law and ignored to add other variables such as money supply, relative prices and socio-

[4] We ignore the break dates of the models where no cointegration exists.

[5] The East Asian countries suffered mainly from the loss of demand and confidence, slumping currencies and devalued stock markets and other asset prices, see McKibbin and Martin (1998).

political factors. Second, we did not use disaggregated data that may provide some useful policy insights. We hope that our work is useful for further work on this topic.

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Table-1: Empirical Studies Related to Wagner's Law

Author	Country	Period	Specification/ Methodology	Main Findings
Courakis *et al.* (1993)	Greece Portugal	1958-1985	(1)/ ML	Equation (1) was extended to incorporate permanent income, relative prices, stabilization policy and socio-political factors. However, there is little evidence of Wagner's law in both countries.
Ahsan *et al.* (1996)	Canada	1952-1988	(1) and (4)/ EG	Support for Wagner's Law in Canada.
Cotsomitis *et al.* (1996)	China	1952-1992	(1) to (5)/ EG	Support for Wagner's Law in China.
Ansari *et al.* (1997)	Ghana Kenya South Africa	1963-1988 1964-1989 1957-1990	(1)/ EG	No support for Wagner's Law in all cases.
Abizadeh and Yousefi (1998)	South Korea	1961-1992	(1)/ ML	Private sector income Granger-cause expenditure growth. Government spending have not contributed to economic growth.
Kolluri *et al.* (2000)	G7 countries	1960-1993	(1)/ ECM	Support for Wagner's Law in G7 countries
Islam (2001)	USA	1929-1996	(4)/ JML	Support for Wagner's Law in USA
Burney (2002)	Kuwait	1969-1995	(4)/ JML	Equation (4) was extended to include other socioeconomic variables. In all cases, there is no support for Wagner's Law in Kuwait.
Chow *et al.* (2002)	UK	1948-1997	(1) and (4)/ JML	No Support for Wagner's Law. However, the inclusion of money supply re-establishes the long run link between government spending and income in UK.
Muhlis and Hakan (2003)	Turkey	1965-2000	(1) to (5)/ EG	No support for Wagner's Law in Turkey.
Chang *et al.* (2004)	10 Countries	1951-1996	(1) to (5)/ JML	Support for Wagner's Law in South Korea, Taiwan, Japan, UK and US. No support for Wagner's Law in Australia, Canada, New Zealand, South Africa and Thailand.
Huang (2006)	China Taiwan	1979-2002	(1) to (5)/ ARDL	No support for Wagner's Law in China and Taiwan.
Sinha (2007)	Thailand	1950-2003	(1) to (5)/ ARDL	No Support for Wagner's Law in Thailand.
Narayan *et al.* (2007)	Chinese Provinces	1952-2004	(1) to (3)/ Pedroni	Less support for Wagner's Law for China.
Sideris (2007)	Greece	1833-1938	(1) to (5)/ JML	Support for Wagner's Law in Greece.

JML is Johansen maximum likelihood, *EG* is Engle and Granger, *ARDL* is autoregressive distributed lag model, *ML* is autoregressive maximum likelihood and *ECM* error correction method.

Table 2: Results of ADF and PP Unit Root Tests

Variables	$\ln G$	$\Delta \ln G$	$\ln Y$	$\Delta \ln Y$
China				
ADF Statistic	0.166 [1]	6.523 [0]	1.702 [0]	10.581 [0]
PP Statistic	0.443 [5]	3.992 [2]	1.876 [2]	5.760 [4]
Hong Kong				
ADF Statistic	1.334 [0]	3.668 [0]	2.834 [1]	5.552 [1]
PP Statistic	1.779 [2]	5.671 [3]	1.221 [3]	4.902 [2]
Japan				
ADF Statistic	0.056 [0]	4.671 [1]	0.114 [1]	4.447 [1]
PP Statistic	0.557 [4]	8.730 [3]	0.905 [2]	8.100 [2]
Taiwan				
ADF Statistic	2.356 [0]	3.701 [0]	1.523 [1]	7.922 [0]
PP Statistic	0.388 [2]	4.112 [5]	2.030 [2]	10.860 [1]
South Korea				
ADF Statistic	0.117 [1]	7.369 [0]	0.892 [0]	5.366 [1]
PP Statistic	0.468 [3]	4.550 [2]	1.169 [2]	12.802 [2]

Notes: The ADF and PP critical values at 5%, respectively, are 3.521 and 3.519. The lag lengths for ADF and PP are in parenthesis.

Table-3: Cointegration Tests with Structural Breaks 1960-2007

	Break Date	GH Test Statistic	5% Critical Value	Existence of Cointegration
China				
Model-I	1984	-1.007	-3.603	No
Model-II	1997	-5.822	-3.603	YES
Model-III	1998	-6.501	-3.190	YES
Model-IV	1987	-1.427	-3.190	No
Hong Kong				
Model-I	1998	-3.844	-3.603	Yes
Model-II	2001	-0.176	-3.603	No
Model-III	1985	-1.223	-3.190	No
Model-IV	1997	-1.427	-3.190	No
Japan				
Model-I	1992	-2.550	-3.603	No
Model-II	1997	-1.998	-3.603	No
Model-III	1998	-5.626	-3.190	Yes
Model-IV	1998	-0.489	-3.190	No
Taiwan				
Model-I	1997	-6.003	-3.603	Yes
Model-II	1997	-0.006	-3.603	No
Model-III	2002	-1.532	-3.190	No
Model-IV	1986	-0.021	-3.190	No
South Korea				
Model-I	1997	-2.901	-3.603	No
Model-II	2002	-0.115	-3.603	No
Model-III	1997	-3.650	-3.190	Yes
Model-IV	1986	-1.263	-3.190	No

Table-4: Cointegrating Equations 1960-2007

	China		*Hong-Kong*	*Japan*	*Taiwan*	*South Korea*
	Model-II	Model-III	Model-I	Model-III	Model-I	Model-III
Intercept	1.376 (3.87)[a]	1.376 (3.87)[a]	0.734 (2.11)[a]	0.774 (2.11)[a]	1.602 (3.35)[a]	0.935 (2.15)[a]
Dum ×Intercept	0.628 (5.00)[a]	0.628 (5.00)[a]	-1.568 (2.02)[a]	1.944 (3.27)[a]	-0.056 (2.08)[a]	5.621 (1.85)[b]
Trend	6.772 (1.88)[b]					
$\ln Y_t$	-3.562 (0.72)	0.905 (4.52)[a]	1.003 (1.89)[b]	0.756 (5.58)[a]	0.899 (4.46)[a]	1.155 (2.17)[a]
Dum × $\ln Y_t$		1.102 (2.11)[a]		0.987 (4.75)[a]		1.266 (2.50)[a]

Notes: Absolute *t*-ratios are in parentheses below the coefficients. Significance at 5% and 10% levels are denoted by [a] and [b] respectively.