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GOVERNMENT EXPENDITURES IN CHINA AND TAIWAN: DO THEY FOLLOW WAGNER'S LAW?

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This paper tests Wagner's Law for China and Taiwan, using annual time series data covering the period 1979-2002. To estimate the long-run relationship between government expenditures and output, we use a robust estimation method known as the Bounds Test based on Unrestricted Error Correction Model (UECM) estimation (Pesaran *et al*. (2001)). Empirical results from the Bounds Test indicate that there exists no long-run relationship between government expenditures and output in China and Taiwan. Furthermore, Toda and Yamamoto's (1995) Granger non-causality test results also show that Wagner's Law does not hold for China and Taiwan over this same period.

Keywords: Wagner's Law, UECM, Bounds Test
JEL classification: C32, H10

1. INTRODUCTION

Over the past three decades, several studies have been devoted to test the validity of Wagner's Law, which postulates the tendency for government activities to expand along with economic expansion. Empirical tests of this law have yielded results that differ considerably from country to country. Several multi-country studies have been conducted, an example being the studies of Wagner and Weber (1977) which tests the law for 34 nations during the post World War II era. With the exception of France, Germany and Iceland, Wagner and Weber conclude that most Western democracies show trends supporting Wagner's Law. Studies done by Abisadeh and Gray (1985) cover the period 1963-1979 for 53 countries and point out that Wagner's Law holds true for the developing countries but not for poor and developed countries. On the other hand, studies by Ram (1986) examines 63 countries for the period 1950-1980 and finds limited support for Wagner's Law. Similarly, results presented by Afxentiou and Serletis (1996)

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examine six European countries (France, Italy, Germany, Belgium, the Netherlands and Luxembourg) over the period 1961-1991, also finding no strong evidence to support Wagner's Law in relation to any of these countries. The studies of Ansari *et al*. (1997) for three African countries, Ghana, Kenya, and South Africa, also find no evidence supporting Wagner's Law. However, a recent studies by Chang (2002) examines three emerging countries in Asia (South Korea, Taiwan, and Thailand) as well as three industrialized countries (Japan, the United States, and the United Kingdom) over the period 1951-1996, with the exception of Thailand, again supports the validity of Wagner's Law. The validity of Wagner's Law is further supported by country-specific studies, such as those presented by Ganti and Kalluri (1979), Yousefi and Abizadeh (1992), and Islam (2001) which have studied the law for the U.S., Khan (1990) for Pakistan, Gyles (1990) for the U.K., and Nomura (1995) for Japan. There is however, still a dissent among recent research as the studies of Mann (1980), Nagarajan and Spears (1990) and Lin (1995), which have obtained mixed results concerning the validity of Wagner's Law for Mexico, Chletsos and Kollias (1997) for Greece, and Pluta (1979) for Taiwan. The studies of Singh and Sahni (1984), and Afxentiou and Serletis (1991) for Canada, Henrekson (1993) for Sweden, and Burney (2002) for Kuwait do not support the Wagner's Law. In general, current studies do not support the Wagner's Law for under-developed or developed countries.

While previous studies focus mostly on the industrial and developing countries, this study attempts to contribute to the line of research using the Bounds Test proposed by Pesaran *et al*. (2001), and Toda and Yamamoto's (1995) Granger non-causality test to examine Wagner's Law for China and Taiwan. The reason why China and Taiwan are selected in this study is as follows. Taiwan is one of the recently industrialized countries of Asia and is the world's third largest holder of foreign exchange reserves after Japan and China. Furthermore, of the previously mentioned studies, only the studies presented by Pluta (1979) and Chang (2002) have been on Taiwan. Similarly, China has made remarkable economic progress over last few decades and its economic growth rate over the past decade (1990-2002) has been 9.48%. At the end of 2002, China became the world's fourth largest trading country with foreign exchange reserves of nearly US$290 billion. Another interesting area is that, China had only implemented an "Open-Door" policy in the late 1970s, and thus sufficient data are available for researchers to evaluate the effects of economic liberalization in various economic phenomena. However, since previous studies have not focused on this issue in relation to China, this study will be the first to test for the relationship with this specific situation of China with Wagner's Law.

2. METHODOLOGY

Empirically, Wagner's Law investigates the long-run relationships between government size (as generally denoted by government expenditures) and the economy (as conventionally denoted by output). Since there are different measures of government

size and output, there are different empirical versions of Wagner's Law. In this study, following Mann's (1980) study, five different versions of Wagner's Law are employed. To be consistent with most of the empirical versions of Wagner's Law, this study uses real terms of government expenditures. The five different models of testing Wagner's Law are presented as follows:

$$\text{Model 1:}\quad RG = f(RGDP), \tag{1}$$

$$\text{Model 2:}\quad RG = f\left(\frac{RGDP}{N}\right), \tag{2}$$

$$\text{Model 3:}\quad \frac{RG}{N} = f\left(\frac{RGDP}{N}\right), \tag{3}$$

$$\text{Model 4:}\quad \frac{RG}{RGDP} = f\left(\frac{RGDP}{N}\right), \tag{4}$$

$$\text{Model 5:}\quad \frac{RG}{RGDP} = f(RGDP), \tag{5}$$

where RG = real total government expenditures, $RGDP$ = real GDP, N = population, $RGDP/N$ = real GDP per capita, RG/N = real total government expenditures per capita, and $RG/RGDP$ = the ratio of real total government expenditures to real GDP. Models 1 and 2 refer to the "traditional" Peacock-Wiseman version (Peacock and Wiseman (1967)) and Goffman version (Goffman (1968)), respectively. Model 3 represents the Gupta/Michas version (Gupta (1967), Michas (1975)), model 4 represents the Musgrave version (Musgrave (1969)), and the Peacock-Wiseman "share" version is displayed in model 5. The major differences among these five versions are measures of government size and the economy. Government size is measured by real total government expenditures (in models 1 and 2), real total government expenditures per capita (in model 3), or real total government expenditures as proportion of real GDP (in models 4 and 5). The economy is measured by real GDP (in models 1 and 5) or real GDP per capita (in models 2, 3 and 4).

The bounds test proposed by Pesaran *et al.* (2001) is employed in this study because Pesaran *et al.*'s approach has two main advantages over the common practice of cointegration analysis (Engle and Granger (1987), Johansen (1988), Johansen and Juselius (1990)). First, the bounds test procedure can be applied irrespective of whether the explanatory variables are I(0) or I(1). Second, the methodology can be applied to studies with samples that are small in scale (Mah (2000)), as is the case in this study. For data with small sample sizes, no cointegrating relationship can be made among variables that are I(1) (Kremers *et al*. (1992)) and the ECM and Johansen (1988) methods are not reliable (Mah (2000)). Furthermore, the conventional ADF test (like many other unit root tests) suffers

from poor size and power properties especially in small samples (Harris (1995)).

Since our study has a very small sample size (24 observations), the cointegration relationships for our five versions of the Wagner's Law model are estimated using the recently-developed econometric techniques of the Bounds Test, which is based on the following UECM:

$$d\ln Y_t = a_0 + \sum_{i=1}^{K} a_{1i} d\ln Y_{t-i} + \sum_{i=1}^{K} a_{2i} d\ln X_{t-i} + a_3 \ln Y_{t-1} + a_4 \ln X_{t-1} + \varepsilon_t \,, \tag{6}$$

where $d\ln Y_t$ and $d\ln X_t$ are the first differences of the logarithms of Y and X, respectively. Y represents real total government expenditures in models 1 and 2, real total government expenditures per capita in model 3, and the ratio of real total government expenditures to real GDP in models 4 and 5. X represents real GDP in models 1 and 5 and represents real GDP per capita in models 2, 3, and 4. K is the optimal lag length for UECM; ε is a disturbance term assuming white noise and normal distribution.

Following Pesaran *et al*. (2001), the test is conducted in the following way. The null hypothesis is tested by considering the UECM in Equation (6) and excluding the lagged variables ln$Y$ and ln$X$, based on the Wald or F-statistic. The asymptotic distribution of the F-statistic is non-standard under the null hypothesis of no cointegration relationship between the examined variables, irrespective of whether the underlying explanatory variables are purely I(0) or I(1). More formally, we perform a joint significance test, where the null hypothesis is

$$H0: a_3 = a_4 = 0$$

For some significance level of α, if the F-statistic falls outside the critical bound, a conclusive inference can be made without considering the order of integration of the underlying regressors. For instance, if the F-statistic is higher (lower) than the upper (lower) critical bound, then the null hypothesis of no cointegration is rejected (accepted). In the case when the F-statistic falls inside the upper and lower bounds, a conclusive inference cannot be made. Here, the order of integration for the underlying explanatory variables must be known before any conclusion can be drawn.

In this study, Toda and Yamamoto (1995) causality tests are performed to test Wagner's Law for China and Taiwan. The models are presented as follows:

$$\ln Y_t = a_0 + \sum_{i=1}^{K+d_{\max}} a_{1i} \ln Y_{t-i} + \sum_{i=1}^{K+d_{\max}} a_{2i} \ln X_{t-i} + \varepsilon_t \,. \tag{7}$$

Here, $\ln Y_t$ and $\ln X_t$ are the logarithms of Y and X, respectively; K is the optimal lag length; $d_{\max}$ is the maximum order of integration in the system. As mentioned before, Y represents *RG* for models 1 and 2, *RG/N* for model 3, and *RG/GDP* for models

4 and 5. *X* represents *RGDP* for models 1 and 5 and *GDP/N* for models 2, 3, and 4. This allows us to test the null hypothesis that there is no Granger causality from *X* to *Y*, i.e., to test $H_0 : a_{2i} = 0$, i = 1, 2, …, K.[1] a Wald test, which is asymptotically distributed as a χ_k can be performed. The advantage of this procedure, as argued by Zapata and Rambaldi (1997), is that it does not require knowledge of the cointegration properties of the system. It has a normal limiting chi-square distribution, and the usual lag selection procedure to the system can be applied even if there is no cointegration and/or the stability and rank conditions are not satisfied "…so long as the order of integration of the process does not exceed the true lag length of the model…" (see Toda and Yamamoto (1995), p. 225).

3. THE DATA AND EMPIRICAL RESULTS

The data used in this study are real GDP, real government expenditures, and population. The annual data covers the period 1979-2002. The data for China are obtained from IMF's *International Financial Statistics* and the data for Taiwan are taken from the EPS/AREMOS data base of the Taiwan Ministry of Education.

Table 1. Bounds Testing for Cointegration Analysis

Model	Examined Variables	Lags	F statistic	10% Critical bounds	5% Critical bounds
China					
1	*RG, RGDP*	*K* = 2	0.37566	4.04-4.78	4.94-5.73
2	*RG, RGDP/N*	*K* = 1	0.56367	4.04-4.78	4.94-5.73
3	*RG/N, RGDP/N*	*K* = 1	0.57347	4.04-4.78	4.94-5.73
4	*RG/RGDP, RGDP/N*	*K* = 1	0.69589	4.04-4.78	4.94-5.73
5	*RG/RGDP, RGDP*	*K* = 1	0.66524	4.04-4.78	4.94-5.73
Taiwan					
1	*RG, RGDP*	*K* = 1	1.6204	4.04-4.78	4.94-5.73
2	*RG, RGDP/N*	*K* = 1	1.7972	4.04-4.78	4.94-5.73
3	*RG/N, RGDP/N*	*K* = 1	1.6272	4.04-4.78	4.94-5.73
4	*RG/RGDP, RGDP/N*	*K* = 1	1.5826	4.04-4.78	4.94-5.73
5	*RG/RGDP, RGDP*	*K* = 1	1.5882	4.04-4.78	4.94-5.73

Notes: Lag structure of K was selected based on the Schwartz criterion. The bounds critical values are obtained from Table CI(iii) Case III: unrestricted intercept and no trend for one regressor (Pesaran *et al.*

[1] According to Toda and Yamamoto (1995), if Z_t (here, Z_t are $\ln Y_t$ and $\ln X_t$, respectively) follows a VAR(K), we can then use standard causality tests, provided the VAR is augmented by d additional lags that are ignored in the causality test. In this study, the d is chosen as 0 and 1 for all of the models.

(2001), p. 300).

The Bounds Test results are reported in Table 1.[2] The computed F-statistic for five different Wagner's Law models for China all appear to be lower than the lower bounds critical values of 4.94 and 4.04 at 5% and 10% significance levels, respectively. These results indicate that there exists no cointegration between *RG* and *RGDP* in model 1, *RG* and *RGDP/N* in model 2, *RG/N* and *RGDP/N* in model 3, *RG/GDP* and *RGDP/N* in model 4, and *RG/RGDP* and *RGDP* in model 5. For Taiwan, the computed F-statistics for five different Wagner's Law models show similar results. Generally speaking, these results indicate that there exists no cointegration between government size and the economy in China and Taiwan over this test period. Empirically, Wagner's Law investigates the long-run relations between government size and the economy. If Wagner's Law statically holds true, it makes sense to conclude that a cointegration relationship (long-run relationship) should exist between government size and the economy. However, empirical results show that no such cointegration relationship can be found between government size and the economy in China and Taiwan. Therefore, the validity of Wagner's Law is not held for China and Taiwan.

Table 2. Granger Causality Test for China based on Toda and Yamamoto Test

Model	d	H_0	P-value
Output does not cause government expenditures			
1	0	*RGDP* does not cause *RG*	0.0954
	1		0.4768
2	0	*RGDP/N* does not cause *RG*	0.4208
	1		0.1485
3	0	*RGDP/N* does not cause *RG/N*	0.2413
	1		0.1329
4	0	*RGDP/N* does not cause *RG/RGDP*	0.0062*
	1		0.7561
5	0	*RGDP* does not cause *RG/RGDP*	0.0063*
	1		0.7238
Government expenditures does not cause output			
1	0	*RG* does not cause *RGDP*	0.8801
	1		0.8609
2	0	*RG* does not cause *RGDP/N*	0.8807
	1		0.0554
3	0	*RG/N* does not cause *RGDP/N*	0.7371
	1		0.0515
4	0	*RG/RGDP* does not cause *RGDP/N*	0.7371
	1		0.0515
5	0	*RG/RGDP* does not cause *RGDP*	0.6837
	1		0.0617

Note: $d_{\max}$ is the maximum order of integration in the system and, in our system, it is one.

* Denotes 5% level of significance.

[2] The lag lengths of K for each model were selected based on the Schwartz criterion (SC).

Table 3. Granger Causality Test for Taiwan based on Toda and Yamamoto Test

Model	d	H_0	P-value
Output does not cause government expenditures			
1	0	*RGDP* does not cause *RG*	0.0407*
	1		0.2031
2	0	*RGDP/N* does not cause *RG*	0.0360*
	1		0.1610
3	0	*RGDP/N* does not cause *RG/N*	0.0391*
	1		0.1824
4	0	*RGDP/N* does not cause *RG/RGDP*	0.5705
	1		0.5535
5	0	*RGDP* does not cause *RG/RGDP*	0.5880
	1		0.5615
Government expenditures does not cause output			
1	0	*RG* does not cause *RGDP*	0.7662
	1		0.7239
2	0	*RG* does not cause *RGDP/N*	0.9182
	1		0.7953
3	0	*RG/N* does not cause *RGDP/N*	0.7394
	1		0.7207
4	0	*RG/RGDP* does not cause *RGDP/N*	0.7394
	1		0.7206
5	0	*RG/RGDP* does not cause *RGDP*	0.7662
	1		0.7239

Note: $d_{\max}$ is the maximum order of integration in the system and, in our system, it is one.

* Denotes 5% level of significance.

Table 2 and Table 3 present the results of the Granger non-causality tests performed for China and Taiwan respectively, based on the Toda and Yamamoto (1995) approach. Toda and Yamamoto's studies clearly point to the independence between output and government expenditures in most of the cases, with a few exceptions where d is set to zero. Our empirical results support neither the Wagner's Law postulate, which states that as economic activity grows there is a tendency for government activities to increase, nor the Keynesian view, which states that the fiscal policy variables are major determinants of economic growth. As a matter of fact, in a large country like China with a strong power-based government, we would not expect economic growth and government activity to reinforce each other. Apparently, these empirical results are consistent with our expectations. Unlike the findings earlier by reported by Chang (2002), our empirical results do not support the validity of Wagner's Law for Taiwan. Nevertheless, it is worth pointing out here that our results are consistent with those found in previous empirical

studies which provide no evidence that supports Wagner's Law in relation to most industrial and developing countries. The major findings of our study have important implications within the economic and governmental system.

4. CONCLUSION

In this study we empirically test Wagner's Law for China and Taiwan over the 1979-2002 period, using Bounds Test proposed by Pesaran *et al*. (2001) and Toda and Yamamoto's (1995) Granger non-causality tests. The results from the Bounds Test indicate that there exists no long-run relationship between government size and the economy either in China or in Taiwan. Furthermore, Toda and Yamamoto's (1995) causality test results also show that Wagner's Law does not hold for China and Taiwan over this test period.

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