Economic growth and government expenditure in China

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ECONOMIC GROWTH AND GOVERNMENT EXPENDITURE IN CHINA

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ABSTRACT

In this paper, I study the relationship between government expenditure and
GDP in China using modern time series econometric techniques. To my
knowledge, there has not been any previous study exploring such relationship
for China. The regression results find general support for the existence of a
strong positive relationship between government expenditure and GDP. The
Granger causality tests indicate that there is some evidence that causality flows
from government expenditure to GDP but not the other way around.

I. INTRODUCTION

Adolf Wagner proposed that there is a positive correlation between the level of economic development and the scope of government. During the last 25 years, Wagner's law has been tested very intensively especially for the developed countries. In recent years, it has also been increasingly tested for the developing countries. However, to our knowledge, no study has explored the relationship between government expenditure and GDP in China. One possible reason might be that time series data on macroeconomic variables of a reasonable length were not available for China until very recently. This paper attempts to fill the gap. Annual data from the Penn World Table are for the period 1950-92. The Penn World Table data which were developed by the International Comparison Project in cooperation with the World Bank are reportedly more reliable than data from other sources. The data are being constantly updated. We use the most recent version of the Penn World Table (version 5.6). The data series are described in detail in Summers and Heston (1991).

As pointed out by Henrekson (1993), Wagner saw three main reasons for the increase in the government's role. First, industrialization and modernization would lead to a substitution of public for private activities. Expenditures on law and order as well as on contractual enforcement would have to be increased. Second, an increase in real income would lead to an expansion of the income elastic "cultural and welfare" expenditures. Wagner cited education and culture to be two areas in which the government could be a

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better provider than the private sector. Third, natural monopolies such as the railroads had to be taken over by the government because private companies would be unable to run these undertakings efficiently because it would be impossible to raise such huge finance that are needed for the development of these natural monopolies.

Different interpretations of the Wagner's Law has been tested for many different countries. Afxentiou and Serletis (1992) summarize these different interpretations.

(a) $G=f(Y)$ Peacock-Wiseman (1961)

(b) $GC=f(Y)$ Pryor (1968)

(c) $G=f(Y/N)$ Goffman (1968)

(d) $G/Y=f(Y/N)$ Musgrave (1969)

(e) $G/N=f(Y/N)$ Gupta (1967) and Michas (1975)

(f) $G/Y=f(Y)$ Mann's (1980) "modified Peacock-Wiseman version

where G, GC, Y and N stand for total government expenditure, (total) government consumption expenditure, gross domestic product and population respectively. Since the Penn World Table do not contain data on government consumption expenditure, we will limit our testing using all but (b) versions.

In recent years, China has achieved a remarkably high rate of economic growth. Since the beginning of the economic reforms, real GDP has grown at an average rate of over 9 percent (World Bank (1995)). However, in achieving such a high rate of growth, the economy has overheated a number of times resulting in a high rate of inflation. For example, the inflation rate was more

than 20 percent in 1994. In the context of China, the testing of the relationship

assumes special significance in view of the increasing role of the market

system in China. Past data on China will be useful in determining the

relationship between government expenditure and real GDP

Figure 1 shows government expenditure as a percentage of GDP (both

in real terms) in China for 1960-92. One striking feature that stands out is that

government expenditure as a percentage of GDP during never exceeded 17

percent during the period. This is surprisingly low for any country let alone for

a socialist country. Contrast this with India. Using the same source, we find

that government expenditure as a percentage of GDP was almost never below

25 percent during the same period in India. The Penn World Table uses the

same definitions for all variables for all countries. One of its purpose is to

make comparisons across countries easier. However, it still has to rely on

government agencies for getting basic data. Therefore, it is possible that

government expenditure data for China are grossly underestimated.

[Figure 1, about here]

II. ECONOMETRIC METHODOLOGY

The earlier studies testing the Wagner's Law do not test for stationarity

of the variables. This raises the possibility that these studies estimate spurious

relationships (see Granger and Newbold (1974) and Phillips (1986)).

If a variable is stationary ie, it does not have a unit root, it is said to be

I(0) (ie, integrated of order zero). If a variable is not stationary in its level form

but stationary in its first-differenced form, it is said to be integrated of order

one denoted by I(1). We will use the Phillips-Perron (1988) test. The test is

well suited for analyzing time series whose differences may follow mixed ARMA (p,q) processes of unknown order in that the test statistic incorporates a nonparametric allowance for serial correlation. Consider the following equation:

$$y_t = \tilde{c}_0 + \tilde{c}_1 y_{t-1} + \tilde{c}_2 (t - T/2) + v_t \tag{1}$$

where $\{y_t\}$ is the relevant time series in equation (1), T is the number of observations and v_t is the error term. The null hypothesis of a unit root is H_0: $\tilde{c}_1 = 1$. We can drop the trend term to test the stationarity of a variable without the trend.

The regressions, however, do not give us any indication of the causality. Thus, the cointegration analysis will be followed by Granger (1969) causality tests. The Granger causality tests are valid only if the variables are cointegrated or if the variables are I(0) (see Granger (1988)). If the variables are not cointegrated, causality tests can be conducted in the first differences of the variables provided the variables in their first difference forms are stationary. In our case, we will use the variables in their log forms. Thus, the first difference will give us the growth rates.

Let $\{x_t\}$ and $\{y_t\}$ be two time series. Suppose we regress y_t on past values of y and past values of x:

$$y_t = a_1 y_{t-1} + a_2 y_{t-2} + \ldots + b_1 x_{t-1} + b_2 x_{t-2} + \ldots + u_t \tag{2}$$

First, we run the regression the unrestricted regression (2) and and then we add conditions that $b_1 = b_2 = \ldots = 0$. Let the error sum of squares for the restricted and unrestricted equations be E(r) and E(u). Then

$$F(r, n-k-1) = [E(r)-E(u)/r]/[E(u)/(n-k-1)] \tag{3}$$

will have will have a F distribution with r and n-k-1 degrees of freedom where r is the number of restrictions and n-k-1 is the degrees of freedom in equation (3). Similarly, if we reverse the roles of the two variables, and run a similar test, we can conclude about causality in the opposite direction.

III. RESULTS

The results of the Phillips-Perron tests are in table 1. All variables were found to have trends. We use all variables in their log form (denoted by ln in front). Results indicate that ln(G), ln(Y), ln(Y/N) are stationary in their level form. However, ln(G/Y) and ln(G/N) are non-stationary. Although we do not show here, these two variables achieve stationarity after first differencing. Since at least one of the variables is stationary in its level form according to different formulations of the Wagner's Law, the question of testing for cointegration does not arise. If we use two variables in a regression and one of them achieves stationarity after differencing, then both variables have to be used in their first differences. Otherwise, there will be problems of interpretation.

[Table 1, about here]

The regression equations of different versions of the Wagner's Law are given below.

$$ln(G) = -4.7637 + 1.1359 \ln(Y) \qquad R^2 = 0.99 \qquad \text{D-W Statistic} = 1.77 \qquad (4)$$
$$ (-5.414) \ (26.574)$$

$$ln(G) = 7.2127 + 1.6722 \ln(Y/N) \qquad R^2 = 0.99 \qquad \text{D-W Statistic} = 1.74 \qquad (5)$$
$$ (28.477) \ (44.621)$$

$$\Delta\ln(G/Y) = 0.0127 - 0.0584\,\Delta\ln(Y/N) \quad R^2 = 0.01 \quad \text{D-W Statistic}=2.01 \qquad (6)$$
$$(1.639) \quad (-0.575)$$

$$\Delta\ln(G/Y) = 0.0140 - 0.0630\,\Delta\ln(Y) \quad R^2 =0.01 \qquad \text{D-W Statistic}=2.02 \qquad (7)$$
$$(1.647) \quad (-0.653)$$

$$\Delta\ln(G/N) = 0.0127 + 0.9416\,\Delta\ln(Y/N) \qquad R^2 =0.74 \quad \text{D-W Statistic}=2.01 \qquad (8)$$
$$(1.639) \quad (9.266)$$

T-ratios are given in parentheses. Δ stands for the first difference. For equations (4) and (5), the iterative Cochrane-Orcutt procedure had to be employed to overcome the problem of serial correlation. In the other three cases, the OLS was employed. For equations (6) and (7), we observe that we find a negative relationship between the government expenditure as a percentage of GDP and GDP and between government expenditure as a percentage of GDP and per capita GDP respectively when the variables are expressed in their first differences. This is contrary to expectations. However, we must note that in both cases, the estimated coefficient on the independent variable is not significant. Moreover, the explanatory power of the two equations as evidenced by R^2 is extremely low in both cases. Thus, we should not put much weight on these equations. Equations (4), (5) and (8) show that there is a strong positive relationship between government expenditure and GDP (in their various forms). This is in accordance with the expectations and supports Wagner's Law. Note that while equations (4) and (5) were estimated using variables in their levels, equations (6), (7) and (8) were estimated using the variables in their first differences. This strategy was obviously dictated by

the results of the stationarity tests as described earlier. The same strategy was used in doing the causality tests.

The results of causality tests with lags of one, two and three are in tables 2, 3 and 4 respectively. Akaike's Final Prediction Error (FPE) criterion was also used in selecting the lags but in all cases, the lag never exceeded three. With a lag of one, there is strong evidence that government expenditure (or the growth of government expenditure when first differences are used) in its various forms causes GDP (or the growth of GDP when first differences are used) in its various forms. With a lag of two or three, there is still a strong evidence that total government expenditure causes per capita income. However, the evidence of reverse causality (which supports Wagner's Law in the sense that a rise in GDP will cause a rise in government expenditure) is not very strong.

[Tables 2-4, about here]

IV. CONCLUSIONS

This paper looks at the relationship between government expenditure and GDP in China during 1960-92 using the Penn World Table data. The results of regressions generally support that there is a strong relationship between government expenditure and GDP. The causality tests do not provide much support for the Wagner's Law. However, there is fairly substantial support for the proposition that government expenditure causes GDP. One possible explanation for this phenomenon is that published data on government expenditure seem to be very low as a percentage of GDP. Thus, it is quite

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possible that at low levels, government expenditure can be quite effective in causing GDP to rise. But higher levels of government expenditure may not be that effective. Published data on government expenditure in China seem to be underestimates of actual government expenditure.

One obvious limitation of this study is that this study looks at aggregate government expenditure. Thus, it does not distinguish between government expenditure at various levels (ie, federal, province and local levels). It is quite possible that the relationship between government expenditure and real GDP will vary at various levels of government. Also, we do not distinguish between various types of government expenditures. For example, the effect of expenditure on subsidies on food for urban consumers may be quite different from that of expenditure on wages and benefits of the government employees. However, time series data at such disaggregated levels are not readily available. It must also be noted that almost all previous studies also explore the relationship at the aggregate level as we have done.

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Figure 1. Government Expenditure as a Percentage of GDP in China, 1960-92.
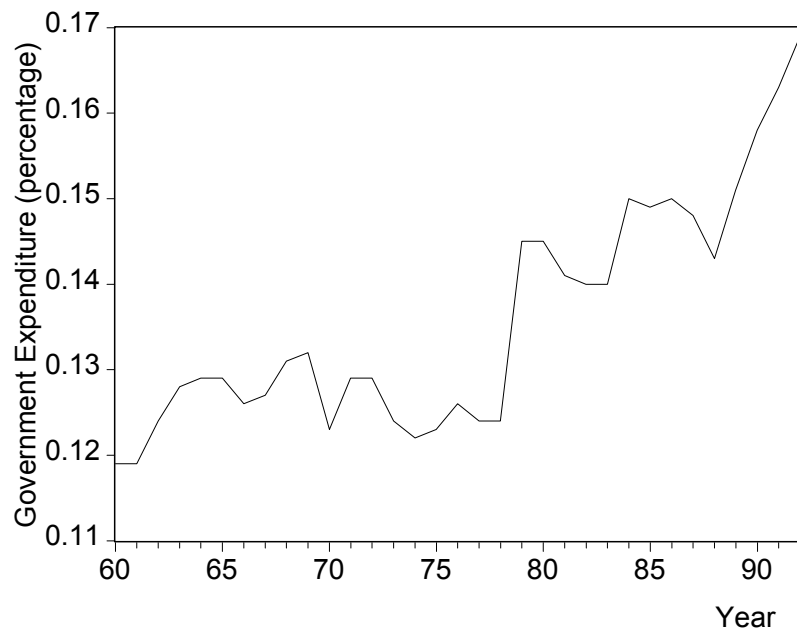
Table 1. Phillips-Perron Tests

Variable	Test Statistic
ln(G)	-4.0190
ln(Y)	-4.6248
ln(Y/N)	-4.6080
ln(G/Y)	-1.9188
ln(G/N)	-3.3535

Note: The test statistics for variables with constants and trends. All variables are found to have trends. The critical value at the 5% level are from Mackinnon (1991) is -3.5562. The lag of 3 was determined using the Schwert (1989) Criterion.

Table 2. Granger Causality Tests with Lag of One

Cause	Effect	Test Stat.	Probability
ln(G)	ln(Y)	3.7265	0.0634
ln(Y)	ln(G)	0.7880	0.3820
ln(G)	ln(Y/N)	33.071	0.0000
ln(Y/N)	ln(G)	13.919	0.0008
Δln(G/Y)	Δln(Y/N)	4.5408	0.0420
Δln(Y/N)	Δln(G/Y)	0.1950	0.6622
Δln(G/Y)	Δln(Y)	4.1023	0.0525
Δln(Y)	Δln(G/Y)	0.3386	0.5653
Δln(G/N)	Δln(Y/N)	0.6193	0.4379
Δln(Y/N)	Δln(G/N)	0.5408	0.0420

Table 3. Granger Causality Tests with Lag of Two

Cause	Effect	Test Stat.	Probability
ln(G)	ln(Y)	2.8623	0.0753
ln(Y)	ln(G)	0.2668	0.7679
ln(G)	ln(Y/N)	15.145	0.0000
ln(Y/N)	ln(G)	2.6741	0.0879
Δln(G/Y)	Δln(Y/N)	2.4406	0.1076
Δln(Y/N)	Δln(G/Y)	0.1021	0.9033
Δln(G/Y)	Δln(Y)	2.0407	0.1510
Δln(Y)	Δln(G/Y)	0.0579	0.9439
Δln(G/N)	Δln(Y/N)	2.4406	0.1076
Δln(Y/N)	Δln(G/N)	0.0115	0.9886

Table 4. Granger Causality Tests with Lag of Three

Cause	Effect	Test Stat.	Probability
ln(G)	ln(Y)	1.8864	0.1601
ln(Y)	ln(G)	0.0318	0.9922
ln(G)	ln(Y/N)	9.0949	0.0004
ln(Y/N)	ln(G)	2.1911	0.1166
Δln(G/Y)	Δln(Y/N)	2.3142	0.1038
Δln(Y/N)	Δln(G/Y)	1.3526	0.2832
Δln(G/Y)	Δln(Y)	1.7061	0.1949
Δln(Y)	Δln(G/Y)	1.4327	0.2602
Δln(G/N)	Δln(Y/N)	2.3142	0.1038
Δln(Y/N)	Δln(G/N)	0.8858	0.4638