CAUSAL RELATIONSHIP BETWEEN GOVERNMENT SIZE AND ECONOMIC DEVELOPMENT: AN EMPIRICAL STUDY OF THE U.S.

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ABSTRACT

This paper empirically examines the causal relationship between government size and economic development within the "Wagner's Law" of expanding government sector using a long annual time series data for the U.S. The Engle-Granger cointegration tests suggest that a long-run equilibrium relationship exists between the relative size of government and economic development as suggested by Wagner. The causality tests suggest that the causal linkage is uni-directional, which flows from economic development to relative government size. These results thus provide strong support for the Wagner's hypothesis for the U.S.

INTRODUCTION

Government sector in the United States has grown rapidly since the 1930's, especially since the World War II. This phenomenal growth has continued to the present. But in the 1980's, concern arose over the volume of spending and the resulting deficits and the national debt. As a result, the age-old controversy over the proper role of government and its appropriate size in the context of a mixed economy has intensified.

Various theoretical explanations have been provided by researchers towards a better understanding of the growth of government in the U.S. and other countries. One of the explanations of the government growth has been the well-known Wagner's law, which states that the government sector has a tendency to grow at a faster rate than the growth of the economy. Many researchers for different countries in particular have tested this law empirically over different time periods using both time-series and cross-section data, and using different definition of the relevant variables. The previous empirical tests of this hypothesis have reported mixed results.

The previous studies, however, suffer from data limitations and a number of methodological flaws. One major problem in previous studies has been that these studies have treated some measure of economic progress as an exogenous variable in explaining the size and growth of the public sector. This causal nexus is probably what Wagner had in mind. However, one may argue a reverse causal linkage running from the public sector growth to the progress of the economy. It is also possible to have a bi-directional causality existing between these variables. Therefore, it becomes an empirical question to determine the direction of causality between these variables, which are normally included in testing the Wagner's hypothesis. The existing studies on this subject have paid little attention on this critical issue.

The primary purpose of this study is to examine this causality question using both the standard Granger causality test and the more advanced Granger causality test, which is conducted within the error-correction framework. The causality tests are expected to detect various possible causal relationships (unidirectional causality, bi-directional causality, or independence) between the above-mentioned variables. In addition to the causality tests, this study utilizes other advanced econometric techniques such as the unit root tests and cointegration tests which were not utilized in previous studies. These techniques allow one to examine not only the long-run relationship hypothesized by Wagner, but also the short-run dynamics that occur within the long-run framework. The model is estimated using various advanced econometric methods. Annual time series data for the United States from 1929 to 1996 are utilized in this study.

This study makes an important contribution in the field by effectively quantifying the role of economic growth in explaining the expansion of the government sector in the U.S. This quantification is extremely important for resolving the controversy surrounding the Wagner's law of expanding government activity with the progress of society.

THE THEORETICAL FRAMEWORK

The first scholar who proposed a long-run relationship between the level of economic development and the size and scope of government was Adolph Wagner, a German economist. In *Grundlegung der politischen okonomie*, Wagner (1893) elaborated on his □law of increasing expansion of public, and particularly state, activities.□ Today, the view that there is a long-run tendency for the public sector to grow relative to national income has become widely accepted as a stylized fact in public finance (Atkinson and Stiglitz, 1980, p. 326; and Henrekson, 1990, p. 7).

Wagner's proposition was inspired by the empirical observation that the growth of public expenditure and output per capita had tended to be correlated in a number of otherwise markedly differing countries. From this fact it was inferred that there existed some kind of general law that related the growth of government to the growth of output per capita. Wagner (1893) gave three reasons for the increased role of the public sector in the economy, which is discussed below.

Firstly, Wagner argues that industrialization and modernization would lead to a substitution of public for private activity. In an increasingly complex society, the need for public protective and regulative activities would grow. In addition, the greater division of labor and urbanization accompanying industrialization would require higher expenditures on contractual enforcement as well as on the enforcement of law and order in order to ensure the efficient performance of the economy.

Second, Wagner (1893) reasoned that the progress of the economy would facilitate the relative expansion of income-elastic 'cultural and welfare' expenditures. He cited education and culture as areas where collective producers would in general be more efficient than private ones. Finally, Wagner (1893) argued that economic development and changes in technology required government to take over the management of natural monopolies in order to enhance economic efficiency. Similarly, the required scale of investment was in some cases (e.g. railroads) so large that the financing could not be done by the private sector alone.

A review of the relevant literature on Wagner's Law indicates that Wagner's Law can be interpreted as predicting an increasing relative share for the public sector in the total economy (g) as per capita real income (y) grows. Henrekson (1990, p. 7), for example, argues that "the most easily interpretable, and at the same time empirically correct, manner to test Wagner's Law (as it has normally been interpreted in the literature) is to relate the chosen expenditure ratio to GDP per capita". The two testable implications arising from this relationship are given below:

i) The growth in the share of the public sector (g) in GDP has a long-run equilibrium relationship with the progress of the economy as measured by real GDP per capita (y); and

(ii) The causal linkage runs from y to g.

Since (i) implies a long-run equilibrium relationship, the hypothesis has to be tested preferably within the context of a particular country over a long time period. More formally, the relationship given in (i) above can be presented in the following general form:

(1) $g = f(y)$

Since Wagner's hypothesis does not specify any specific functional form of this relationship, this study proposes to use a log-linear functional form because of it has two advantages over a linear functional form. Firstly, the coefficients in this form can be interpreted directly as elasticity values (Henrekson, 1990; and Maddala, 1992). Secondly, this formulation may reduce the problem of heteroskedasticity in the data (see Maddala, 1992; and Khan, Rahman and Islam, 1997). Using a log-linear functional form and using t as the time subscript and adding a random error term w, equation (1) can be rewritten as:

(2) $g_t = a\, y_t^{\ b}\, w_t$

Taking logarithms on both sides and using 'ln' to indicate the logarithmic transformation of the variables, equation (2) takes the following form:

(3) $\ln g_t = \ln a + b \ln y_t + \ln w_t$

In this paper, equation (3) is the empirically testable form of the long-run relationship proposed by Wagner. Note that this is a constant elasticity formulation of the general equation given by equation (1). In this formulation, Wagner's Law is supported if the following hypothesis holds:

(4) The elasticity coefficient exceeds zero: $b > 0$

And the random error term satisfies the usual regularity conditions (such as constant variance and no autocorrelation). Note that this interpretation is similar to Bird (1970; 1971) and Henrekson (1990), among others.

THE EMPIRICAL FRAMEWORK

Unit Root Tests

For model building, empirical testing, or policy purposes, researchers need to know whether a time series is stationary or non-stationary. For example, shocks to a stationary time series are temporary meaning that the effects of the shocks will be dissipated and the series will revert to its long run mean level (mean reversion). This may not happen in the case of a non-stationary series. As a result, it is important to empirically test whether a time series is stationary or non-stationary. A stationary series is generally characterized by a time-invariant mean and a time-invariant variance. There are alternative methods for testing for non-stationarity of a time series. This paper will apply the following two well known and by now widely used techniques to determine whether the variables in the model are stationary or non-stationary (see Dickey and Fuller (1979) and Phillips and Perron (1988) respectively for a discussion of these tests): (1) The Augmented Dickey-Fuller test (ADF test); and (2) The Phillips-Perron test (PP test).

Cointegration Tests: The Engle Granger (EG) Method

If the variables in the model were found to be non-stationary by the unit root tests, then the Engle-Granger (1987) cointegration would be applied. One could use the more advanced multivariate cointegration method as developed by Johansen-Juselius (1990). However, since this model involves only a bivariate relationship, the use of a multivariate technique may not be necessary. In this context, the Engle-Granger method is presumed to give efficient estimation involving a bivariate relationship. This method involves estimating the stated long-run equation by the standard regression technique and then the residuals are recovered for cointegration test by applying the ADF and the PP unit root tests. If these tests reveal that the residuals are stationary in their levels, and then one concludes that the variables in the long-run model are cointegrated, i.e. they share a common trend even though the variables in the stated model are individually non-stationary.

Short-run Dynamics Using the Error-Correction Model (ECM)

According to the `Granger Representation Theorem', if the variables in the long-run model are found to be cointegrated, then there must exist an associated error-correction model (henceforth called ECM). This ECM model can then be used to capture the short-run dynamics of the system and it can be used to distinguish between the short-run and the long run relationships among the variables. The procedure involves regressing the first difference of the dependent variable on the lagged values of the first differences of all these variables including the dependent variable and the lagged residuals from the long-run equilibrium regression.

The parameters of the ECM equation can be estimated by the OLS method since all the variables are stationary because they are in their first difference form. The coefficient of the lagged residual in the ECM equation is of particular interest because it represents the speed of adjustment parameter. The number of lags to be included in the ECM equation is determined such that the errors in this equation become white noise. Appropriate lag length tests need to be performed here to ensure white noise error terms. In view of the trade-off between bias and efficiency of the estimated parameters when the lag orders are changed, Akaike's (1969) final prediction error (FPE) criterion can be used for selecting the optimum lag lengths.

The magnitude of the speed of adjustment parameter is expected to be less than one in absolute terms for stability of the system and for the variables in the long-run regression to be cointegrated. If the system deviates from its long-run path, the sign and magnitude of this parameter would indicate respectively the direction of adjustment and speed at which the variables would adjust in the short-run in order to go back to its long-run equilibrium path.

Granger Causality Test With and Without the ECM Framework

The Granger causality test has been widely used in economics. In this paper, both the standard Granger causality test and the more advanced Granger causality test, which is conducted within the error correction framework, will be applied in deriving the causality results. These tests are discussed below.

On an intuitive level, the standard Granger (1969) causality test examines whether past changes in one variable, x, help to explain current changes in another variable, y, over and above the explanation provided by past changes in y itself. If this is true, then one concludes that x Granger causes y; otherwise, x does not Granger cause y. To determine whether causality runs in the other direction, one simply repeats the above experiment, but with x and y interchanged. Four possible outcomes are possible: (1) Unidirectional causality: x Granger causes y, but not vice versa; (2) Unidirectional causality: y Granger causes x, but not vice versa; (3) Bi-directional causality: x Granger causes y and y Granger causes x; and (4) Independence: neither variable causes the other.

The application of the Granger test requires that the variables, y and x, be stationary. Since most economic variables are non-stationary in level forms, the standard Granger causality test is conducted using regressions based on appropriately differenced stationary variables. This differencing process throws away useful long-run information about causal relationships among the variables. Therefore, it is advisable to apply the ECM framework to examine the Granger causality issue instead of the standard Granger method. The causality test within the ECM method is described below.

Granger (1983; 1986) and Engle and Granger (1987) developed a more sophisticated and more comprehensive test of causality within the framework of cointegration and error-correction (ECM) models. This methodology specifically allows for a causal linkage between two variables stemming from a common trend or long-run equilibrium relationship. More specifically, this new framework considers the possibility that the long-run information in the data represented by the lagged level of a variable, x, may help to explain the current changes in another variable, y, even if the short-run information in the data given by the past changes in x do not.

The intuition in this new methodology is that if y and x have a common trend, then the current changes in y is partly is the result of y moving into alignment with the trend value of x. Such causality may not be detected by the standard Granger test, which only examines only short-run information given by the past changes in a variable, x, help explain current changes in another variable, y. Note that the ECM framework can also be used to detect the possibility of having reverse or even bi-directional causality. As long as x and y have common trends, however, causality must exist in at least one direction within this ECM framework. Thus in the ECM framework, the possibility of finding no causality in either direction - one of the possibilities with the standard Granger test - is ruled out when the variables share a common trend (cointegrated).

In more formal terms, this new test is based on error-correction models that incorporate information from the cointegration properties of time-series variables as discussed earlier. In this method, one needs to test whether the residual series from the long-run regression is stationary or not. If the residual series is found to be non-stationary, it implies that there is no meaningful relationship between y and x. As a result, there is no need to proceed further to examine the existence of causal relationship between them. However, if these tests determine the existence of a long-run relationship, then one would proceed with the causality test by forming the error-correction model involving the first differences of the cointegrated non-stationary variables, which also includes the lagged residual of the long-run equilibrium model.

The inclusion of this last variable differentiates the error-correction model from the standard Granger causality regression. Thus, by including this term, the ECM model introduces an additional channel through which Granger causality may emerge. Based on this ECM framework, the null hypothesis that "x does not Granger cause y" is accepted or rejected based on the standard Wald F-test to determine the joint significance of the restrictions under the null hypothesis. If the null hypothesis is rejected, one concludes that x Granger causes y. Notice that the ECM framework allows for the possibility that x Granger causes y, even if the coefficients on lagged changes in x itself are not jointly significant.

To examine whether causality exists in the reverse direction, one needs to estimate the ECM equation with the first difference of the other variables as the dependent variable and then apply the Wald F-test against its restricted version. The null hypothesis that "y does not Granger cause x" is rejected if the appropriate coefficients including the coefficient of the lagged residual are jointly significant. In this case, y is said to Granger cause x. If both hypotheses are rejected, one then concludes that there exists a bi-directional causality (feedback) between y and x. As already mentioned above, in the ECM framework, the possibility of no causal relationship between y and x is ruled out because of the fact that y and x have a common trending relationship. It may be noted here that even in the absence of co-integration between two variables, the ECM model can still be estimated to test for short-run standard Granger causality (Bahmani and Payesteh, 1993). In this case, the error-correction term(s) should not be included in the model (s) for estimation purposes.

DATA AND VARIABLES

Several commentators on Wagner's Law (Musgrave, 1969, p. 73) have claimed that it is unclear whether the law relates to the relative share of government in national economy or just to the absolute size of government. Following the general consensus in the literature, this study used the relative size of government in testing this Law (see for example, Henrekson, 1990; and Timm, 1961). In *Finanzwissenschaft* (1883, p. 7) Wagner explicitly states that "State expenditure may be higher, in absolute terms and as a percentage of national income": (i) the higher the economic value of a service; (ii) the higher its contribution to general productivity; (iii) the higher the "free" national income, i.e. the part of national income remaining when the people's essential needs have been fulfilled; and (iv) the higher the share of non-tax income relative to tax income.

Although we may conclude that Wagner was referring to an increasing share of government in GDP, it is still ambiguous what is meant by government. A close examination of the literature suggests that most researchers have interpreted Wagner as referring to the ratio of <u>total</u> public expenditures (which includes transfer payments) to GDP (see Kuznets, 1967 and North and Wallis, 1982). There are exceptions to this view, however. For instance, Pryor (1968, p. 451) claims that "Wagner asserted that in growing economies the share of public consumption expenditures in national income increases". Henrekson (1990) argues that if transfers are included in the expenditure figure, the resulting definition of expenditure share is not very satisfactory, since transfer payments are not part of the denominator, GDP. In fact, in the presence of taxable transfers, the ratio may even exceed unity. Partly for this reason, Chrystal and Alt (1979, p. 130) argues against inclusion of transfer payments in defining government expenditures. Following Kuznets and North and Wallis, the paper used total government expenditures including transfer payments as the appropriate measure of government.

The next question is about how to measure the level of economic development. It is difficult to find any direct references in Wagner's writings to per capita real income as an indicator of economic development. However, as pointed out by Michas (1975) there seems to exist a systematic relationship between real GDP per capita and aspects of sociopolitical change referred to by Wagner (Adelman and Morris, 1965). Thus, per capita real income may be taken as a good proxy for Wagner's broader concept of development. The variables used in this paper are defined and measured as follows:

(5) SGTN = (100 * TGE)/GNPN
(6) TGE = Total Government Expenditures (Purchases and Transfer Payments) (federal, state, and local combined)
(7) GNPN = the nominal Gross National Product (GNP)
(8) GNPR = (100 * GNPN)/DEF
(9) DEF = GNP Deflator as the general price index for the economy
(10) GNPRPC = GNPR/POP
(11) POP = Mid-year population
(12) LSGTN = ln (SGTN), where □ln□ stands for natural logarithm
(13) LGNPRPC = ln (GNPRPC)

The variable SGTN in equation (5) stands for the share of government in the economy, which is used as a proxy for "g" in equation (1). The variable GNPRPC in equation (10) stands for per capita real GNP, which is used as a proxy for "y" in equation (1). The last two variables, LSGTN (equation 12) and LGNPRPC (equation 13), are derived from SGTN and GNPRPC respectively. Note that LSGTN is used as a proxy for "ln g" and LGNPRPC is used as a proxy for "ln y" respectively in the final empirical model specified in equation (3) earlier. The data used in this study were compiled from various publications of the U.S. Department of Commerce. Annual data is used covering the time period from 1929 to 1996. The variables are measured in million units.

THE EMPIRICAL RESULTS

It is generally observed that both relative public spending and income have had a tendency to grow over time. However, unless the two variables (appropriately defined) are cointegrated, one cannot show that there is a long-run relationship between them, i.e. the observed relationship may be entirely spurious in the sense of Granger and Newbold (1974). Their focal point is that regression equations specified in the levels of economic time series often lead to erroneous inferences if the levels are non-stationary. Therefore, one needs to conduct unit root tests to determine the time series properties such as stationarity of the variables included in the model.

Unit Root Tests

Table 1 reports the unit root test results using both the ADF and PP tests. The ADF test reveals that the null hypothesis of unit root is accepted for SGTN and GNPRPC variables because the calculated values are less than the corresponding McKinnon (1991) critical values for the levels of the variables. For the first difference of the variables, the calculated values exceed the critical values, thus rejecting the null of unit roots for the first-differenced series.

The above results thus indicate that these variables are non-stationary in their levels and stationary in their first differences. Similarly, the Philips-Perron (PP) test reveals that these variables are non-stationary in their levels and stationary in their first differences. It is thus concluded that the standard regression estimation method would not be appropriate in examining the relationship between SGTN and GNPRPC. This is because, given that the variables are non-stationary, the traditional t-tests and F-tests would not be meaningful and the regression equation may only reflect a "spurious" relationship between the variables (Granger 1986 and Granger and Newbold 1974). In this situation, one needs to apply the cointegration technique to uncover the appropriate relationships.

Table 1
ADF and Phillips-Perron Tests for Unit Root

Variables	Level	1% Critical Values	First Difference	1% Critical Values	Accept/ Reject Null
ADF Test:					
SGTN	-3.45	-4.10	-6.05	-2.60	Accept
GNPRPC	-3.39	-4.10	-4.32	-2.60	Accept
PP Test:					
SGTN	-3.51	-4.09	-5.14	-2.60	Accept
GNPRPC	-3.26	-4.09	-4.67	-2.60	Accept

Notes: (1) With intercept and trend, the 1%, 5%, and 10% the McKinnon critical values respectively are: -4.10, -3.48, and -3.17. (2) Without intercept and trend, the 1%, 5%, and 10% McKinnon critical values respectively are: –2.60, -1.94, and -1.61.

Cointegration Test: The Engle-Granger Method

The long-run cointegrating relationship specified in the empirical model specified by equation (3) earlier is estimated by the OLS method and is presented in Table 2. In this equation, the elasticity coefficient "b" associated with the LGNPRPC variable is found to be 0.53 which is positive and statistically significant at better than 1% level of significance. This variable explains about 58% of the variation of the dependent variable as shown by the R^2 value. Also, the F value is 90.0 which is statistically significant at better than 1% level. This indicates that the overall regression is highly statistically significant. Note, however, that since both the variables are non-stationary in their levels, these standard regression interpretations are not valid. This table also shows that the R^2 value exceeds the Durbin-Watson statistic, which is an additional indicator of possible "spurious" relationship between the variables (see Granger and Newbold, 1974). This leads us to the Engle-Granger test of the residuals from this regression. The ADF and the PP unit root tests were applied to examine whether the residual series from this long-run regression is stationary or non-stationary. Using information in Table 2, the RES series is estimated as follows:

(14) $$RES = LSGTN - (-1.77 + 0.53\ LGNPRPC)$$

The ADF and PP tests on the residuals from the long-run equation (RES) are presented in Table 3 below. The results from both tests suggest that the residual series (RES) is stationary. This is because the null of unit root is rejected at the 1% McKinnon critical value. Based on this result, it is concluded that the LSGTN and the LGNPRPC variables are cointegrated.

Table 2
Engle-Granger Long-run Equilibrium Regression

Variable	Coefficient	t-statistic	Probability
Constant	-1.77***	-3.31	0.0015
LGNPRPC	0.53***	9.49	0.0000
R^2	0.58		
Adjusted R^2	0.57		
S.E.	0.19		
D-W	0.46		
F	90.0***		0.0000

Note: *** indicates significance at 1% level.

Table 3
ADF and PP Tests on the Residuals from the Long-run Regression

Variables	Level	1% Critical Value	Accept/Reject Null
ADF Test:			
RES	-5.38	-2.60	Reject
PP Test:			
RES	-4.74	-2.60	Reject

Notes: (2) Without the intercept and trend, the 1%, 5%, and 10% McKinnon critical values respectively are: -2.60, -1.94, and -1.61.

Short-run Dynamics and the ECM Estimates

Given that the variables are cointegrated, one can proceed to estimate the ECM model. The coefficients of the short-run dynamics based on the ECM model are presented in Table 4. In estimating this model, one lag for each of the explanatory variables were sufficient to make the residuals become white noise. As Table 4 shows, the ECM regression equation is highly significant given that the F statistic is highly significant at 1% level or better. The Durbin-Watson statistic of 2.09 shows that the regression is free of autocorrelation. It also shows that the coefficients of three variables, RES(-1), DLSGTN(-1), and DLGNPRPC(-1), are statistically highly significant at better than 1% level. Using information from Table 4, the estimated ECM equation is presented below:

(15) DLSGTN = 0.003 - 0.47 RES(-1) + 0.44 DLSGTN(-1) + 0.58 DLGNPRPC(-1)

where "D" in front of a variable represents the first difference operator. The coefficient of the lagged residual RES(-1) in equation (15) is of particular interest because it represents the direction and speed of adjustment as well as the stability of the system. The absolute value of the coefficient is found to be less than one, which indicates that the system is stable. The absolute value of the coefficient is 0.47 which shows that about 47% of any deviation of the system from its long-run equilibrium path is likely to be corrected within a year.

Table 4
Short-run Dynamics and the ECM Model Estimates

Variable	Coefficient	t-statistic	Probability
Constant	0.003	0.23	0.81
RES(-1)	-0.47***	-5.96	0.00
DLSGTN(-1)	0.44***	4.48	0.00
DLGNPRPC(-1)	0.58***	2.64	0.01
R^2	0.47		
Adjusted R^2	0.44		
S.E.	0.10		
D-W	2.09		
F	18.04***		0.00

Note: *** indicates significance at 1% level.

Granger Causality Test With and Without Error-Correction

As mentioned earlier, Granger causality test can be performed without correction for the error-correction term as well as with correction for the error-correction term within the ECM framework. Although the latter procedure is more appropriate when the variables in the long-run model are individually non-stationary in their levels but have a common trend (cointegrated), causality tests under both scenarios were reported here for comparison purposes. Table 5 reports Wald test results based on the F-test applied on different formulations of the ECM equation (15) under an appropriate null hypothesis as discussed in detail earlier in the section titled "Granger Causality Test With and Without the ECM framework". The calculated as well as the theoretical F values under the null hypotheses under both scenarios are presented in this table.

The standard Granger test without the error-correction term shows that the null hypothesis "GNPRPC does not Granger cause SGTN" could not be rejected. Similarly, the reverse null hypothesis "SGTN does not Granger cause GNPRPC" could not be rejected either. So, this test would lead one to conclude that the two variables in the Wagner model does not Granger cause each other. In other words, these variables appear to be independent of each other.

However, the application of the more appropriate Granger test, which is conducted within the ECM framework shows a different result. This test shows that the null hypothesis of "GNPRPC does not Granger cause SGTN" could be rejected at the 1% level of significance. However, the reverse null hypothesis "SGTN does not Granger cause GNPRPC" could not be rejected. Thus, the latter test shows a clear uni-directional Granger causality flowing from the GNPRPC variable to the SGTN variable. This result is quite consistent with the Wagner's Law in that economic progress as measured by per capita real income Granger causes growth of the public sector as measured by the relative share of the public sector in the economy, but not the other way.

Table 5
Wald F-Test For Granger Causality: With and Without Error Correction

Calculated F	F at 5% (1%)	D.F. (Numerator)	D.F. Denominator	Accept/Reject
A. Standard Granger Causality Test Without the ECM Model				
Ho: LGNPRPC does not Granger cause LSGTN				
0.96	3.98 (7.05)	1	63	Accept Ho
Ho: LSGTN does not Granger cause LGNPRPC				
0.07	3.98 (7.05)	1	63	Accept Ho
B. Advanced Granger Causality Test Within the ECM Model				
Ho: LGNPRPC does not Granger cause LSGTN				
18.51***	3.14 (4.97)	2	62	Reject Ho
Ho: LSGTN does not Granger cause LGNPRPC				
0.26	3.14 (4.97)	2	62	Accept Ho

Note: *** indicates Signifance at 1% level

CONCLUDING REMARKS

This paper tested the Wagner's hypothesis for the United States using annual time-series data for the period 1929 to 1996. The Augmented Dickey-Fuller and the Phillips-Perron tests indicate that the relative size of the public sector and the real per capita income are non-stationary in their levels but stationary in their first differences. The Engle-Granger method of cointegration provided strong support for the Wagner's hypothesis as a long run equilibrium condition. It is evident from these results that deviations from the long-run hypothesised long-run equilibrium relationship do not follow a random walk process.

Further, the elasticity coefficient associated with per capita real income variable was found be greater than zero as hypothesised by the Wagner's Law. The ECM estimates suggest that the relative size of the public sector is a stable function of the progress of the economy in the long run with a speed of adjustment of about 47% over a year. This estimated speed of adjustment appears to be reasonable. Further, although the Granger causality test without the error-correction term shows that the two variables are independent of each other, the more appropriate Granger causality test with the error-correction term clearly shows uni-directional causality flowing from the progress of the economy to the relative size and growth of the public sector in the U.S. There was no evidence found for the reverse or bi-directional causality in the U.S. data. This causality result is quite consistent and strongly supportive of the Wagner's hypothesis.

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