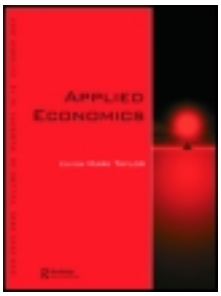

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On the level of persistence in government size: time-series evidence and implications for the US

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For most developed countries, the study of the long-term trend of government size has become a major issue. This study employs advanced time-series techniques to investigate the long-run properties of the government size series for the US. By applying the persistence measures developed by Campbell and Mankiw (*Quarterly Journal of Economics*, **102**, 857–80, 1987) and Cochrane (*Journal of Political Economy*, **96**, 893–920, 1988), this study finds big long-term persistence in government size at all levels of the US government. The finding, indeed, explains the fact that the US has gradually taken steps to control the size of government in the 1990s.

> Against the statement, 'One cannot set economic facts in order unless one has a theory' (I should prefer to say 'hypothesis'), can be put the statement, 'One cannot form an economic theory unless one knows some facts.' And both these statements overlook the fact that the two categories are not mutually exclusive. (Wesley C. Mitchell, 1927)

I. INTRODUCTION

One of the most challenging questions facing public finance economists in the past few decades and possibly for this century is the appropriate size of government (see, for example, Feldstein, 1997).[1] From the empirical viewpoint the contemporary advances of time-series analysis have equipped researchers with further techniques to explore the topic of government size. The empirical application of time-series techniques can directly examine the long-run properties of government activity data. Furthermore, it helps discuss some government policy issues.

Using advanced time-series techniques, the main purpose of this paper is to investigate the long-run properties of the government size series and to establish a stylized fact that theories of government size can be evaluated. By applying the estimation strategies developed by Campbell and Mankiw (1987) and Cochrane (1988), this study finds big long-term persistence in government size at all levels of the US government. The main results indicate that a 1% innovation in government size should change one's forecast of government size by over 1% over a long horizon. The long-run implication of the high degree of persistence, in a sense, suggests that the government spending trend has become more random in nature. From the policy perspective, it becomes non-trivial to recognize the importance of controlling government size.

[1] The government size here primarily refers to the measures of government spending activity. In the literature, approaches to the analysis of the size (and growth) of government can be broadly divided into two strands. The first strand posits that government activities fully reflect the preferences of citizens. Classic studies along this line of research include, at least, Wagner's hypothesis of 'increasing state activity' (see, for example, Bird, 1970, 1971), Baumol (1967) 'cost disease' model, works rely on the 'median voter' theorem (see, for example, Borcherding and Deacon, 1972; Bergstrom and Goodman, 1973), and the influence of interest groups (Becker, 1983,1985). The second strand presumes that government activities reflect the preferences of bureaucrats who run the government. Major studies along this line include, for example, the Peacock–Wiseman (1961, 1979) 'displacement effect,' Niskanen's (1971, 1975) model of bureaucracy, and the 'Leviathan hypothesis,' advanced by Brennan and Buchanan (1977, 1978, 1980) and further extended by Oates (1985, 1989).

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The paper is organized as follows. Section II is a brief description of research background. Section III describes the empirical methodology. Section IV documents the data sources and presents the empirical results. Section V concludes the paper with a discussion on the implications of the results.

II. BACKGROUND

It is well known that the size of government has significantly grown for most developed countries in the past few decades. The growing tendency of government, in fact, has led to intense debate about the proper role of government across the Western European countries over recent years (see, for example, Gemmell, 1993; Borre and Scarbrough, 1995). In the United States, three major spending programmes, Medicare, Medicaid, and Social Security, have been under critical examination (see, for example, Auerbach, 1997; Burtless, 1997). It can be noted that, unlike the more conventional cross-sectional subjects, the present issues tend to evaluate the development of government activities over a relatively long period. An in-depth analysis of long-run data on government activities, indeed, has become increasingly important.

In the public finance literature, the investigation of government size can be traced at least as far back as the mid-nineteenth century in the work of Adolph Wagner. Based upon Wagner's hypothesis of 'increasing state activity' (i.e., the so-called 'Wagner's Law'), the size of government will become larger as the economy expands.[2] Empirically, Wagner's Law investigates the long-run relations between government size (as generally denoted by government expenditures) and the economy (as conventionally denoted by output). From a statistical viewpoint, it is reasonable to infer that data on government expenditures and output behave similarly. In other words, they might possess similar long-run properties. In the macroeconomic literature, Nelson and Plosser (1982) and Campbell and Mankiw (1987), for example, have found large random walk components in output.[3]

As emphasized above, a detailed analysis of long-term data on government size is essential for evaluating and understanding government activities. Furthermore, if Wagner's Law statistically holds true, it makes sense to conclude that the government size series and the output series behave similarly in the long run. As many studies have identified the long-run properties of output, it seems necessary to subsequently examine the government size series.

III. EMPIRICAL METHODOLOGY

To investigate the long-run properties of government size, this paper uses the persistence measures proposed by Campbell and Mankiw (1987) and Cochrane (1988). According to Campbell and Mankiw (1987), the change in a time series can be modeled as a stationary ARMA process. That is,

$$\phi(L)\Delta X_t = \theta(L)\varepsilon_t \tag{1}$$

where $\phi(L) = 1 - \phi_1 L - \phi_2 L^2 - \cdots - \phi_p L^p$, and $\theta(L) = 1 + \theta_1 L + \theta_2 L^2 + \cdots + \theta_q L^q$.

Then, equation (1) can be rearranged into the moving average representation for ΔX_t:

$$\Delta X_t = \phi(L)^{-1}\theta(L)\varepsilon_t = A(L)\varepsilon_t \tag{2}$$

The moving average representation for the level of X_t can be obtained by inverting $1 - L$:

$$X_t = (1 - L)^{-1}A(L)\varepsilon_t = B(L)\varepsilon_t \tag{3}$$

where $B_i = \sum_{j=0}^{i} A_j$. The limit of B_i, in fact, is the infinite sum of A_j coefficients, which can be denoted as $A(1)$. The $A(1)$ measure, infinite sum of moving average coefficients for the differenced process, is the measure of persistence developed by Campbell and Mankiw (1987).

Cochrane's (1988) measure of persistence, which can be denoted as V, is related to that of Campbell and Mankiw (1987). Cochrane's technique is to measure the size of a random walk component in a time series from the variance of its long differences. According to Cochrane, a time series that follows a first-difference stationary linear process has a moving average representation of the following form:

$$\Delta X_t = (1 - L)X_t = \mu + C(L)\varepsilon_t = \mu + \sum_{j=0}^{\infty} c_j \varepsilon_{t-j} \tag{4}$$

where ε_t are i.i.d. error terms with variance σ_ε^2.

Given the representation Equation 4, Cochrane derives several *facts*, including the innovation variance of the random walk component. Campbell and Mankiw (1987) show that the square root of Cochrane's persistence measure is a lower bound on their measure. If the differenced process of the series becomes more predictable, the difference between their measure and the square root of Cochrane's measure becomes greater.

IV. DATA AND RESULTS

Quarterly data for the period 1965:1–1999:2 are taken and adapted from the DRI Basic Economics Database (for-

[2] As Wagner's Law stands in its basic form without explicit formulation, many empirical versions exist in the literature. For different versions of Wagner's Law, see Lin (1995, p. 276) for example.

[3] Using US long historical data, Nelson and Plosser (1982) investigate three output series: real GNP, nominal GNP, and real per capita GNP. Campbell and Mankiw (1987) use the postwar quarterly real GNP data and annual real GNP data since 1869.

Table 1. *The Phillips–Perron test for absolute measures of real government size, 1965:1–1999:2*[a]

Government	Series	Regression T ratio	Normalized estimator $T(\hat{\rho}_\tau - 1)$
Overall	TE	−1.94	−7.93
	CE	−1.45	−4.10
	TR	−2.38	−11.64
Federal	TE	−2.94	−18.35*
	CE[b]	−1.45	−3.08
	TR	−2.31	−10.22
State and local	TE	−0.55	−1.01
	CE	−0.58	−1.37
	TR[b]	−1.02	−2.29

Notes: [a] Phillips (1987) and Phillips and Perron (1988) unit root test with constant and trend; Critical values for the normalized estimator and t-test are from Fuller (1996) pp. 641 and 642, respectively. The number of lags, 4, was chosen based on the Schwert (1989) formula, $\ell_4 = \text{int}[4(T/100)^{1/4}]$.
[b] Constant and no trend for the series.
* Significant at the 10% level.

Table 2. *The Phillips–Perron test for relative measures of real government size, 1965:1–1999:2*[a]

Government	Series	Regression T ratio	Normalized estimator $T(\hat{\rho}_\tau - 1)$
Overall	TE/POP	−2.40	−11.23
	CE/POP[b]	−1.66	−3.07
	TR/POP	−1.64	−6.29
Federal	TE/POP	−2.24	−10.04
	CE/POP[b]	−1.02	−2.72
	TR/POP	−1.76	−5.48
State and local	TE/POP	−1.22	−2.67
	CE/POP	−1.66	−5.00
	TR/POP[b]	−1.14	−2.47

Notes: [a] Phillips (1987) and Phillips and Perron (1988) unit root test with constant and trend; Critical values for the normalized estimator and t-test are from Fuller (1996) pp. 641 and 642, respectively. The number of lags, 4, was chosen based on the Schwert (1989) formula, $\ell_4 = \text{int}[4(T/100)^{1/4}]$.
[b] Constant and no trend for the series.

merly Citibase). The time period chosen is mainly considered from the viewpoint that two of the largest social spending programs in the United States, Medicare and Medicaid, were enacted in 1965. To be consistent with most of the empirical versions of Wagner's Law and the major investigation of real output and real output per capita in the macroeconomic literature, this study examines the real expenditures and real expenditures per capita series for different levels of government.[4] Data are classified as follows. Total government expenditures (TE) are divided into two categories: government consumption expenditures and gross investment (CE; i.e., government purchases of final goods and services), and transfer payments (TR).[5] Consumption expenditures (CE) are converted into real terms with the implicit price deflator for government purchases of final goods and services with respect to different levels of government. Transfer payments are deflated by the price index for personal consumption expenditures.[6] The real total government expenditures, as a result, are arrived by summing the respective deflated amounts of the consumption and transfer components. The relative measures of real government size (i.e., the real expenditures per capita series) are obtained by dividing real expenditures into total population (POP). Eventually, six measures of government size, TE, CE, TR, TE/POP, CE/POP, and TR/POP, for the overall, the federal, and the state and local levels of government are sequentially investigated.

In practice, it is essential to check whether the government size series are stationary or not. Thus, this study first applies the Phillips–Perron unit root test (Phillips, 1987 and Phillips and Perron, 1988) and the results are reported in Tables 1 and 2. The results indicate that we cannot reject the unit root hypothesis for all the series based on the regression t-test. According to the normalized estimator, we can only reject the unit root hypothesis for the federal TE series at the 10% significance level. Overall, the government size series appear to be nonstationary.[7]

Then, the estimation strategies advanced by Campbell and Mankiw (1987) and Cochrane (1988) are applied and the results are reported from Table 3a to Table 4c. Table 3a to Table 3c report estimates of persistence in absolute measures of real government size. At the overall level, the values of $\hat{V}^k$ and $\hat{A}^k(1)$ for the TE series start out above unity (but fall very gradually) and are below unity for window sizes of 55 and above. For the CE series, the values of $\hat{V}^k$and $\hat{A}^k(1)$ are well above unity for window sizes of 55 and below. The TR series appears to be less persistent. At the federal level, the $\hat{V}^k$and $\hat{A}^k(1)$ values for the TE series are greater than 0.5 at all window sizes. Also, one can note that the level of persistence reported at the overall level is mainly attributable to the high level of persistence at the state and local level.

[4] In the literature, Beck (1976, 1979a, 1979b, 1979c, 1981, 1982, 1985) has emphasized the investigation of real (rather than nominal) government size and shown that real size of the government sector has risen less than nominal size. In fact, the nominal government size series are also examined and appear to be more persistent. The results are available upon request.
[5] Unlike consumption expenditures, transfer payment expenditures are not included in national income accounting. In the US, transfer payments include welfare benefits and social security, unemployment compensation, interest payments on debt, and other transfers.
[6] The implicit price deflator for transfer payments is unavailable. Since transfer payments do not involve direct use of resources by government, it is more appropriate to use the implicit price deflator for personal consumption expenditures to deflate transfer payments (see, for example, Beck, 1981). This study also uses the implicit price deflator for government purchases of final goods and services to deflate transfer payments and the key conclusions remain unchanged.
[7] It has been confirmed that all the series are integrated of order one by performing the unit root test on first differences.

Table 3a. *Nonparametric estimates of persistence in absolute measures of real government size at the overall government level, 1965:1–1999:2*

	$\hat{V}^k$			$\hat{A}^k$		
Window size (k)	*TE*	*CE*	*TR*	*TE*	*CE*	*TR*
15	1.048	3.141	1.021	1.028	1.788	1.015
	(0.414)	(1.239)	(0.403)			
25	1.045	3.353	0.828	1.027	1.847	0.914
	(0.526)	(1.687)	(0.417)			
35	1.044	3.113	0.530	1.027	1.780	0.731
	(0.618)	(1.843)	(0.314)			
45	1.016	2.514	0.286	1.013	1.599	0.537
	(0.680)	(1.682)	(0.191)			
55	0.766	1.889	0.328	0.879	1.386	0.575
	(0.565)	(1.395)	(0.242)			
65	0.386	0.787	0.161	0.624	0.895	0.403
	(0.309)	(0.631)	(0.129)			

Note: Standard errors are in parentheses.

Table 3b. *Nonparametric estimates of persistence in absolute measures of real government size at the federal government level, 1965:1–1999:2*

	$\hat{V}^k$			$\hat{A}^k$		
Window size (k)	*TE*	*CE*	*TR*	*TE*	*CE*	*TR*
15	0.613	3.514	0.663	0.795	1.891	0.824
	(0.242)	(1.387)	(0.262)			
25	0.531	4.159	0.691	0.741	2.057	0.841
	(0.267)	(2.092)	(0.347)			
35	0.503	4.211	0.580	0.721	2.070	0.770
	(0.298)	(2.492)	(0.343)			
45	0.569	3.718	0.482	0.766	1.945	0.703
	(0.380)	(2.488)	(0.323)			
55	0.548	2.720	0.419	0.752	1.664	0.655
	(0.404)	(2.008)	(0.310)			
65	0.511	1.416	0.258	0.727	1.200	0.514
	(0.410)	(1.135)	(0.207)			

Note: Standard errors are in parentheses.

Table 3c. *Nonparametric estimates of persistence in absolute measures of real government size at the state and local government level, 1965:1–1999:2*

	$\hat{V}^k$			$\hat{A}^k$		
Window size (k)	*TE*	*CE*	*TR*	*TE*	*CE*	*TR*
15	8.817	3.032	2.283	3.812	1.761	1.547
	(3.479)	(1.196)	(0.901)			
25	12.042	3.677	2.042	4.455	1.939	1.463
	(6.058)	(1.850)	(1.027)			
35	13.938	3.940	1.622	4.793	2.007	1.304
	(8.250)	(2.332)	(0.960)			
45	3.793	4.034	1.147	4.768	2.031	1.096
	(9.229)	(2.699)	(0.767)			
55	11.648	4.286	0.729	4.381	2.093	0.874
	(8.599)	(3.164)	(0.538)			
65	9.149	4.109	0.233	3.883	2.050	0.494
	(7.333)	(3.293)	(0.187)			

Note: Standard errors are in parentheses.

Table 4a. *Nonparametric estimates of persistence in relative measures of real government size at the overall government level, 1965:1–1999:2*

	$\hat{V}^k$			$\hat{A}^k$		
Window size (k)	*TE/POP*	*CE/POP*	*TR/POP*	*TE/POP*	*CE/POP*	*TR/POP*
15	1.420	3.530	1.142	1.193	1.913	1.073
	(0.560)	(1.393)	(0.451)			
25	1.482	3.601	1.059	1.219	1.932	1.033
	(0.746)	(1.811)	(0.533)			
35	1.564	3.236	0.914	1.252	1.832	0.960
	(0.926)	(1.915)	(0.541)			
45	1.661	2.576	0.810	1.290	1.634	0.903
	(1.112)	(1.723)	(0.542)			
55	1.508	1.913	0.983	1.229	1.409	0.995
	(1.113)	(1.412)	(0.726)			
65	1.332	0.743	0.952	1.155	0.878	0.979
	(1.068)	(0.596)	(0.763)			

Note: Standard errors are in parentheses.

Table 4b. *Nonparametric estimates of persistence in relative measures of real government size at the federal government level, 1965:1–1999:2*

	$\hat{V}^k$			$\hat{A}^k$		
Window size (k)	*TE/POP*	*CE/POP*	*TR/POP*	*TE/POP*	*CE/POP*	*TR/POP*
15	0.899	3.790	0.861	0.960	1.977	0.939
	(0.355)	(1.496)	(0.340)			
25	0.923	4.261	1.063	0.973	2.097	1.044
	(0.464)	(2.143)	(0.535)			
35	1.034	4.151	1.152	1.030	2.069	1.087
	(0.612)	(2.457)	(0.682)			
45	1.273	3.559	1.256	1.143	1.916	1.135
	(0.852)	(2.381)	(0.840)			
55	1.412	2.500	1.376	1.203	1.606	1.188
	(1.042)	(1.845)	(1.016)			
65	1.579	1.158	1.397	1.272	1.093	1.196
	(1.266)	(0.928)	(1.119)			

Note: Standard errors are in parentheses.

Table 4c. *Nonparametric estimates of persistence in relative measures of real government size at the state and local government level, 1965:1–1999:2*

	$\hat{V}^k$			$\hat{A}^k$		
Window size (k)	*TE/POP*	*CE/POP*	*TR/POP*	*TE/POP*	*CE/POP*	*TR/POP*
15	8.384	2.894	2.085	3.617	1.724	1.478
	(3.308)	(1.142)	(0.823)			
25	11.084	3.291	1.850	4.159	1.838	1.392
	(5.576)	(1.656)	(0.931)			
35	12.092	3.214	1.482	4.344	1.817	1.246
	(7.158)	(1.903)	(0.877)			
45	10.975	2.893	1.030	4.139	1.723	1.039
	(7.344)	(1.936)	(0.689)			
55	7.769	2.714	0.616	3.482	1.669	0.803
	(5.735)	(2.003)	(0.454)			
65	4.309	2.107	0.138	2.593	1.471	0.380
	(3.453)	(1.689)	(0.110)			

Note: Standard errors are in parentheses.

Table 4a to Table 4c report estimates of persistence in the real expenditures per capita series. Basically, the conclusions obtained are similar to those for absolute measures of government size. At the overall level, the $\hat{V}^k$ and $\hat{A}^k(1)$ values for the TE/POP series are all well above unity at all window sizes. For the CE/POP series, the values of $\hat{V}^k$and $\hat{A}^k(1)$ are well above unity for window sizes of 55 and below. For the TR/POP series, the values of $\hat{V}^k$and $\hat{A}^k(1)$ are all close to unity at all window sizes. It can also be noted that, at the federal level, the $\hat{V}^k$and $\hat{A}^k(1)$ values for the TE/POP and TR/POP series rise gradually and are above unity for most window sizes. At the state and local level, the values for the TR/POP series fall gradually but are above unity for most window sizes.

V. IMPLICATIONS

For most developed countries, the study of the long-term trend of government size has become a major issue. In the public finance literature, there has been no shortage of theories which have to sought to examine the subject of government size. The long-run properties of the government size series that depicted from the existing theories, however, are very limited. Among them, Wagner's Law examines the long-run relations between government size and output, implying that the government size and output series behave similarly from a statistical viewpoint.

Many studies have employed time-series techniques to examine the long-run properties of output. Some of the results show that output fluctuations are largely permanent. By applying the estimation techniques developed by Campbell and Mankiw (1987) and Cochrane (1988), this study also confirms that fluctuations in real government size are permanent. The main results indicate that a 1% innovation in government size should change one's forecast of government size by over 1% over a long horizon. This finding, therefore, is consistent with the implication drawn from Wagner's Law.

The stylized fact presented in this study is not only useful for evaluating theories of government size but also instrumental for designing and implementing government policies. The finding of this study, in a sense, indicates that the long-run government spending trend has become more random in nature. This tendency, in fact, helps explain the fact that the US and many other developed countries have gradually taken steps to control the size of government.

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