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TESTING FOR WAGNER'S LAW ON GREEK ECONOMY

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ABSTRACT: *This paper examines the plausibility of Wagner's 'law' for Greece for the period 1948 – 2010. The paper uses modern time-series econometric techniques boarding on co integrations analysis to test for the validity of Wagner's law, which states that the growth of public expenditure can be explained as a result of the increase in economic activity. The results of the causality test indicate that there is no evidence to support either Wagner's Law or Keynes's hypothesis for Greek economy. Furthermore, evidences from Johansen Maximum Likelihood co-integration test and LSEM both reveal that Wagner's law is not supported for Greece. These results suggest that despite the often vocal opposition from the country's powerful labor unions and the general public, Greek Government should continue with the policy of cutting government spending, downsizing of the public sector, and reforming the labor and pension systems to promote greater private sector involvement in economic activities.*

KEYWORDS: Wagner's Law; Co-integration; Causality; Government size; Growth, OLS.

INTRODUCTION

Greece as in many other European welfare states, government spending is high as the public sector accounts for over 40 percent of GDP. Despite progress being made in reforming and privatizing state-owned enterprises, total government expenditures, including consumption and transfer payments, are so high that in the most recent year, government spending equaled 42.3 percent of GDP (http://www.heritage.org/country/greece).

The Greek economy, with the GDP of $357.5 billion, grew by nearly 4.0% per year between 2003 and 2007, due partly to infrastructural spending related to the 2004 Athens Olympic Games, and in part to an increased availability of credit, which has sustained record levels of consumer spending. But growth dropped to 2.9% in 2008, as a result of the world financial crisis and tightening credit conditions. Greece violated the EU's Growth and Stability Pact budget deficit criteria of no more than 3% of GDP from 2001 to 2006, but finally met that criterion in 2007-08. Public debt, inflation, and unemployment are above the euro-zone average, but are falling. The Greek Government continues to grapple with cutting government spending, reducing the size of the public sector, and reforming the labor and pension systems, in the face of often vocal opposition from the country's powerful labor unions and the general public. Sectoral decomposition of Greece economy shows that Agriculture share 3.7 percent, industry 20.6 percent and service 75.7 percent. (CIA-The World fact Book, 2008).

Wagner's law has been the subject of intensive and extensive investigations, in particular during the post second world war era, when public consumption declined in favor of the private activities development. The above law is of the notion that there is a long-run tendency for government activities to grow relative to economic activity (Wagner,

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1890).More specifically; the law states that, during the process of economic development, as the real income per capita of a nation increases, the share of public expenditures in total economic activities increases. Thus, higher levels of economic growth require higher levels of public expenditure. Wagner stated that during the industrialization process, as real income per capita of a nation increases, the share of public expenditures in total expenditure increases. According by him, three main reasons support this hypothesis: (1) during industrialization, the administrative and regulatory functions of the state would substitute public for private activity; (2) economic growth would result in increased need for cultural and welfare services, which are assumed to be income elastic; (3) state participation would be inevitable to provide the capital funds to finance large-scale projects made to satisfy the technological needs of an industrialized society, where private sector lacks the capacity. In other words, Wagner's law states that government grows because there is an increasing demand for public goods and for the control of externalities. In effect, the law also suggests that causality runs from national income to public consumption, indicating that public expenditure is considered as endogenous to the growth of national income.

Wagner's law is predicated on a simple positive correlation between a nation's gross domestic product (GDP) and government size (G). This has generated different interpretations leading to introduction and empirical examination of several versions of the law since the 1960s (Ferda, 2003). Several commentators on Wagner's Law (see e.g. Musgrave, 1969) have claimed that it is unclear whether the law of expanding scale relates to the share of government in national income or just to the absolute level of government. To Timm (1961), this alleged ambiguity is unjustified as thorough assessment of Wagner's writings, convincingly demonstrates that Wagner had the relative growth in mind. In effect, there seems to be a reasonable consensus in the literature that Wagner's Law should be interpreted as predicting an increasing relative share for the public sector in the total economy as per capita real income grows. If *G/GDP* increases as *GDP/N* increases, the elasticity value for the relationship exceeds zero. Wagner's law in functional forms, however, seems to be more controversial. See Peacock–Wiseman (1961), Musgrave (1969), Goffman and Mahar (1971), Pryor (1968), Mann (1980), Goffman (1968), Gupta (1967) and Michas (1975). The final functional form is a Musgrave (1969) version, which expresses the share of government expenditure in gross domestic product (GE/GDP) as a function of income per capita (GDP/N) as follows:

$$GE/GDP = f(GDP/N) \quad (1)$$

Musgrave (1969) version which was also adopted by Ram (1986), Murthy (1993), Henrekson (1993) and Hsieh and Lai (1994), appears to represent what Wagner had in mind in his proposition and has more or less gained universal acceptance and application. Thus, this paper will follow the same path to investigate the validity of Wagner's Law for the South African economy. The remainder of this paper is, structured as follows: Section 2, brief literature review; section 3, empirical methodology; section 4, presents the empirical evidence and Section 5, the concluding remarks.

BRIEF LITERATURE REVIEW

One of the frequently quoted stylized facts of public sector economics is that of" Wagner's Law" about the long-run tendency for public expenditure to grow relative to some national

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income aggregate such as GDP. This implies that public expenditure can be treated as an outcome, or an endogenous factor, rather than a cause of growth in national income. On the other hand, Keynesian propositions treat public expenditure as an exogenous factor, which could be utilized as a policy instrument. In the former approach, the causality runs from national income to public expenditure whereas in the latter proposition, causality runs from public expenditure via domestic demand to national income (Afonso and Furceri, 2008). Evidence concerning this topic is not conclusive. Moreover, Barro (1990) mentions the importance of government expenditure in public infrastructure for economic growth and Romer (1990) stresses the relevance of research and development expenditure. Therefore, composition of public spending is also a relevant issue, and if the aim is to promote growth, the focus should be put on the more productive items of the budget, even if the balance between the various functional items of the budget can vary in accordance with country specifics.

The basic thrust of Wagner's law is that the relative size of the public sector in the economy (G/DGP) has an inherent tendency to grow as per capita income (GDP/POP) increases. It is fair to say on balance that most of the time series studies have found the ratio-income-elasticity coefficients to be positive and statistically significant, by using

$$G/GDP + \alpha + \beta \{GDP/POP\} + \mu i \qquad 2$$

Thus, Wagner's law has been validated, particularly for countries in the process of transition from Rural-Agricultural to an Urban-Industrial one (Nagarajan and Spear, 1977)

Wagner's law has been tested empirically in time-series and cross-sectional frameworks and, with few exceptions, the law has received strong support. In empirical analyses, country-specific studies are frequently used: for example, Henrekson (1993) for Sweden, Ashworth (1995) for the UK, Hondroyiannis and Papapetrou (1995) for Greece, Nomura (1995) for Japan and Park (1996) for South Korea. Cross-country studies have also become quite popular, thus, Ram (1987) includes 115 countries, Bohl (1996) investigates the G-7 countries and Anwar et al. (1996) analyze 88 countries. In addition to aggregate analyses, disaggregating of data is also noted in empirical studies of Wagner's law. See, Bairam (1995), Asseery et al. (1999) and Burney (2002).

There have been also some empirical studies relating to Wagner's Law for Turkey. Krzyzaniak (1974) conducted a study of Turkey for the period from 1950 to 1969. After regressing public expenditure on GNP he found statistically significant estimates of the income elasticity of public expenditure with regard to GNP which appear to support Wagner's Law. Önder (1974) conducted a study of public expenditure growth in Turkey for the period 1947-1967. Using aggregate variables (in total and in per capita terms), he found the income elasticity of public expenditure with regard to GNP (or GNP per capita) to be smaller than unity. These results appear to undermine Wagner's Law (with aggregate data) for the study period. In a recent study, Yalçin (1987) also found that using aggregate data, her findings did not support the validity of Wagner's Law.

However, Sideris (2007) empirically investigated the long-run tendency for government expenditure to grow relative to national income, Wagner's law, using Greek data for the period 1833 – 1938. The results provide support for the validity of the law, and are in line with other studies examining the relationship between government spending and national income in other economies during the 19th century. Granger causality tests indicate causality

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running from the variables approximating income to the government expenditure variable. In effect, the results of the study support the validity of Wagner's Law for Greece.

Although there are some studies of public expenditure growth in the Greek public finance literature, as mentioned above, in the present contribution, we intend to employ data spanning through differeent time horizon, 1948 – 2008 and econometric methodologies that has gained considerable currency to test for the presence of Wagner's Law in Greece economy both for the purpose of providing further empirical literature for Greece and enquiry into existing results in this direction.

EMPIRICAL METHODOLOGY

Data and Variable Definition

The data we have employed for Benin Republic are annual figures covering the period 1970 – 2008. Following Musgrave (1969) version of Wagner's law formulation, the variables are measured as follows: real income (RGDP) is proxied by the Gross Domestic Product deflated with the GDP deflector, real government expenditure (RG) is proxied by total annual public consumption deflected with annual GDP deflectors to adjust for inflation. Government size is defined as the ratio of real government expenditure to real gross domestic product (GCYR) and real per capita income, defined as gross economic activities of Greece divided by the population (YPCAP). Data are sourced from IMF-International financial statistics (IFS) On-line (2009).

Model Specification and Estimation Procedure

To investigate the relationship between government expenditure and economic activity, this paper adopts Musgrave (1969) final version of functional form of Wagner's law which examines the relationship between government size in GDP and real per capita income. This can be written in linear natural logarithmic regression of the form:

$$LGCYR_t = a_o + a_1 LYPCAP_t + \varepsilon \qquad 3$$

where a_o is the constant term, GCYR is the share of government expenditure in GDP as adjusted for inflation, YPCAP the per capita income, ε is the stochastic error representation, t, the time trend and L, the natural logarithm. The variables are expressed in logarithmic form because studies by Khan and Ross (1977) suggest that in modeling an aggregate import/export demand functions, the log linear specification is preferable to the linear formulation. Secondly, slope coefficients of log-linear model measure the elasticity of a dependent variable with respect to explanatory variables (Gujarati, 1995) and this suits exactly what we need for testing the validity of Wagner's law for Greece. The decision rule is that for Wagner's law to hold, a_1 is expected to be greater than zero (Dimitrios, 2006 and Ferda, 2003).

The estimation procedure adopted in this study is in three sequences.

(i) Unlike traditional econometric methodology, time-series econometrics methodology requires an analysis of the time-series properties of the economic variables in a regression equation before any estimation for fear of spurious regression. To stem the

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problem of spurious regression, it is important that the time series properties of the data set employed in estimation of equation 3 is verified. It might seem reasonable to test for the presence of a unit root in the series using the most general of the models as:

$$\Delta Y_t = a_0 + \gamma y_{t-i} + a_2 t + \sum_p \beta j \, \Delta Y_{t-i-1} + e_t \qquad 4$$

where y is the series; t is (trend factor); a' is the constant term, e_t is the stochastic error term and P is the lag length. The Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) unit root tests are employed to test the integration level and the possible co-integration among the variables. (Dickey and Fuller, 1981; Phillips and Perron, 1988).

(ii) Next, we employ co-integration test to determine if the variables in the system are co-integrated. The Johansen maximum likelihood procedure of testing for cointegration is preferred to the Engle-Granger method as the latter may not yield a definitive conclusion with regard to cointegration between two variables. It is often the case that while cointegration is suggested to exist between two variables in a regression of one variable on the other, a reverse regression between them would yield an opposite conclusion. This problem does not arise with the maximum likelihood procedure. It permits simultaneous estimation of systems involving two or more variables and regards all variables in a model as endogenous within a vector auto regression (VAR) framework. Generally, it allows estimation and testing for the presence of one or more co integrating vectors in a multivariate system.

(iii) Then we estimate equation 3 using ordinary least square (OLS) technique.

(iv) And finally employ Granger Causality test to determine the cause and effect direction between the variables.

Empirical Evidence

In this section, empirical evidence to verify whether or not Wagner's Law, the proposition that there is a long-run tendency for the public sector to grow relative to national income, holds for Greece economy employing the estimation procedures below.

Summary Statistics

Data on all the employed variables for 1948-2008 periods are presented in table 1 with their means, standard deviation (SD) and coefficient of variation (CV).

Table 1: Summary Statistics of Employed Variables

	LRGCYR	LRYPACP
Mean	34.296	0.131
Std. Dev.	16.317	0.016
Coef. of Variation	0.48	0.13
Observations	61	61

Note: The test was performed using Eviews version 6.0 econometric package.

Unit Root Tests

It is pertinent that we establish the time series properties of the employed variables for the period 1948 – 2008. Testing explicitly for the manifestations of non-stationary is of great

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essence in econometric analysis associated with time series data. In one way, it serves the first step in exploring the status of the data and in the other, because the presence of such non-stationary at times has important econometric implication. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test procedures are employed in testing the integration level and the possible co integration among the variables (Dickey and Fuller, 1981, Phillips and Perron, 1988). With respect to the ADF test statistics, it is interesting to note that both the Akaike Information and the Schwarz Bayesian criteria for optimal lag length selection yield consistent results about the order of integration of the variables. The Phillips-Perron tests procedures which compute a residual variance that is robust to auto-correlation are employed as an alternative to the ADF. According to the unit root test results, table 1 in the appendix, all the time-series variables appear to be stationary in their first differences, i.e., they are both 1(1) at 1 percent significant level. This by implication suggests that all the employed data series are non-stationary and thus quiet suitable for purpose intended.

Co integration Test

Now, we proceed to test for co integration between the data series. We present this using the Johansen (1991) and Johansen and Juselius (1994) maximum likelihood approaches to test for co integration employing Trace Test and Maximal Eigenvalue. The tests are based on the comparison of H_0 (r=0) against the alternative H_1 ($r \neq 0$), where "r" represents the number of co integrating vectors. Table 3 in the appendix reports the results from the co integration tests. Evidence from the results suggest that the null hypothesis of r = 0 between the variables cannot be rejected. These results show that there is no long-run relationship between Government size and per capita income in Greece. The results further reveal that Wagner's law is not supported for Greece, since the normalized coefficient of real per capital income is negative (Ferda, 2003).

Granger Causality Test

Evidence from the results of cointegration test suggest that the null hypothesis of r = 0 between the variables cannot be rejected. In the absence of a long-run relationship between the variables, it still remains of interest to examine the short-run linkages between them (Gemmell, 1990). However, without evidence of cointegration an error-correction procedure cannot be used to model short-run relationship between national income and public expenditure (Ansari et al., 1997). However, it may still be possible to model short-run behavior of the relationship between national income and public expenditure applying the Granger causality test. That is, even though a long-run relationship between the two macro economic variables cannot be verified for this time period, it may still be possible that the variables are causally related in the short-run.

The Granger causality test results are presented in Table 4. In the tests, causality is hypothesized to run from per capita income to Government size. This by implication suggests that the hypothesis that GDP causes Public expenditure requires that Public Expenditure does not cause GDP. The tests are carried out using the first differences of each series (i.e. the stationary values). The null hypothesis of no causality is tested using F-statistics. The results of F-tests as presented in Table 4 indicate that there is no evidence to support neither Wagner's Law nor Keynes's hypothesis for Greek economy.

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Estimation of the Model 3 (OLS)

Table 5 in the appendix presents the results of the model estimation of equation 3, using ordinary least square estimation method (OLSEM). The coefficient of the real per capital income (a_1) of 0.000451 even though statistically significant at 0.1 percent level, is not economically different from zero as it portends that even 100percent increase real per capita income can just only lead to 0.04 percent increase in Government size. This is quiet inconsequential and consistent with the outcome of the co integration approach which find no support for Wagner's Law for Greece. For the diagnostic checks conducted, the D.W-statistics of 0.571 indicates the presence of some elements of first order autocorrelation in the employed data series. According to the CUSUM test result not presented here, the recursive residuals strayed outside the critical 5% significant lines, which indicate the presence of structural change, and that the stability of the parameter estimates is not verified.

CONCLUDING REMARKS

In the present contribution, the long-run tendency for government expenditure to grow relative to national income, Wagner's law is investigated empirically using Greek data for the period 1948 – 2008. Utilizing annual data, this paper has examined the validity of Wagner's Law based on co integration analysis, and OLS estimation test. For this purpose, empirical investigation of the stationary properties and the order of integration of the employed variables are conducted using Augmented-Dickey Fuller (ADF) and Philips Peron tests. The results show that all the variables were stationary in their first difference. Since the variables are integrated of 1 (1), we employ co-integration test for the regression model. The hypothesis of a long-run relationship between real income per capita (RYPCAP) and the share of real public expenditure in real gross domestic product (RGCYR) is investigated using Johansen Maximum Likelihood approach to co-integration test and found to be false .Evidence from the results suggest that the null hypothesis of r = 0 between the variables cannot be rejected. The results further reveal that Wagner's law is not supported for Greece since the normalized coefficient of real per capital income (rypcap) is negative. The OLS estimation results still support the validity of the cointegration results as the value of the coefficient of income per capita, economically, is not significantly different from zero. All the results of the empirical estimations point to the fact that Wagner's Law is not supported for Greek economy during the period under review. This finding is inconsistent with the contribution of Sideris, 2007 for Greece, but in agreement with the finding of Demirbas, 1999 for Turkey.

REFERENCES

Afonso, A. and Furceri, d. (2008), "Government Size, Composition and Valotility and Economic Growth", Working Paper Series NO. 849, European Centeral Bank-Eurosystem.

Ansari, M.I., D.V. Gordon and C. Akuamoah, (1997), "Keynes versus Wagner: Public

Anwar, M. S., Davies, S. and Sampath, R. K., (1996), "Causality between government expenditures and economic growth: an examination using co-integration techniques", *Public Finance/Finances Publiques*, 51 (2), 166–184.

2053-2199 (Print), 2053-2202(Online)

Ashworth, J., (1995), 'The empirical relationship between budgetary deficits and government expenditure growth: an examination using co-integration', *Public Finance/Finances Publiques*, 50 (1), 1–18.

Asseery, A. A., Law, D. and Perdikis, N., (1999), "Wagner's law and public expenditure in Iraq: a testing using disaggregated data", *Applied Economic Letters*, 6 (1), 39–44.

Bairam, E. I., (1995), "Level of aggregation, variable elasticity and Wagner's law", *Economics Letters*, 48, 341–344.

Barro, R. J. (1990), "Government Spending in a Simple Model of Endogenous Growth", *Journal of Political Economy, Vol*. 1990.

Bir Çalisma (1963-1985). *Unpublished PhD thesis.* Ankara: Ankara Üniversitesi

Bohl, M. T., (1996), 'Some international evidence on Wagner's law', *Public Finance/ Finances Publiques, 51* (2), 185–200.

Burney, N. A., (2002), "Wagner's hypothesis: evidences from Kuwait using co-integration tests", *Applied Economics*, 34 (34), 49–57.

Demirbas, S. (1999), "Cointegration Analysis-Causality Testing and Wagner's Law: The Case of Turkey, 1950 – 1990. This paper was presented at the Annual Meeting of the

Dickey, D. and Fuller, W.A. (1981), "Likelihood Ratio Statistics for Autoregressive Time Series with Unit Root", *Econometrica 49, 1057 -72*.

European Public Choice Society that held in Lisbon (April: 7-10, 1999) at the Instituto Superior de Economiae Gestao, Universidade Technica de Lisboa.

Expenditure and National Income for three African Countries", *Applied Economics*, 29, 543-550.

Fakülteler Matbaasi.

Ferda, H. (2003), "Testing Wagner's Law for Turkey, 1960 – 2000", *Rev. Middle East Econ. Fin.*, 1 (2), 129 – 140.

Gemmell, N. (1990). "Wagner's Law, Relative Prices and the Size of the Public

Goffman, I.J. and D.J. Mahar (1971), "The Growth of Public Expenditures in Selected Developing Nations: Six Caribbean Countries", *Public Finance* 26(1), pp. 57–74.

Goffman, J. J., (1968), 'On the empirical testing of Wagner's law: a technical note', *Public Finance/Finances Publiques*, 3 (3), 359–364.

Gujarati, D. N. (1995) Basic Econometrics, 3rth Edition, *New York:* McGraw-Hill.

Gupta, S.P. (1967), "Public Expenditure and Economic Growth: A Time-Series Analysis", *Public Finance* 22(4), pp. 423–461.

Henrekson, M., (1993), 'Wagner's law – a spurious relationship'? *Public Finance/Finances Publiques*, 48 (2), 406–415.

Hondroyiannis, G. and Papapetrou, E. (1995), "An Examination of Wagner's Law for Greece", *Public Finance* 50.

Hsieh, E. and Lai, K. S., (1994), 'Government spending and economic growth: the G-7 experience'. *Applied Economics*, 26 (6), 535–542.

http://www.heritage.org/country/greece

Johansen, S. (1991), "Estimation and Hypothesis Testing of Gaussian Vector Autoregression Models", *Econometrics 59.*

Johansen, S. and Juselius, K. (1994), "Identification of Long-run and Short-run Structure: An application of ISLM Model", *Journal of Econometrics 63, 7 – 36*

Khan, M.S. and Rose, K. Z. (1977). "The functional form of Aggregate Import Equation" *Journal of International Economics 7: 149-160*

2053-2199 (Print), 2053-2202(Online)

Krzyzaniak, M. (1974). "The Case of Turkey: Government Expenditures, the Revenue Constraint, and Wagner's Law", *Growth and Change*, 5, 13-19.

Mann A.J. (1980), "Wagner's Law: An Econometric Test for Mexico, 1925–1976", *National Tax Journal* 33(2), pp. 189–201.

Michas, N.A. (1975), "Wagner's Law of Public Expenditures: What is the Appropriate Measurement for a Valid Test?" *Public Finance* 30(1), pp. 77–84.

Murthy, V. N. R., (1993), 'Further evidences of Wagner's law for Mexico: an application of co- integration analysis'. *Public Finance/Finances Publiques*, 48 (1), 92–96.

Musgrave, R.A. (1969), *Fiscal Systems*, New Haven and London: Yale University Press.

Nomura, M., (1995), 'Wagner's hypothesis and displacement effect in Japan, 1960–1991'. *Public Finance/Finances Publiques*, 50 (1), 121–135.

Önder, I. (1974). *Türkiye'de Kamu Harcamalarinin Seyri: 1927-1967*. Istanbul:

Park, W. K., (1996), 'Wagner's law, vs. Keynesian paradigm: the Korean experience', *Public Finance/Finances Publiques*, 51 (1), 71–91.

Peacock, A.T. and J. Wiseman (1961), *The Growth of Public Expenditure in the UnitedKingdom*, Princeton: Princeton University Press.

Perron, Pierre (1989) The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis, *Econometrica* 57, November, 1361-401.

Phillips, P.C.B. and Perron, P. (1988) Testing for a Unit Root in Time Series Regression, *Biometrica*, 75, 335-46.

Pryor, F. L., (1968), 'Public Expenditure in Communist and Capitalist Nations', *London: George Allen and Unwin.*

Ram, R., (1986), 'Causality between income and government expenditure: a broad international perspective', *Public Finance/Finances Publiques*, 31 (3), 393–413.

Ram, R., (1987), 'Wagner's hypothesis in time series and cross section perspectives: evidence from 'Real'data for 115 countries', *Review of Economics and Statistics*, 69 (2), 359–393.

Romer, P. M. (1990), "Growth and Public Sector: A Critical Review Assay", *Journal of Political Economy*, 98 (5), 71 – 102.

Sector", *The Manchester School*, 57 (4), 361-377.

Sideris, D. (2007), "Wagner's Law in 19th century Greece: a Cointegration and Causality Analysis", *Department of Economic, University of Ioaninna University Campus 45110 Ioaninna, Greece.*

Timm, H. (1961), "Das Gesetz des wachsenden Staatsausgaben", *Finanzarchiv* 19**,** pp. 201–247.

Wagner, A., (1890), "Finanzwissenschaft", Winter, C.F., Leipzig..

World Factbook (2009) *https://www.cia.gov/library/publications/the-world-factbook/*

Yalçin (Akbulut), H. E. (1987). Kamu Kesiminin Büyümesi: Türkiye için Uygulamali

Ziramba, E. (2008) 'Wagner's Law: An Econometric Test for South Africa, 1960-2006' *South African Journal of Economics*, 76 (4), 596-606.

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APPENDIX

Table 2: Results of ADF and PP Unit Root Tests

Variables	ADF		Phillips Perron		
	Intercept	Trend/Intercept	Intercept	Trend/Intercept	Decisions
LRGCYR	0.762 $^{1(0)}$	-2.101 $^{1(0)}$	0.543 $^{1(0)}$	-1.304 $^{1(0)}$	1(0)
ΔLRGCYR	-5.139 $^{1(1)*}$	-5.246 $^{1(1)*}$	-5.410 $^{1(1)*}$	-5.524 $^{1(1)*}$	1(1)
LRYPCAP	-2.587 $^{1(0)}$	-2.819 $^{1(0)}$	-2.444 $^{1(0)}$	-2.779 $^{1(0)}$	1(0)
ΔLRYPCAP	-10.860 $^{1(1)*}$	-10.838 $^{1(1)*}$	-10.860 $^{1(1)*}$	-10.838 $^{1(1)*}$	1(1)

*Notes: *, represents 1 percent level of significance.*
The test was conducted using E-view version 6.0 econometric package

Table 3: Results of Co integration Test.

No of CE(s)	Trace Statistics	0.05 Critical Value	Prob**
None	10.062	15.494	0.275
At most 1	0.296	3.841	0.585
Maximum Eigenvalue			
None	9.765	14.264	0.227
At most 1	0.296	3.841	0.585
Notes: 1. *Both Trace and Max-Eigen Tests indicate no co integration at the 0.05 level* *2.The test was conducted using E-view version 6.0 econometric package* **, denotes rejection of the hypothesis at the 0.05 level.*			

Table 4: Pairwise Granger Causality Test Results.

Null Hypothesis	Obs	F-Statistic	Prob.
LRYCAP does not Granger Cause LRGCYR	59	2.51608	0.0902
LRGCYR does not Granger Cause LRYCAP		1.55503	0.2205

Note: The test was performed using Eviews version 6.0 econometric package.

Table 5: Results of the OLS Estimation.

Dependent Variable: LRGCYR Included Observation: 61				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRYPCAP	0.00045	0.00012	3.9374	0.0002
C	0.11566	0.00435	26.6084	0.0000
Adjusted R-square: 0.195 *F-statistic: 15.50* *D.W stat.: 0.571*				

The test was conducted using E-view version 6.0 econometric package

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