

## Antoniou Antonis

State General Archives of Greece,  
Greece

✉ galkn@otenet.gr

## Katrakilidis Constantinos

Department of Economics,  
Aristotle University of Thessaloniki,  
Greece

✉ katrak@econ.auth.gr

## Tsaliki Persefoni

Department of Economics,  
Aristotle University of Thessaloniki,  
Greece

✉ ptsaliki@econ.auth.gr

We acknowledge the valuable  
comments of two anonymous referees.

# Wagner's Law versus Keynesian Hypothesis: Evidence from pre-WWII Greece

**Summary:** With data of over a century, 1833-1938, this paper attempts, for the first time, to analyze the causal relationship between income and government spending in the Greek economy for such a long period; that is, to gain some insight into Wagner and Keynesian Hypotheses. The time period of the analysis represents a period of growth, industrialization and modernization of the economy, conditions which are conducive to Wagner's Law but also to the Keynesian Hypothesis. The empirical analysis resorts to Autoregressive Distributed Lag (ARDL) Cointegration method and tests for the presence of possible structural breaks. The results reveal a positive and statistically significant long run causal effect running from economic performance towards the public size giving support to Wagner's Law in Greece, whereas for the Keynesian hypothesis some doubts arise for specific time sub-periods.

**Key words:** Wagner's Law, Economic growth, ARDL cointegration, Causality.

**JEL:** H50, E69, E62, C22, C51.

The theoretical and empirical relationship between government expenditures and economic growth turned to be an intense subject of analysis and controversy within the economic literature. It was raised as far back as in late 1800s and since then many empirical attempts have been proposed in order to explore the flow of causality between government size and economic development. Adolph Wagner (1893) was among the first who observed the overtime increasing tendency of public spending and the concomitant Wagner's Law, as presented in economic literature since then, states that economic performance has a fundamental positive impact on public sector's growth. However, an equally important strand in economic policy literature, rooted in Keynesian principles, argues for the opposite; that is public spending can form an exogenous tool of economic policy to enhance growth through its multiple effect on aggregate demand. As a result, many economists following the Keynesian tradition argue that an economy needs a Keynesian-type fiscal stimulus to be given temporarily in periods of recession by an active government (Phillip Arestis 2011), whereas, others, belonging to mainstream economics, argue that the government has to be small and not to replace the market mechanism. The evolution of the debate about the role of government in a society is presented in Daniel Yergin and Joseph Stanislaw (2002).

For the first time, the present paper attempts to gain some insight into the causal relationship between economic performance and government size in Greece

for such a long period of over a century, 1833-1938. In so doing, we explore the dynamics of this highly debated relation in a developing country, since Greece during this period was gradually transformed into a modern state. It is worth noting that the majority of relevant studies refer only to Postwar Greece and use econometric techniques that may give rise to spurious results about the strength of the long-run equilibrium relationship between government expenditure and national income. Instead, in the context of our empirical analysis the use of Autoregressive Distributed Lag (ARDL) approach to cointegrated analysis (Hashem H. Pesaran and Yongcheol Shin 1999) and time series data from 1833-1938 allows us to arrive to more reliable conclusions. The major advantage of the ARDL method is that by employing an appropriate augmentation it avoids problems of serial correlation and of endogeneity experienced by other cointegration methods. In addition, this method avoids pretesting of the order of integration, which is associated with other cointegration techniques. Moreover, the present effort checks for structural breaks in the data set, since the time period is very long. Consequently, the results derived from our empirical analysis are expected to be more reliable and thus to provide us with a better understanding of the long run causal relation between government size and economic performance in Greece.

The remainder of the paper is organized as follows: Section 1 briefly presents the theoretical underpinnings of Wagner's Law and reviews the basic literature about the causal relation between government size and economic performance. In Section 2, the ARDL approach to cointegration is presented; the section continues with the description of data and the presentation and discussion of the empirical findings. Finally, the concluding remarks and the proposals for future research are reported in Section 3.

## 1. Wagner's Law in Economic Literature

Through the years, several attempts have been made to explain the growth in public sector. Several propositions were put forward either by economists or economic historians. Walt W. Rostow (1960) suggested that the increase in public expenditure might be related to the pattern of economic growth and development of the various societies whereas Alan T. Peacock and Jack Wiseman (1961) argue that social crises cause the increase in public sector expenditure. William J. Baumol (1967) argues that the public sector, by being less productive than the private, is doomed to increase as the private sector increases, whereas Morris Beck (1976) suggests that the "relative price effect", meaning that public sector unit costs increase faster than those in private sector, is the cause for the rise in public sector expenditure. Nevertheless, Wagner's Law is among the first attempts made to explain the increase in public sector and mathematically can be formulated as:

$$G_t = f(Y_t) \quad (1)$$

where  $G$  refers to the size of the public sector,  $Y$  stands for the level of economic performance, and  $t$  is for time. The various empirical studies use different indexes to approximate the size of the government, (i.e. the share of government spending over

GNP, the growth rate of government spending, the per capita public spending, etc.) and the level of economic activity, (i.e. the GNP per capita, the growth rate of GNP, etc).

However, different interpretations of the hypothesis under testing inevitably led to various models modifications. For instance, Richard A. Musgrave (1969) uses total and partial public spending and GNP in logarithms as the dependent and independent variables, respectively, in an attempt to estimate the income elasticity of "public goods". Arthur J. Mann (1980), in his model for Mexico, estimates the income elasticity by taking GNP per capita as the independent variable and the share of public spending to GNP as the dependent variable.

Wagner's Law has been empirically asserted over the years and, not surprisingly, the reported results are highly diverse and conflicting. For example several studies - Subrahmanyam Ganti and Bharat R. Kolluri (1979); Rati Ram (1987) for a sample of 115 countries; Les Oxley (1994) for Britain; John Thornton (1999) for the 19<sup>th</sup> century Europe; Kolluri, Michael J. Panik, and Mahmoud S. Wahab (2000) for the G-7 countries; Nikolaos Dritsakis and Antinios Adamopoulos (2004) for Greece - have presented results in favour of Wagner's Law. In contrast, the studies by Magnus Henrekson (1993) for Sweden and by George Hondroyiannis and Evangelia Papapetrou (1995) for Greece have reported empirical evidence that contradict Wagner's hypothesis. Moreover, mixed results have been reported by Ram (1986) for a sample of 63 countries, Michael Chletsos and Christos Kollias (1997) for Greece, Erkin I. Bairam (1995) for USA and by Chang Tsangyao, Wenrong Liu, and Stecen B. Caudill (2004) for a sample of ten industrialized countries.

In addition, studies exploring Wagner's hypothesis versus the Keynesian one have also reported highly diverse and conflicting results. Panos C. Afentiu and Apostolos Serletis (1996) for six European countries showed no evidence for both propositions, whereas the study by Biswal Bagala, Dhawan Uruashi, and Hooi-Yean Lee (1999) for Canada and the work by Constantinos P. Katrakilidis and Persefoni Tsaliki (2009) for Postwar Greece find supportive empirical evidence for both hypotheses. The studies by Mohammed A. Ansari, Daniel V. Gordon, and Christian Akuamoah (1997) for three African countries, Anisul M. Islam (2001) for the USA and by Abdulrazak F. Al-Faris (2002) for the Gulf Cooperation Council countries find evidence supporting the Wagner hypothesis but not the Keynesian view, whereas the study by John Loizides and George Vamvoukas (2005) for UK, Ireland and Greece reports mixed results.

However, the econometric techniques engaged in the aforementioned empirical analyses render their results problematic. Recently, progressive economic studies allow the use of cointegration and other advanced techniques in order to check; first, the over time tendency of public spending and gross national product; second, the hypothesis of a long-run relationship between public spending and gross national product; and third, the underline causality of this relationship (Islam 2001; Al-Faris 2002).

## 2. Methodology, Data and Results

### 2.1 Methodological Issues

#### The ARDL Cointegration Approach

In the present analysis, we use the ARDL approach to cointegration which we consider it as a more appropriate technique since it presents certain advantages over other conventional cointegration procedures such as: the long and short-run parameters of the model are estimated simultaneously; all variables are assumed to be endogenous and the estimates obtained are unbiased and efficient since they avoid the problems that may arise due to serial correlation and endogeneity (Pesaran, Shin, and Richard J. Smith 2001); inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle-Granger method are avoided; the need to establish the order of integration amongst the variables is obviated, which is equivalent to saying that the method can be applied even in the case where the variables are  $I(0)$  or  $I(1)$  or a mixture of the two but not  $I(2)$ . Moreover, in case that cointegration is detected, the resulting Error Correction Model (ECM) can be used for Granger non-causality tests, as suggested recently by Joao R. Faria and Miguel Leon-Ledesma (2003). An advantage of using a bi-variate approach to test for causality is that it allows to test, on the one hand, the short-run causality through the lagged differenced explanatory variables and, on the other hand, the long-run causality through the Error Correction (EC) term. As Clive W. J. Granger, Bwo-Nung Huang, and Chin-Wei Yang (2000) suggest a significant EC term implies long-run causality from the explanatory variables to the dependent variable. The ARDL approach to cointegration involves the estimation of the following conditional EC versions:

$$dG_t = \alpha_0 + \sum_{i=1}^p b_i dG_{t-i} + \sum_{i=0}^q c_i dY_{t-i} + \delta_1 G_{t-1} + \delta_2 Y_{t-1} + e_t \quad (2)$$

$$dY_t = \alpha_0 + \sum_{i=1}^p b_i dY_{t-i} + \sum_{i=0}^q c_i dG_{t-i} + \delta_1 Y_{t-1} + \delta_2 G_{t-1} + e_t \quad (3)$$

where  $G$  is a proxy for government expenditure,  $Y$  is a proxy for economic performance and  $d$  denotes first differences. Based on the above equations, we perform a “bounds test” for the detection of a long-run causal relationship between the two variables. The test involves an  $F$ -test on the joint null hypothesis that the coefficients of the level variables are jointly equal to zero (Pesaran and Shin 1999; Pesaran, Shin, and Smith 2001). The statistic displays a non-standard  $F$ -distribution and its value depends on whether the variables are individually  $I(0)$  or  $I(1)$ . Instead of the conventional critical values, the test employed involves two asymptotic critical value bounds, depending on whether the variables are  $I(0)$  or  $I(1)$  or a combination of both. If the test statistic exceeds their respective upper critical values, it may be argued then that there is evidence of a long-run relationship. If the test statistic falls below the lower critical values, we cannot reject the null hypothesis of no cointegration. However, if the test statistic lies between the bounds, inference about cointegration is inconclusive.

The conditional long-run model can be produced from the reduced form solution of the above equations, when the first-differenced variables jointly equal zero. The long-run coefficients and the corresponding ECM are estimated through an appropriate ARDL specification. The lag structure for the ARDL specification is determined by the Akaike's Information Criterion (AIC). Autocorrelation has also been considered.

### The LM Unit Root Test of Lee and Strazicich with Break

Junsoo Lee and Mark C. Strazicich (2004) developed two versions of the LM unit root test with one structural break, Model A known as the "crash model" and Model C known as the "crash-cum-growth model". Model A allows for a one-time change in the intercept under the alternative hypothesis and is described as  $Z_t = [1, t, D_t]'$ , where  $D_t = 1$  if  $t \geq T_B + 1$ , and zero otherwise. Model C allows for a shift in intercept and change in trend slope under the alternative hypothesis and is described as  $Z_t = [1, t, D_t, DT_t]'$ , where  $DT_t = t - T_B$  for  $t > T_B + 1$ , and zero otherwise.

The one break LM unit root test statistics according to the LM (score) principle are obtained from the following regression:

$$\Delta y_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + u_t \quad (4)$$

where  $\tilde{S}_t = y_t - \tilde{\psi}_x - Z_t \tilde{\delta}$  ( $t = 2, \dots, T$ ) and  $Z_t$  is a vector of exogenous variables defined by the data generating process;  $\tilde{\delta}$  is the vector of coefficients in the regression of  $\Delta y_t$  on  $\Delta Z_t$  respectively with  $\Delta$  the difference operator; and  $\tilde{\psi}_x = y_1 - Z_1 \tilde{\delta}$ , with  $y_1$  and  $Z_1$  the first observations of  $y_t$  and  $Z_t$  respectively. The unit root null hypothesis is described in (1) by  $\phi = 0$  and the LM  $t$ -test is given by  $\tilde{\tau}$ ; where  $\tilde{\tau} = t$ -statistic for the null hypothesis  $\phi = 0$ . The augmented terms  $\Delta \tilde{S}_{t-j}$ ,  $j = 1, \dots, k$  terms are included to correct for serial correlation. The value of  $k$  is determined by the general to specific search procedure. To endogenously determine the location of the break ( $T_B$ ), the LM unit root searches for all possible break points for the minimum (the most negative) unit root  $t$ -test statistic as follows:

$$\text{Inf} \tilde{\tau}(\tilde{\lambda}) = \text{Inf}_{\lambda} \tilde{\tau}(\lambda); \text{ where } \lambda = T_B / T \quad (5)$$

## 2.2 Data

The empirical analysis engages annual data of the Greek economy (Antonios Antoniou 2004; Antoniou, George Kostelenos, and Ioannis Kaskarellis 2007) and the time period under investigation covers the period 1833-1938. At this point, we have to mention that for Greece, there are official published data since 1911 by the Statistical Service. Prior to 1911, there are no officially completed time series data: however, a reliable time series data set for the period under question has been constructed by two research institutions, namely the Centre of Planning and Economic Research and the Historical Archives of National Bank of Greece (Georgios Kostelenos et al. 2007).

As a proxy for the size of the public sector we employ the total real per capita government expenditure in logarithmic form ( $G$ ), whereas for the economic performance we use the log of real per capita GDP ( $Y$ ). The use of per capita indexes for public size and economic performance was imposed on us, since Greece from its formation as a state in 1833 until the outbreak of the World War II experienced significant changes in both population and territorial size.

## 2.3 Results

The first step in our empirical analysis is the application of the Dickey-Fuller (David A. Dickey and Wayne A. Fuller 1981) test in order to examine the integration properties of the series. Table 1 below, shows that the augmented Dickey-Fuller tests for  $G$  and  $Y$  series provide rather vague results depending on the presence of a time trend variable; when testing the variables in first differences ( $dG$  and  $dY$ ) the results clearly indicate stationary properties. In such a case and given that the conventional cointegration tests (Soren Johansen 1988; Johansen and Katarina Juselius 1990) are based only on  $I(1)$  variables, we employ the ARDL cointegration method which can be applied regardless of the stationary properties of the variables involved.

**Table 1** Augmented Dickey-Fuller Test, 1833-1938

Variable	with intercept with intercept		with intercept and trend	
	lags	test statistic	lags	test statistic
Y	3	-0.70	3	-3.02
G	2	-2.55	1	-6.03
dY	1	-10.10	1	-10.20
dG	1	-9.74	1	-9.71

**Note:** 95% critical value for the augmented Dickey-Fuller statistic without a trend is -2.8900 and with a linear trend is -3.4543.

Source: Authors' estimations.

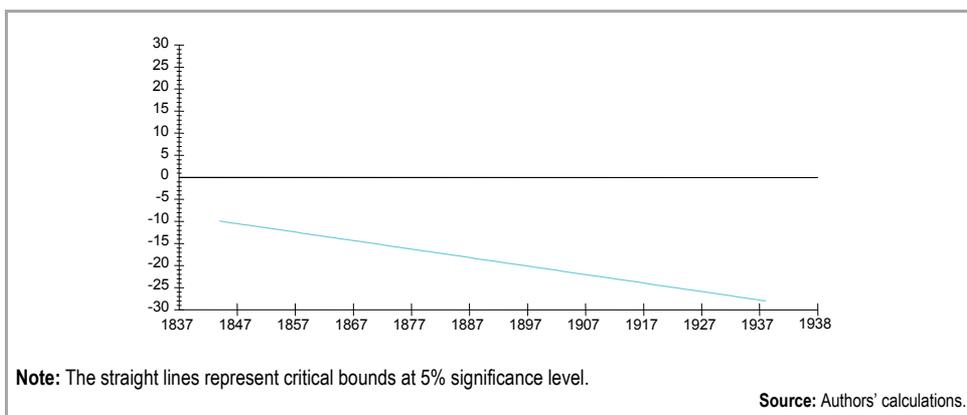
We next report the results of the empirical analysis regarding the Wagner and in turn the Keynesian hypotheses for the entire period (Tables 2 and 3 below). An ARDL (1,1) model has been selected by means of AIC to test the Wagner hypothesis. From Table 2 (left panel), we see that there is a significant positive long-run relationship between  $Y$  and  $G$ . Actually, the long-run coefficient of the  $Y$  is 1.94 and significant ( $p$ -value<0.01) indicating that the income elasticity of government spending is elastic. Interpretation of Wagner's Law suggests that public expenditure grows faster than national income, indicating that the income elasticity for public goods is positive rendering their demand similar to the demand for normal goods. Plausible reasons explaining the value of elasticity for public goods can be found in Dritsakis and Adamopoulos (2004).

In addition, from Table 3 (left panel) the negative and statistically significant coefficient of the EC term (-0.44 with  $p$ -value<0.01) confirms the existence of a long-run causal relationship from  $Y$  towards to  $G$ , while the statistically significant  $dY$  variable ( $p$ -value=0.01) reveals a short-run causal effect running from income towards public spending. However, the applied Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ) tests showed that the coefficients in the equation are not that stable over the

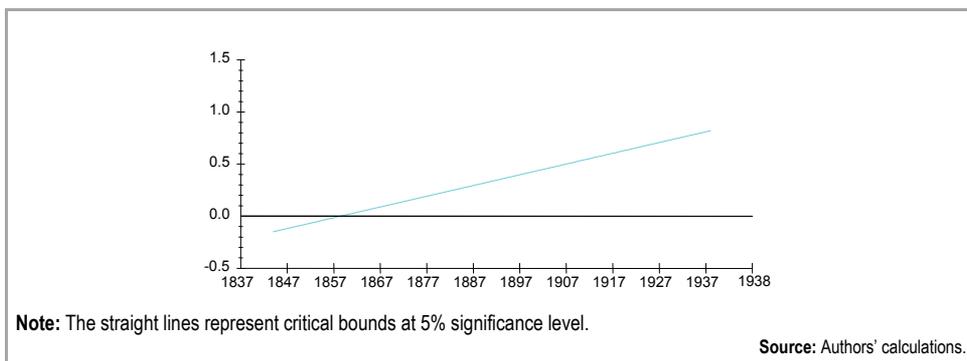
whole period suggesting the existence of at least two distinct periods in the data set and a possible significant structural break (Figures 1a and 1b).

We next proceed with the investigation of the Keynesian hypothesis for the entire period by employing an ARDL(1,1) model selected by means of AIC as well. Following Table 2 (right panel), there is a significant positive long-run causal effect (0.35 and  $p$ -value=0.014) running from  $G$  to  $Y$ .

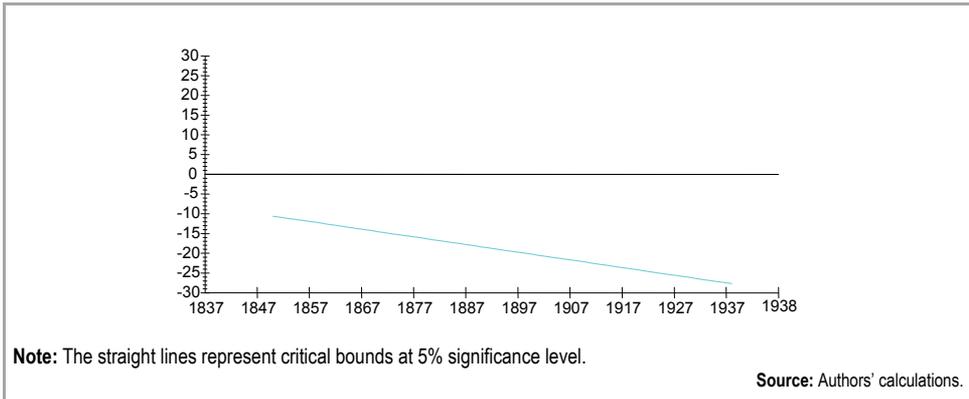
In addition, from Table 3 (right panel), the ECM estimates confirm that there is a rather weak long-run relationship between the two variables ( $p$ -value for EC term=0.068), as well as short-run effects, running from  $dG$  towards  $dY$  ( $p$ -value for EC term<0.01). Once again, the applied CUSUM and CUSUMSQ tests showed instability of coefficients, suggesting the existence of at least two distinct periods in the data set and a possible significant break (Figures 2a and 2b).



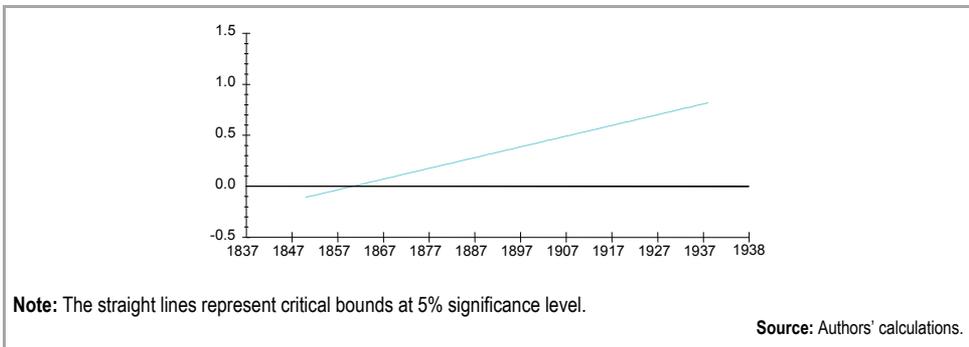
**Figure 1a** Wagner's Hypothesis (1833-1938)  
Plot of Cumulative Sum of Recursive Residual



**Figure 2a** Wagner's Hypothesis (1833-1938)  
Plot of Cumulative Sum of Squares of Recursive Residuals



**Figure 1b** Keynesian Hypothesis (1833-1938)  
Plot of Cumulative Sum of Recursive Residuals



**Figure 2b** Keynesian Hypothesis (1833-1938)  
Plot of Cumulative Sum of Squares of Recursive Residuals

**Table 2** Estimated Long Run Coefficients Using the ARDL Approach

Wagner hypothesis, 1833-1938 dependent variable G ARDL(1,1) selected based on AIC				Keynesian hypothesis, 1833-1938 dependent variable Y ARDL(3,1) selected based on AIC			
R/essor	coeff.	St/Er	T-Ratio[prob]	R/essor	coeff.	St/Er	T-Ratio[prob]
Y	1.940	.327	5.929[.000]	G	.350	.139	2.510[.014]
C	-6.691	1.787	-3.7438[.000]	C	4.1297	.543	7.612[.000]

**Source:** Authors' estimations.

**Table 3** Error Correction Representation for the Selected ARDL Model

Wagner hypothesis, 1833-1938 dependent variable dG ARDL(1,1) selected based on AIC				Keynesian hypothesis, 1833-1938 dependent variable dY ARDL(3,1) selected based on AIC			
R/essor	coeff.	St/Er	T-Ratio[prob]	R/essor	coeff.	St/Er	T-Ratio[prob]
dY	1.301	.243	5.361[.000]	dY(-1)	-2.279	.102	-2.725[.008]
dC	-2.975	.930	-3.199[.002]	dY(-2)	-.137	.091	-1.499[.137]
ecm(-1)	-.445	.082	-5.395[.000]	dG	.156	.032	4.837[.000]
				dC	.659	.379	1.736[.086]
				ecm(-1)	-.159	.086	-1.847[.068]

Source: Authors' estimations.

In order to gain a more clear insight about the presence of a structural break, we test the integration properties of both the spending and income series by applying the LM test proposed by Lee and Strazicich (2004). This test allows for a structural change to be determined “endogenously” from the data searching for possible significant structural breaks either in the mean or in the slope, or in both the mean and the slope of the examined series. The results, reported in Table 4, panel A, confirm that public spending is a non-stationary process with a t-significant break in both the mean and the slope, identified around the year 1876. Similar findings, reported in panel B of the same table, reveal that the income series is also non-stationary with a t-significant break in both the mean and the slope, identified around the year 1880. Following the above results and in order to avoid unreliable inferences, we proceed by splitting the whole period in two sub-periods, a first one from 1833 to 1880 while the second from 1881 to 1938.

**Table 4** Lee and Strazicich min LM t-stat  
Testing model:  $z(t) = \text{intercept} + aS(t-1) + bB(t) + cD(t) + (\text{lags})$ 

Panel A Tested variable LGR			
Min t-stat	Break date	t-stat mean dummy	t-stat slope dummy
-2.7526	1876	4.4378*	-2.7216*
Panel B Tested variable LYR			
Min t-stat	Break date	t-stat mean dummy	t-stat slope dummy
-3.5851	1880	2.2635*	-2.5725*

Note: \* denotes 5% statistical significance.

Source: Authors' estimations.

It is worth noting at this point that the two sub-periods, 1833-1880 and 1881-1938, indicated by the empirical analysis, correspond to two distinct economic and political periods of the Greek state. From its establishment till 1860's, Greece's fiscal policy was determined by the decisions of its monarch whose management was characterized by the total neglect on human capital and infrastructure concerns. As a matter of fact, during the period 1833-1843 (absolute monarchy) the bulk of public expenditure was directed towards the purchase and construction of buildings to host mostly monarch's luxury needs. During the constitutional monarchy period (1844-1862), we had the construction of new public buildings, as well as some public ex-

penditure on transportation infrastructure. According to Maria Synarelli (1989), Antoniou (2011) and Thanassis Kalafatis and Evangelos Prontzas (2011) during the years 1833-1881 a very small portion of public expenditures was directed towards public infrastructure and public investment in general. Until the decade of 1860's, state revenues lacked significantly state expenditures and external borrowing was the main source to finance mainly the royal standards of living. After 1860's and the first Constitution, the political climate became more stable. In the late 1870's the Greek economy opened to foreign markets and applied active fiscal policy through spending in transport infrastructure (railroads, ports, etc.). During the same period, several sectors showed rapid growth, such as banks, trade, shipping and agriculture. Greek and foreign funds were invested in the economy providing in that way the ground for better economic performance (Lefteris Tsoulfidis 2003).

Thus, the two distinct periods of the Greek state should appear in the analysis. As a matter of fact, the results, reported in Tables 5 and 6 below, for the period 1833-1880 confirm the existence of cointegration between the tested variables and reveal that the Wagner hypothesis holds. With  $G$  as the dependent variable the evidence reveal the existence of a long-run equilibrium relationship ( $p$ -value=0.013), with long-run causality running from  $Y$  to  $G$  (Table 5, left panel) providing support in favour of Wagner's Law. The ECM representation, reported in Table 6 (left panel), also confirms the existence of long-run causality running from  $Y$  to  $G$ , since the respective coefficient is statistically significant and have the correct negative sign (-0.488,  $p$ -value = 0.006). Besides, there is evidence of a short run causal impact running from  $dY$  to  $dG$  ( $p$ -value < 0.01) while the CUSUM and CUSUMSQ tests reject the instability of the estimated coefficients.

Turning now to the Keynesian hypothesis (Table 5, right panel) with  $Y$  as the dependent variable, we see that the evidence is not in favour of long-run causality running from  $G$  to  $Y$  ( $p$ -value = 0.751). That is, for that specific period of time, the Keynesian hypothesis is not vindicated. The same conclusion can be drawn from Table 6 (left panel) which refers to the EC estimates. Actually, we observe that there is a short-run causal effect running from  $dG$  to  $dY$  ( $p$ -value = 0.00) but there is no evidence of a long-run relation, since the EC term is not statistically significant ( $p$ -value=0.235). CUSUM and CUSUMSQ tests confirm stability of the estimated coefficients. As already mentioned, a possible explanation for the above results can be found in the total absence of public works and in the increase in royal spending absorbing all state revenues and loans (Synarelli 1989; Tsoulfidis 2003).

**Table 5** Estimated Long-Run Coefficients Using the ARDL Approach

Wagner hypothesis, 1833-1880 dependent variable $G$ ARDL(1,1) based on AIC				Keynesian hypothesis, 1833-1880 dependent variable $Y$ ARDL(2,1) based on AIC			
R/ressor	coeff.	St/Er	T-Ratio[prob]	R/ressor	coeff.	St/Er	T-Ratio[prob]
Y	1.019	.388	2.625[.013]	G	.174	.543	.322[.751]
C	-1.635	2.044	-.799[.430]	C	4.715	1.944	2.425[.022]
T	-.011	.004	-2.452[.020]				

Source: Authors' estimations.

**Table 6** Error Correction Representation for the Selected ARDL Model

Wagner hypothesis, 1833-1880 dependent variable dG ARDL(1,1) based on AIC				Keynesian hypothesis, 1833-1880 dependent variable dY ARDL(2,1) based on AIC			
R/ressor	coeff.	St/Er	T-Ratio[prob]	R/ressor	coeff.	St/Er	T-Ratio[prob]
dYR	1.207	.257	4.719[.000]	dY(-1)	-.237	.114	-2.083[.046]
dC	-.797	.984	-.810[.424]	dG	.334	.069	4.867[.000]
dT	-.005	.003	-1.932[.062]	dC	.585	.503	1.164[.253]
ecm(-1)	-.488	.165	-2.958[.006]	ecm(-1)	-.124	.102	-1.212[.235]

Source: Authors' estimations.

In contrast, for the sub-period 1881-1938, the analysis confirms that both Wagner's Law and Keynesian hypothesis hold (Tables 7 and 8 below). When government spending  $G$ , is the dependent variable, the appropriate specification, by means of AIC, is an ARDL(1.1) model, which is used to investigate the long-run relation between the economic level and government spending. The left panel of Table 7 indicates the existence of a positive and statistically significant long-run causal effect ( $p$ -value<0.01) running from income towards government spending; hence, the results provide evidence in favour of Wagner's Law. Also, the ECM representation reported in Table 8 (left panel), also confirms the existence of long-run causality running from  $Y$  to  $G$ , since the respective error correction term is statistically significant and negative (-0.54,  $p$ -value<0.01). Besides, the statistically significant coefficient of  $dY$  ( $p$ -value=0.01) reveals a short-run causality running from  $dY$  to  $dG$ .

Turning now to the Keynesian Hypothesis with  $Y$  as the dependent variable the evidence reported in Table 7(right panel) is also in favour of a long-run equilibrium relationship with long-run causality running from  $G$  to  $Y$  ( $p$ -value=0.003) vindicating the Keynesian hypothesis. The same conclusion can be drawn from Table 8 (right panel) which refers to the EC estimates. In particular, there is evidence of significant causal effect running from public spending to income in both the long and short-run period (EC term=-0.50 with  $p$ -value=0.00 and  $p$ -value=0.00 for  $dG$ ). It should be noted at this point that the employed ARDL models for all sub-samples were also tested for coefficients' stability by the CUSUM and CUSUMSQ tests and we found no evidence of coefficients' instability over the examined sub-periods.

**Table 7** Estimated Long-Run Coefficients Using the ARDL Approach

Wagner hypothesis, 1881-1938 dependent variable G ARDL(1,1) selected based on Akaike Information Criterion				Keynesian hypothesis, 1833-1880 dependent variable Y ARDL(1,1) selected based on Akaike Information Criterion			
R/ressor	coeff.	St/Er	T-Ratio[prob]	R/ressor	coeff.	St/Er	T-Ratio[prob]
Y	2.361	.567	4.165[.000]	G	.191	.061	3.114[.003]
C	-8.953	3.122	-2.868[.006]	C	4.742	.249	19.011[.000]

Source: Authors' estimations.

**Table 8** Error Correction Representation for the Selected ARDL Model

Wagner hypothesis, 1881-1938 dependent variable dG ARDL(1,1) selected based on Akaike Information Criterion				Keynesian hypothesis, 1833-1880 dependent variable dY ARDL(1,1) selected based on Akaike Information Criterion			
R/ressor	coeff.	St/Er	T-Ratio[prob]	R/ressor	coeff.	St/Er	T-Ratio[prob]
dY	1.396	.363	3.849[.000]	dG	.144	.037	3.849[.000]
dC	-4.848	1.913	-2.534[.014]	dC	2.384	.567	4.201[.000]
ecm(-1)	-.542	.113	-4.806[.000]	ecm(-1)	-.503	.120	-4.174[.000]

Source: Authors' estimations.

### 3. Conclusions

In this paper we use Greek time series data of government expenditures and GDP that have been recently published (Antoniou 2004; Antoniou, Kostelenos, and Kaskarellis 2007) and span for the period from 1833 to 1938 which represents the early phase in the development of the Greek economy. Moreover, we attempt for the first time, to gain some new insight into the causal relationship between economic performance and government size in Greece for such a long period. For this purpose, we use the ARDL approach to cointegration which removes the pre-testing problems related to unit root and cointegration analysis. Also, with the use of econometric tests we ascertain the presence of a structural break in the data series. The econometric analysis showed that there is a possible structural break around 1880 and this is the reason why we explored the Wagner's Law and the Keynesian Hypothesis not only for the entire period but also for the sub-periods 1833-1880 and 1881-1938. The results of the present empirical analysis confirmed the existence of cointegration between the tested variables. The use of EC models confirm the existence of a long-run causality running from the size of public spending to economic performance and *vice versa*.

Wagner's Law is confirmed for the entire period, as well as for the sub-periods defined in our analysis. Hence, the empirical analysis for Greece confirms Wagner's hypothesis that industrialization, modernization and growth of an economy increase state activities in providing public goods, cultural and welfare services, as well as needed infrastructure. More importantly, the confirmation of Wagner's Law for such a long period, during which different governments followed strict austerity programs shows that the increase in state activities is a systemic element of economic development. Therefore, Wagner's Law is at least valid for economies which are in their early phase of development.

By contrast, the Keynesian hypothesis fails to be confirmed during the first sub-period, whereas it holds true for the entire period of our analysis and for the sub-period 1881-1938. We may argue that the cause for this is that in the first period, public authority intervention is the least possible reflecting not only the economic philosophy of the various governments but also the fact that the monarchy absorbed all capital funds to satisfy luxury needs. In the post 1881 period government becomes more active, the level of public spending increases and Greece is gradually transformed into a state with similar characteristics with those of other Western European countries.

The analysis shows that whenever there is an active state following Keynesian policies, the growth performance of an economy improves. This becomes obvious from the results, since in the second sub-period 1881-1938 in which the state undertook a more active role in country's reform, the performance improved. These results imply that active Keynesian policies may help an economy's growth record and thus the austerity programs in the phase of a severe recession period such as the current one in Greece might not be the most appropriate economic policy to follow. However, the detection of Wagner's hypothesis, at the same time, could be justified by the increased needs of a newly formed State to build the necessary mechanisms (institutions) in order to control and organize effectively its functions. The same needs, someone may argue, are still present and have to be considered in the restructuring of the Greek State to overcome from the current deep recession conditions.

## References

- Al-Faris, Abdulrazak F.** 2002. "Public Expenditure and Economic Growth in the Gulf Cooperation Council Countries." *Applied Economics*, 34: 1187-1193.
- Afxentiou, Panos C., and Apostolos Serletis.** 1996. "Government Expenditures in the European Union: Do They Converge or Follow Wagner's Law?" *International Economic Journal*, 10(4): 33-47.
- Ansari, Mohammed A., Daniel V. Gordon, and Christian Akuamoah.** 1997. "Keynes versus Wagner: Public Expenditures and Natural Income for Three African Countries." *Applied Economics*, 29(9): 543-550.
- Antoniou, Antonios.** 2004. "Les Dépenses Publiques en Grèce 1833-1939." PhD diss. Paris 1 – Sorbonne.
- Antoniou, Antonios.** 2011. *Public Works Policy in Greece during the 19<sup>th</sup> Century*. Athens: Neollinika Istorika, Academy of Athens.
- Antoniou, Antonios, George Kostelenos, and Ioannis Kaskarelis.** 2007. *Public Spending 1830-1938*. Athens: IAETE.
- Arestis, Philip.** 2011. "Fiscal Policy Is Still an Effective Instrument of Macroeconomic Policy." *Panoeconomicus*, 58(2): 143-156.
- Bagala, Biswal, Dhawan Uruashi, and Hooi-Yean Lee.** 1999. "Testing Wagner versus Keynes Using Disaggregated Public Expenditure Data for Canada." *Applied Economics*, 31(10): 1283-1291.
- Bairam, Erkin I.** 1995. "Level of Aggregation, Variable Elasticity, and Wagner's Law." *Economic Letters*, 48(3-4): 341-344.
- Baumol, William J.** 1967. "Macroeconomic of Unbalanced Growth: The Anatomy of Urban Crisis." *The American Economic Review*, 57: 415-426.
- Beck, Morris.** 1976. "The Expanding Public Sector: Some Contrary Evidence." *National Tax Journal*, 29(1): 15-21.
- Chletsos, Michael, and Christos Kollias.** 1997. "Testing Wagner's Law Using Disaggregated Public Expenditure Data in the Case of Greece: 1958-1993." *Applied Economics*, 29(4): 371-377.
- Dickey, David A., and Wayne A. Fuller.** 1981. "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root." *Econometrica*, 49(4): 1057-1072.
- Dritsakis, Nikolaos, and Antonios Adamopoulos.** 2004. "A Causal Relationship between Government Spending and Economic Development: An Empirical Examination of the Greek Economy." *Applied Economics*, 36(5): 457-464.
- Faria, Joao R., and Miguel Leon-Ledesma.** 2003. "Testing the Balassa-Samuelson Effect: Implications for Growth and the PPP." *Journal of Macroeconomics*, 25(2): 241-253.
- Ganti, Subrahmanyam, and Bharat R. Kolluri.** 1979. "Wagner's Law of Public Expenditures: Some Efficient Results for the United States." *Public Finance*, 34(2): 223-233.
- Granger, Clive W. J., Bwo-Nung Huang, and Chin-Wei Yang.** 2000. "A Bivariate Causality between Stock Prices and Exchange Rates: Evidence from Recent Asian Flu." *The Quarterly Review of Economics and Finance*, 40(3): 337-354.
- Henrekson, Magnus.** 1993. "Wagner's Law: A Spurious Relationship?" *Public Finance*, 48(2): 406-415.
- Hondroyiannis, George, and Evangelia Papapetrou.** 1995. "An Explanation of Wagner's Law for Greece: A Cointegration Analysis." *Public Finance*, 50(1): 67-79.

- Islam, Anisul M.** 2001. "Wagner's Law Revisited: Cointegration and Exogeneity Tests for the USA." *Applied Economics Letters*, 8(8): 509-515.
- Johansen, Soren.** 1988. "Statistical Analysis of Cointegration Vectors." *Journal of Economic Dynamics and Control*, 12(2-3): 231-254.
- Johansen, Soren, and Katarina Juselius.** 1990. "Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for the Money." *Oxford Bulletin of Economics and Statistics*, 52(2): 169-210.
- Kalafatis, Thanasis, and Evaggelos Prontzas.** 2011. *Economic History of Greek State, Vol. 1*. Athens: Cultural Foundation of Peireous Bank.
- Katrakilidis, Constantinos P., and Persefoni Tsaliki.** 2009. "Further Evidence on the Causal Relationship between Government Spending and Economic Growth: The Case of Greece, 1958-2004." *Acta Oeconomica*, 59(1): 57-78.
- Kolluri, Bharat R., Michael J. Panik, and Mahmoud S. Wahab.** 2000. "Government Expenditure and Economic Growth: Evidence from G7 Countries." *Applied Economics*, 32(8): 1059-1068.
- Kostelenos, Georgios, Vasileiou Dimitrios, Kounaris Emmanouil, Petmezas Sokratis, and Michail Sfakianakis.** 2007. *Gross Domestic Product 1830-1939. Sources of Economic History of Modern Greece, Quantitative Data and Statistical Series 1830-1939*. Athens: Historical Archive of the National Bank of Greece and Centre for Planning and Economic Research.
- Lee, Junsoo, and Mark C. Strazicich.** 2004. "Minimum LM Unit Root Test with One Structural Break." Appalachian State University Working Paper 04-17.
- Loizides, John, and George Vamvoukas.** 2005. "Government Expenditure and Economic Growth: Evidence from Trivariate Causality Testing." *Journal of Applied Economics*, 8(1): 125-152.
- Mann, Arthur J.** 1980. "Wagner's Law: An Econometric Test for Mexico 1925-1976." *National Tax Journal*, 33(2): 189-201.
- Musgrave, Richard A.** 1969. *Fiscal Systems*. New Haven: Yale University Press.
- Oxley, Les.** 1994. "Cointegration, Causality and Wagner's Law: A Test for Britain 1870-1913." *Scottish Journal of Political Economy*, 41(3): 286-298.
- Peacock, Alan T., and Jack Wiseman.** 1961. *The Growth of Government Expenditures in the United Kingdom*. Princeton: Princeton University Press.
- Pesaran, Hashem M., and Yongcheol Shin.** 1999. "An Autoregressive Distributed Lag Approach to Cointegration Analysis." In *Econometric and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium*, ed. Steinar Strøm. Cambridge: Cambridge University Press.
- Pesaran, Hashem M., Yongcheol Shin, and Richard J. Smith.** 2001. "Bounds Testing Approaches to the Analysis of Level Relationships." *Journal of Applied Econometrics*, 16(3): 289-326.
- Ram, Rati.** 1986. "Government Size and Economic Growth: A New Framework and Some Evidence from Cross-Section and Time-Series Data." *American Economic Review*, 76(1): 191-203.
- Ram, Rati.** 1987. "Wagner's Hypothesis in Time-Series and Cross-Section Perspectives: Evidence for 'Real' Data for 115 Countries." *Review of Economics and Statistics*, 69(2): 194-204.
- Rostow, Walt W.** 1960. *The Stages of Growth*. Cambridge: Cambridge University Press.

- Synarelli, Maria.** 1989. *Roads and Ports in Greece, 1830-1880*. Athens: Cultural Foundation of the Greek Bank for Industrial.
- Thornton, John.** 1999. "Cointegration, Causality and Wagner's Law in 19th Century Europe." *Applied Economics Letters*, 6(7): 413-416.
- Tsangyao, Chang, Wenrong Liu, and Stecen B. Caudill.** 2004. "A Re-examination of Wagner's Law for Ten Countries Based on Cointegration and Error-Correction Modeling Techniques." *Applied Financial Economics*, 14(8): 577-589.
- Tsoufidis, Lefteris.** 2003. *Economic History of Greece*. Thessaloniki: University of Macedonia Press.
- Yergin, Daniel, and Joseph Stanislaw.** 2002. *The Commanding Heights: The Battle for the World Economy*. New York: Simon and Schuster.
- Wagner, Adolph.** 1893. *Grundlegung der Politischen Okonomie*. 3rd ed. Leipzig: C. F. Winter.