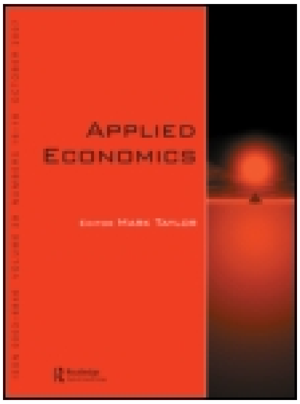

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A causal relationship between government spending and economic development: an empirical examination of the Greek economy

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A causal relationship between government spending and economic development: an empirical examination of the Greek economy

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During the past few years, in many countries, both developed and developing, there has been a tendency to increase government spending. This article intends to examine this tendency of the public sector as well as the existing relationship between the extent of government spending and economic development. The data used cover a time period between 1960 and 2001. An effort is made to determine causal relationships between spending and economic development through the use of Wagner's theory.

I. INTRODUCTION

The aim of this study is to analyse the trends in public spending of the Greek economy, and determines the causes and sources of their development by proving the existence of certain long-term relationships with economic progress. The empirical analysis of public development is based on Wagner's law, which relates public development to economic growth, taking as granted that a positive income elasticity exists in the public sector. Wagner (1883) was the first who observed the diachronical tendency to increase public spending, which he managed to combine with the positive rates of economic growth. While an economy is developing, public spending – as a percentage of gross national product – increases at the expense of the costs of the private sector. The fact that the percentage of public spending on the gross national product increases with time, means that elasticity consumption for public goods is greater than one, whereas the elasticity consumption for goods coming from the private sector is less than one. In other words, the demand for public goods shows the same characteristics with the demand for non-essential private goods or luxury goods.

The main reasons why Wagner suggests that elasticity consumption for public goods is greater than 1 are shown as follows: While an economy is being developed, the dealings between individuals, both as consumers and producers (titles, contractual relationships, etc.) are becoming more and more complex and consequently demand a greater extent of regulatory state intervention. The enactment and application of statute laws (civil, criminal, administrative, etc.), the introduction and amelioration of economic institutions (employer–employee relations, framework of the operation of enterprises, social security, etc.), consumer's protection from monopolies (private monopoly pricing policy controls, takeover of relative activities by the state, etc.) are certain fields that demand a constant state presence, in the form of providing services administratively, judicially and legally.

One could easily suggest that most public goods and services fall into the category of civil goods. Very few public services, such as public order and security, could be characterized as primary goods. Education and health care services are civil goods. Therefore, as household income increases, the demand for education and health care services increases faster in proportion to the raise of income. Consequently, public spending must also increase faster in proportion to the raise of national income, since political power is supposed to satisfy the constantly increasing demand for these goods.

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Due to the fact that economic growth is usually the result of a successful industrialization process and industrialization presupposes, among other things, a population shift from the province towards urban areas, the state gets to play a very important part at that point. The needs of urban population in infrastructure (water supply, sewerage, electricity, road network, etc.) are bigger than the ones of a rural population. Similarly, the adjustment of rural population to the labour demands of industrial units, the specialization and generally the amelioration of the productivity of work-force demand the disposal of significant resources for education.

All the aforementioned services, provided by the state, especially education and income redistribution services, are considered to pertain to the civil goods category (the equivalent of private luxury goods), and according to this characteristic, they have elasticity consumption, which is greater than one. The given increase of gross national product leads to a proportionately larger increase of demand for these specific goods, and so public spending for their provision becomes higher diachronically as a percentage of gross national product.

While, Wagner's hypothesis shows that public spending has a causal effect on economic development, Keynes's models have studied a reverse flow of this causality. The macroeconomic models of Keynes have used public spending as a tool of exogenous politics, which causes changes in centralized production. Generally, Wagner's law, with few exceptions has received strong support by many researchers such as Peacock and Wiseman (1961), Musgrave (1969, 1988), Michas (1975), Mann (1980), Ram (1986, 1987), Courakis *et al*. (1993). However, most studies have confirmed that the time series data are stationary and that inappropriate techniques of evaluation have consequently been used.

Recently, progressive economic studies allow the use of a cointegration technique, in order to check the tendency of public spending and gross national product (Murthy, 1993; Henrekson, 1993; Hondroyiannis and Papapetrou, 1995; Legrenzi, 2000).

The aim of this study is to examine, at first, the value of stationarity and the integration order of the data used, and then check the hypothesis of a long-run relationship between public spending and gross national product by using bivariate functions, as well as the causality of time series used in different models.

The remainder of this study is organized as follows. Section II presents a theoretical and mathematical formulation of Wagner's law. Section III provides an empirical test of the long-run relationship between the public sector and economic development. In Section IV the error correction models are tested. Section V presents a test of the causality of public spending and finally, Section VI concludes.

II. THEORETICAL AND MATHEMATICAL FORMULATION OF WAGNER'S LAW

The increasing expansion of fiscal activities may be attributed to the fact that a very important category of social goods (education, health care, welfare, etc.) share, as their main characteristic, a high income elasticity. According to the law, the part referring to the development of the public sector constitutes a positive function of the level of economic growth. The size of the public sector expresses the percentage of public spending in the gross national product, while per capita income is used as an indicator of the level of development. So, the mathematical formulation of the law is as follows:

$$\left[\frac{G}{GNP}\right]_t = f\left[\frac{GNP}{P}\frac{1}{N}\right]_t$$

where:
G = Total amount of public spending.
GNP = Gross National Product.
N = Population of the country.
P = Indicator of price levels.

The specification of the mathematical expression mentioned above mostly takes the form of an exponential function, which transforms in order to facilitate econometric estimations to the following function:

$$\log\left[\frac{G}{GNP}\right]_t = \alpha + \beta \log\left[\frac{GNP}{P}\frac{1}{N}\right]_t + u_t$$

where: u_t = disturbance term
The value of parameter β is the one determining the acceptance or not of Wagner's law. If $\beta > 0$ then the law on the increase of public spending is also empirically verified, since value $\beta > 0$ is equal to a value of elasticity of consumption for public spending that is greater than one.

Different aspects and still much controversy remains among researchers about the exact formulation of Wagner's law hypothesis. However, it would be more proper to state that the level of economic development affects and causes public spending and determines the size of public sector. In economic theory there are different interpretations of the hypothesis leading up to the following three models:

$$LG_{ti} = \alpha_0 + \alpha_1 LGNP_t + u_t \tag{1}$$

$$LG_{ti} = \beta_0 + \beta_1 LGNP_t + e_t \tag{2}$$

$$LRG_{ti} = \delta_0 + \delta_1 LGNP_t + s_t \tag{3}$$

where:
LG_{ti} = Total and partial public spending logarithm.
$LGNP_t$ = Gross national product logarithm.
$LPGNP_t$ = Per capita gross national product logarithm.

LRG_{ti} = Logarithm of total and partial public spending on gross national product.
i = Relative total and partial public spending.
u_t, e_t, s_t white noise.

Peacock and Wiseman (1961), Musgrave (1969), and Goffman and Mahar (1971) have studied this model, which tests income elasticity taking into consideration the gross national product as explanatory variable, as well as the total and partial public spending as a dependent variable.

The second model was utilized by Goffman (1968), Mann (1980) and tests income elasticity, taking into consideration the per capita gross national product as an explanatory variable, and total and partial public spending as a dependent variable.

The third model was initially studied by Mann (1980). This model tests income elasticity taking into consideration the gross national product as an explanatory variable, and the percentages of total and partial public spending on gross national income as a dependent variable. In order to verify Wagner's law in the above-mentioned models some constraints have to be set: $\alpha_1 > 1$, $\beta_1 > 1$, and $\delta_1 > 0$.

III. AN EMPIRICAL TEST OF THE LONG-TERM RELATIONSHIP BETWEEN THE PUBLIC SECTOR AND ECONOMIC DEVELOPMENT

First, the stationarity of all time series is tested, in order to avoid the problem of spurious regression,[1] which can be misleading for many empirical studies on the Wagner's law (Michas 1975; Courakis *et al.*, 1993; Henrekson, 1993). For this reason the adjusted Dickey–Fuller test is used (1979, 1981), Dickey and Pantula (1987), Dickey *et al.* (1984) which indicates the presence of first and second order of autocorrelation in time series.

The results of Dickey–Fuller (DF) test, as well as the results of the adjusted Dickey–Fuller (ADF) test for unit root (stationarity) in the levels of variables and in the first differences of all time series are presented in Table 1. The autocorrelation test of residuals is realized through the use of the Lagrange multiplier LM (1),[2] while for the number of time lags the Akaike (1973) and Schwartz (1978) criteria are used. The lowest values of the two criteria have shown that the best functions were the ones including only the constant and relative numbers of time lags. For all variables, besides *LGNP*, *LPGNP*, *LGCE* variables, in the first differences the Lagrange multiplier test LM (1) shows that there is no autocorrelation disturbance term.

The results presented in Table 1 show that the variables become stationary in their first differences, so they can be characterized as integrated order $I(1)$.

In a long term period, a non-stationarity in the levels of variables could principally cause a problem of spurious regressions and for that reason a cointegration test is necessary, in order to provide a long-term balance relationship between the examined variables, just like those suggested in Wagner's law.

The results of the regressions for all models, which have been examined, are presented in Tables 2 and 3.

The determination coefficients of all regressions range between 0.97 and 0.99 corrected towards the degrees of freedom. In general, Wagner's law seems to be confirmed for most of the variables under examination. Particularly, it is worth pointing out that Wagner's law in Models 1 and 2 presents high income elasticity and great coefficient of determination. Also, Wagner's law is proved to be correct for the major part of public spending, such as health care, education, culture, etc., all of them proposing a higher long-term elasticity towards development.

Table 3 presents the results of estimations of cointegrated vectors although this is not true for the estimated errors of these vectors. Through these estimations, the corresponding disturbance terms (equilibrium errors u_i) were found.

In order for two variables to be cointegrated, the equilibrium errors must be stationary. To check stationarity the methodology of DF/ADF criteria is used for unit root in estimated equilibrium errors. However, the DF/ADF functions do not include a stationary term because due to the formation of residuals according to OLS method, the functions are concentrated around zero.

MacKinnon (1991) reported critical values for such tests that are given in Table 3 and, as can be seen, are even more

[1] A problem of spurious regression can occur when two time series in a regression are highly correlated whereas there is no actual relationship between them. High correlation is due to the existence of time trends in both time series (Granger and Newbold, 1974).
[2] Calculations are made through the method of inverse interpolation, maximizing the logarithm of the likelihood function in the case of first order autoregressive procedure AR(1), the ML estimators are given through the following maximum likelihood function.

$$LL_{AR1}(\vartheta) = -\frac{n}{2}\log(2\pi\sigma_e^2) + \frac{1}{2}\log(1-\rho^2) - \frac{1}{2\sigma_e^2}(y - x\beta)'R(\rho)(y - x\beta)$$

Whereas for a second order autoregressive process AR(2), the maximum likelihood function is given by the relationship:

$$LL_{AR2}(\vartheta) = -\frac{n}{2}\log(2\pi\sigma_e^2) + \log(1+\rho_2) + \frac{1}{2}\log[(1-\rho_2^2) - \rho_1^2] - \frac{1}{2\sigma_e^2}(y - X\beta)'R(\rho_1\rho_2)(y - X\beta)$$

where ρ represents the autoregression process coefficients, θ represents the estimated parameters and $R(\theta)$ is the $\eta\times\eta$ matrix of autoregression coefficients (Pesaran and Pesaran, 1998).

Table 1. *DF/ADF unit root tests*

	In levels			In 1st differences		
Variable	Lag	Test statistic (DF/ADF)*	LM (1)**	Lag	Test statistic (DF/ADF)	LM (1)
LG	1	−1.0999	18.368 [0.000]	0	−2.9655	1.3968 [0.376]
LGNP	1	−0.72245	14.674 [0.000]	1	−3.9096	4.1034 [0.043]
LPGNP	1	−0.67194	13.353 [0.000]	1	−3.0456	3.8868 [0.049]
LGCE	1	−1.5830	24.445 [0.000]	0	−3.8789	4.4459 [0.046]
LCULT	1	−1.4375	22.098 [0.000]	0	−3.0950	2.0986 [0.308]
LHEAL	1	−1.2909	22.420 [0.000]	1	−3.1785	3.7189 [0.050]
LGEN	1	−1.3816	22.745 [0.000]	0	−3.0379	2.7459 [0.089]
LSOC	1	−1.3547	23.702 [0.000]	0	−4.6722	3.7023 [0.070]
LEDU	1	−1.5363	17.681 [0.000]	0	−3.4860	1.6810 [0.217]
LDEF	1	−1.5856	8.9280 [0.003]	0	−3.5410	2.9280 [0.103]
LRG	0	−1.7103	37.981 [0.000]	0	−5.9198	0.0072 [0.932]
LRGCE	1	−0.76787	5.0154 [0.025]	0	−4.2173	3.0154 [0.075]
LRCULT	1	−1.0578	11.078 [0.001]	1	−3.2805	3.6489 [0.056]
LRHEAL	1	−1.3856	11.155 [0.001]	1	−4.4085	1.9216 [0.129]
LRGEN	1	−0.93574	7.8812 [0.005]	1	−3.5093	2.9765 [0.085]
LRSOC	1	−1.3912	3.3029 [0.069]	0	−4.4051	3.3129 [0.071]
LREDU	1	−0.81321	3.3141 [0.069]	0	−4.5782	3.3141 [0.069]
LRDEF	0	0.38155	0.9776 [0.323]	0	−5.1548	0.9776 [0.323]

Notes: *Critical values: −2.9358.
** Numbers in parentheses indicate significant levels.

Table 2. *Cointegrating regressions*

Variable	CONST	OLS estimated Income elasticity	$\bar{R}^2$	Cointegrating regression
LG	−3.8543	1.1760	0.99878	model 1
LGCE	−2.5420	1.0197	0.98994	model 1
LCULT	−6.7649	1.0226	0.98264	model 1
LHEAL	−5.6314	1.0806	0.98851	model 1
LGEN	−3.4690	1.0274	0.99102	model 1
LSOC	−4.5272	1.1687	0.99845	model 1
LEDU	−4.2390	1.0138	0.98992	model 1
LDEF	−2.3177	0.9350	0.97699	model 1
LG	6.6489	1.2247	0.99858	model 2
LGCE	6.5668	1.0618	0.98939	model 2
LCULT	2.3705	1.0647	0.98187	model 2
LHEAL	4.0208	1.1251	0.98796	model 2
LGEN	5.7076	1.0699	0.99065	model 2
LSOC	5.9108	1.2172	0.99834	model 2
LEDU	4.8162	1.0556	0.98942	model 2
LDEF	6.0357	0.9734	0.97600	model 2
LRG	−3.8543	0.1759	0.94834	model 3
LRGCE	−2.5420	0.0197	0.012316	model 3
LRCULT	−6.7649	0.0226	0.003347	model 3
LRHEAL	−5.6314	0.0805	0.312221	model 3
LRGEN	−3.4690	0.0273	0.051210	model 3
LRSOC	−4.5272	0.1687	0.930395	model 3
LREDU	−4.2390	0.0137	0.006364	model 3
LRDEF	−2.3177	0.0649	0.153057	model 3

negative than the standard Dickey-Fuller values. This happens because the estimation of the DF/ADF regressions are biased due to the fact that by construction the OLS methodology seeks to produce stationary residuals u_i. The results in Table 3 have been produced in a similar manner with that of the results presented in Table 1.

For all variables, except u_2, u_{10}, u_{14} and u_{18}, the LM (1) test on first differences shows that there is no autocorrelation

Table 3. *ADF unit root for equilibrium errors*

Variable	Lag	DF/ADF	LM (1)
U1	1	−5.6859	0.6904 [0.406]
U2	0	−4.2867	4.2522 [0.039]
U3	1	−3.9086	3.6606 [0.056]
U4	1	−4.5937	3.1082 [0.094]
U5	1	−3.9656	2.0386 [0.153]
U6	0	−4.9175	3.6833 [0.055]
U7	0	−4.6193	2.9232 [0.087]
U8	0	−5.0615	1.7290 [0.189]
U9	0	−6.6929	0.518E-4 [0.994]
U10	0	−4.3386	4.0192 [0.045]
U11	1	−3.7948	3.6946 [0.055]
U12	1	−3.7885	2.2483 [0.194]
U13	1	−3.8556	2.3050 [0.129]
U14	0	−4.9018	3.9389 [0.047]
U15	0	−4.6446	2.8430 [0.092]
U16	0	−5.0687	1.6793 [0.195]
U17	1	−5.6859	0.6904 [0.406]
U18	0	−4.2867	4.2522 [0.039]
U19	1	−3.8086	3.6606 [0.056]
U20	1	−3.7937	1.1082 [0.234]
U21	1	−3.7656	2.0386 [0.153]
U22	0	−4.9175	3.6833 [0.055]
U23	0	−4.6193	2.9232 [0.087]
U24	0	−5.0615	1.7290 [0.189]

Notes: *Critical values: −3.74.
** Numbers in parentheses indicate significant levels.

in the disturbance terms. The DF/ADF statistics in Table 3 suggest that all residuals are stationary. In other words, all residuals in Table 3 are integrated zero order $I(0)$. This means that the original variables that were included in the cointegrating regressions from Models 1, 2 and 3 are cointegrated.

IV. ERROR-CORRECTION MODELS

The specification of error-correction models requires the existence of some equilibrium relationship between the examined variables. This means that if two variables are cointegrated, according to Engle and Granger (1987), there is a long-run equilibrium relationship between these variables. Even if Wagner's Law corresponds to a long-run model, it is of high interest to examine the short-run reactions of government spending. In the short-term these variables can be used to specify an error-correction model (ECM). In this case the error-correction model that links the short-run and long-run behaviour of the two variables is given by the equation:

$$DLG_{ti} = a + b_1\, DLGNP_t + b_2 u_{t-1} \tag{4}$$

where $-1 < b_2 < 0$ is the short-term adjustment coefficient.

The results of error-correction model estimation are presented in Table 4. The short-term elasticity of consumption and the short-term adjustment coefficient in the table confirm the importance of long-run elasticity of consumption for Wagner's Law.

V. CAUSALITY TESTS FOR PUBLIC SPENDING

From the causality analysis of public spending constituents one can analyse in detail the relationship between the public sector and economic growth. More specifically, one can examine if the expansion of public sector had a favourable effect on economic growth or if public spending, as dictated by Keynesian theory, stimulated economic growth.

The previous section proved the existence of a positive relationship between public spending and national income but this does not allow conclusions to be drawn about the direction of the underlying causality. The data employed can be used to test both Wagner's theory, according to which the direction of gross national product increases towards public spending, and also Keynesian theory in which the direction is reverse.

In order to examine Granger-causality the following equations are considered:

$$LG_t = \alpha_0 + \sum_{i=1}^{m} a_i LG_{t-i} + \sum_{i=1}^{m} \beta_i LGNP_{t-i} + u_i \tag{5}$$

$$LGNP_t = \alpha_0 + \sum_{i=1}^{m} \gamma_i LG_{t-i} + \sum_{i=1}^{m} \delta_i LGNP_{t-i} + e_i \tag{6}$$

where m is the number of lags.

As a testing criterion the F statistic was used. With the F statistic the hypothesis of statistic significance of specific groups of explanatory variables was tested for each separate function.

Table 5 gives the results of all variables for the Granger causality analysis. From these results one can infer that in most cases the causality is in both directions meaning that public spending increases economic development and that in the same period economic development has a positive effect in rising public spending. In other cases, like with general government spending, the Granger causality model follows the simple Keynesian theory, while in total spending and in social welfare spending, they follow Wagner's theory.

The results of Granger causality tests for Equations 2 and 3 differ from those of Equation 1. More specifically, total expenditure appears to follow Keynesian theory in Equation 2 where one has per capital gross national product, while general government expenditure has a bi-directional relationship. In Equation 3 one observes a change of direction for social welfare expenses with respect to gross national product.

Table 4. *ECM regression results*

Dependent variable	Const	Short−run income elasticity	ECM	Model
DLG	0.0023 [0.932]	1.1496 [0.000]	−0.1584 [0.010]	model 1
DLGCE	−0.0337 [0.372]	1.1874 [0.000]	−0.2128 [0.054]	model 1
DLCULT	−0.0603 [0.127]	1.3716 [0.000]	−0.2287 [0.086]	model 1
DLHEAL	−0.0542 [0.132]	1.4081 [0.000]	−0.1339 [0.053]	model 1
DLGEN	−0.0581 [0.053]	1.3628 [0.000]	−0.1263 [0.038]	model 1
DLSOC	0.0349 [0.126]	0.9264 [0.000]	−0.1443 [0.094]	model 1
DLEDU	−0.0475 [0.217]	1.2876 [0.000]	−0.2397 [0.073]	model 1
DLDEF	−0.0029 [0.965]	0.8909 [0.056]	−0.3115 [0.104]	model 1
DLG	0.0087 [0.757]	1.1507 [0.000]	−0.1234 [0.031]	model 2
DLGCE	−0.0243 [0.521]	1.1688 [0.000]	−0.1511 [0.087]	model 2
DLCULT	−0.0492 [0.222]	1.3490 [0.000]	−0.2220 [0.082]	model 2
DLHEAL	−0.0462 [0.204]	1.4094 [0.000]	−0.1276 [0.031]	model 2
DLGEN	−0.0525 [0.083]	1.3794 [0.000]	−0.1216 [0.103]	model 2
DLSOC	0.0368 [0.114]	0.9521 [0.000]	−0.2307 [0.029]	model 2
DLEDU	−0.0394 [0.310]	1.2829 [0.000]	−0.2310 [0.061]	model 2
DLDEF	0.0104 [0.873]	0.8316 [0.076]	−0.1122 [0.079]	model 2
DLRG	0.0031 [0.908]	0.1450 [0.428]	−0.1733 [0.114]	model 3
DLRGCE	−0.0337 [0.372]	0.1874 [0.461]	−0.1123 [0.111]	model 3
DLRCULT	−0.0603 [0.127]	0.3715 [0.156]	−0.1277 [0.157]	model 3
DLRHEAL	−0.0542 [0.132]	0.4080 [0.091]	−0.1309 [0.211]	model 3
DLRGEN	−0.0581 [0.053]	0.3628 [0.068]	−0.1353 [0.098]	model 3
DLRSOC	0.0349 [0.126]	0.7353 [0.615]	−0.1443 [0.086]	model 3
DLREDU	−0.0475 [0.217]	0.8761 [0.263]	−0.1097 [0.212]	model 3
DLRDEF	−0.0029 [0.965]	0.0907 [0.810]	−0.1111 [0.073]	model 3

Table 5. *Estimated causality patterns*

X	*Y*	*M*	Value on F_1	Value on F_2	Estimated causality pattern
LGNP	LG	2	22.80	1.58	LG⇐LGDP
LGNP	LGCE	2	102.91	110.84	LGCE ⟺ LGNP
LGNP	LCULT	2	125.07	215.58	LCULT ⟺ LGNP
LGNP	LHEAL	2	94.25	127.18	LHEAL ⟺ LGNP
LGNP	LGEN	2	2.61	126.53	LGEN ⟺ LGNP
LGNP	LSOC	2	47.29	2.55	LSOC ⟺ LGNP
LGNP	LEDU	2	64.20	114.46	LEDU ⟺ LGNP
LGNP	LDEF	2	57.00	300.50	LDEF ⟺ LGNP
LPGNP	LG	2	2.69	10.71	LG⇒LPGDP
LPGNP	LGCE	2	111.58	90.03	LGCE ⟺ LPGNP
LPGNP	LCULT	2	132.69	214.21	LCULT ⟺ LPGNP
LPGNP	LHEAL	2	97.45	119.06	LHEAL ⟺ LPGNP
LPGNP	LGEN	2	22.79	115.91	LGEN ⟺ LPGNP
LPGNP	LSOC	2	50.13	2.41	LSOC ? LPGNP
LPGNP	LEDU	2	68.56	107.33	LEDU ⟺ LPGNP
LPGNP	LDEF	2	63.87	293.75	LDEF ⟺ LPGNP
LGNP	LRG	2	1.00	57.13	LRG⇒LGDP
LGNP	LRGCE	2	83.40	2161.53	LRGCE ⟺ LGNP
LGNP	LRCULT	2	146.62	1629.41	LRCULT ⟺ LGNP
LGNP	LRHEAL	2	123.21	9425.56	LRHEAL ⟺ LGNP
LGNP	LRGEN	2	105.03	1685.58	LRGEN ⟺ LGNP
LGNP	LRSOC	2	3.17	1450.13	LRSOC⇒LGNP
LGNP	LREDU	2	63.95	1859.48	LREDU ⟺ LGNP
LGNP	LRDEF	2	42.20	2537.03	LRDEF ⟺ LGNP

Note: Critical values: $F = 3.27$.

VI. CONCLUSION

This study attempted an empirical test for the growth of the Greek economy focusing on Wagner's theory, which explains national growth on the basis of economic development given the consumption elasticity of public goods.

Three alternative models were evaluated with respect to Wagner's Law using all the total and partial public expenses for the years 1960 to 2001 (thus exceeding the Maastricht Treaty of 1993). These expenses increased with great speed hence confirming Wagner's Law.

The empirical results confirm Wagner's Law since the estimated elasticity of consumption for total and partial public spending was found to be consistent with the limitations dictated by Wagner's Law.

Finally, Granger-causality tests on Wagner's Law and in the Keynesian model provided evidence supporting the complexity of the underlying interactions with most of the relationships being bi-directional in the causality models.

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APPENDIX

Data sources

The data used for this paper cover a time period from 1960 to 2001 and come from the following sources: European Economy, National Accounts, Eurostat and Social Budget. For partial government spending of the public sector the structure of national accounts has been followed, which has been developed by the United Nations and in general adopted by some international organizations in order to conduct comparative research.

Descriptive analysis of the variables

The variables considered for empirical control of Wagner's law models relevant to relationship between public spending and economic development are the following:

GNP = Gross national product, current market prices
PGNP = Per Capita GNP
G = General government expenditure, current prices
GCE = General government consumption expenditure, current prices
EDU = General government education expenditure, current prices
HEAL = General government expenditure on health, current prices
CULT = General government expenditure on culture, current prices
GEN = General government expenditure on general public services, current prices
SOC = General government social expenditure, current prices
DEF = General government expenditure on defense, current prices

RG = G/GNP
RGCE = GCE/GNP
REDU = EDU/GNP
RHEAL = HEAL/GNP
RGEN = GEN/GNP
RSOC = SOC/GNP
RDEF = DEF/GNP
LG = Log (G)
DLG = LG-LG(-1)