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Wagner's Law and Peacock and Wiseman's Displacement Effect in European Union Countries: A Panel Data Study

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ABSTRACT

Wagner's Law is the first model of public expenditure in the history of public finance. It suggests that during the process of economic development the share of public spending in national income tends to expand (Wagner, 1883). Nevertheless, Peacock and Scott in 2000 wrote a paper entitled "The curious attraction of Wagner's law," explaining the reasons for why this (apparently) outworn theory is still studied by modern economists. On the other hand, Keynes (1936) considered public spending as an exogenous factor to be used as a policy instrument to influence growth. Moreover, Peacock and Wiseman (1961) presented the displacement effect, according to which during times of war tax rates are increased to generate more revenues, sustaining the increase in defense spending. While Peacock and Wiseman (1979) surveys the literature on public expenditure growth. This paper aims to analyze the relationship between public expenditure and aggregate income in European Union countries, for the period 1980-2013, using panel data methodologies. After a brief introduction, a survey of the economic literature on this issue is discussed. Then, panel data tests on stationarity, cross-dependence, cointegration, and causality are shown. Finally, some notes on policy implications conclude the paper.

Keywords: Wagner's Law, Public Expenditure, Gross Domestic Product, Economic and Monetary Union, Panel Data
JEL Classifications: C23, E60, H50, H60

1. INTRODUCTION

The relationship between public expenditure and gross domestic product (GDP) has been well debated in economic literature (Peacock and Wiseman, 1961; 1979; Gupta, 1967). On the one hand, public expenditure is seen as an exogenous factor, which can be used as a policy instrument to influence growth (Keynes, 1936). On the other hand, public expenditure is seen as an endogenous factor or as an outcome, not a cause of growth in national income (Wagner, 1993). The standard empirical approach used to evaluate the two different hypotheses has been to apply causality testing techniques in the Granger (1969) framework (Ansari et al., 1997). Knowing the direction of the causality between public expenditure and GDP is of great importance for policymaking. In fact, if the causality flow proposed by the aforementioned Keynesian approach holds, then public expenditure becomes a significant tool of economic policy. Conversely, if the causality runs towards the direction defined by Wagner's law, then the influence of public expenditure to be an effective policy instrument for economic growth declines (Singh and Sahni, 1984).

Better knowledge on the dynamic relationship between government expenditure and GDP is relevant for policy in two major respects. First, it improves the understanding of long-term, structural public finance issues. Second, a better understanding of the dynamic relation between government expenditure and GDP helps the comprehension of policy-relevant issues over a short-to medium term horizon (Arpaia and Turrini, 2008).

Wagner's law (Wagner, 1883) suggests that during the process of economic development, the share of public expenditure/GDP tends to expand. The reasons are varied: (a) Public functions to substitute private activities; (b) when the development results in an expansion of spending on culture and welfare, public intervention might be necessary to manage natural monopolies (Magazzino, 2011; 2012b). Thus, the expansion of public spending

can be seen as a product of the economic development, and not *viz*. (Bird, 1971).

The main methodological contribution of this paper is the use of a panel approach, which has been used before in the literature on Wagner's law only in very few studies. Moreover, as discussed by Henrekson (1993), the findings from time series studies on Wagner's law conducted prior to the 1990s may not be robust, for they did not analyze the stationarity properties of the data. Notwithstanding, the studies conducted since the 1990s typically test Wagner's law either for a single country or a sample of countries, treating each country in the sample as a separate entity and do not exploit the panel properties of the data.

Besides, the remainder of the paper is organized as follows: Section 2 presents the empirical literature on the relationship between public expenditure and aggregate income in a context of panel data. Section 3 illustrates empirical strategy and the data used in the present work. Section 4 shows the results, while Section 5 concludes.

2. SURVEY OF THE EMPIRICAL LITERATURE

Adolph Wagner's law of "increasing expansion of public and state activities" postulates that as real income increases, there is a long-run tendency for the share of public expenditure to increase relative to national income (Wagner, 1883).

Alongside Wagner's law, another very famous theory on the determinants of public expenditure is the so-called Peacock and Wiseman's "displacement effect." Alan Peacock and Jack Wiseman in their well-known 1961 monograph The Growth of Public Expenditure in the United Kingdom explained their hypothesis according to which government expenditure tends to evolve in a steplike pattern, coinciding with social upheavals, notably wars. However, in a further article (Peacock and Wiseman, 1979) they suggested two complementary approaches to the empirical analysis of the public expenditure growth, the first being represented by factor analysis at the general econometric level, and the second by the development of models of group behavior leading to explanations in terms of the changing relationships of social groups through time.

In a more recent work, Peacock and Scott (2000) underlined how an examination of the relevant articles reveals ignorance both of Wagner's definition of "state activity" and of his insistence that he was not engaged in prediction.

There are several large multi-country studies, which have reached mixed results. Although there are a number of studies which test Wagner's law for single countries, panel data analyses are almost absent.

Arreaza et al. (1999) generate panel-based estimates of the degree of cyclicality in government consumption, transfers, subsidies, and tax revenues. Their results suggest that current government expenditures increase during recessions, mainly due to an increase in transfers. Wahab (2004), studying Organization for Economic Cooperation and Development (OECD) economies in the 1950-2000 period, shows that government expenditure seems to react asymmetrically conditional on the state of economic growth. In fact, government expenditure increases less than proportionately with accelerating economic growth, whilst it decreases more than proportionately with decelerating economic growth. Narayan et al. (2008) studying Wagner's law in the context of Chinese provinces, find mixed evidence in support of Wagner's law for China's central and western provinces, but no support for Wagner's law for the full panel of provinces or for the panel of China's eastern provinces. Arpaia and Turrini (2008) analyses both the long and the short-run relation between government expenditure and potential output in European Union 15 (EU-15) countries over the 1970-2003 period. Results show that it cannot be rejected the hypothesis of a common long-run elasticity between cyclically-adjusted primary expenditure and potential output close to unity. However, the long-run elasticity decreased considerably over the decades and is significantly higher than unity in catching-up countries, in fast-ageing countries, in low-debt countries, and in countries with weak numerical rules for the control of government spending. Moreover, the average speed of adjustment of government expenditure to its long-term relation is 3 years, but there are significant differences across countries. Yu et al. (2009), using a dynamic generalized method of moment (GMM) model and a panel dataset for 44 developing countries between 1980 and 2004, find that the various types of government spending have different impact on economic growth. Alam et al. (2010) panel cointegration analyses illustrate the existence of a long-run dynamic relationship among variables in case of 10 Asian developing countries. They conclude that expenditures in the social sector can affect economic growth. Thus, such social expenditures enhance productivity by providing infrastructure, education, health and harmonizing private and social interests. Bayrak and Esen (2014) using data from 27 OECD economies between the years 1995 and 2012 find the presence of a both short- and long-run relationship between public expenditures and economic growth. Afonso and Jalles (2014) use a panel dataset of 155 developed and developing countries for the period 1970-2010. Their strong evidence supports the causal linkages from government expenditures to per capita GDP, therefore favoring the idea of Wagner's law. In particular, there are also significant short- and long-run effects.

As a conclusion, econometric studies confirm the mixed evidence on Wagner's law. They tend to find a positive relation between the public expenditure-to-GDP ratio and per capita income only for some countries and certain time periods (Barrios and Schaechter, 2008). Typically when low and high-income countries are included in a panel analysis, a significant link is established.

3. METHODOLOGY AND DATA

With the growing use of cross-country data over time to study purchasing power parity (PPP), growth convergence and international R and D spillovers, the focus of panel data econometrics has shifted towards studying the asymptotic of macro panels with large N (number of countries) and large T (length of the time series) rather than the usual asymptotic of micro panels

with large N and small T. A strand of literature applied time series procedures to panels, worrying about non-stationarity, spurious regression and cointegration. Im et al. (IPS, 2003) proposed a test based on the average of the augmented Dickey-Fuller (ADF) statistics computed for each individual in the panel. Formally, we assume that under the alternative hypothesis the fraction of the individual processes that are stationary is non-zero. Maddala and Wu (1999) proposed a new simple test based on Fisher's suggestion, which consists in combining P values from individual unit root test. Fisher-type tests approach testing for panel-data unit roots from a meta-analysis perspective. The joint test statistic, under the null and the additional hypothesis of cross-sectional independence of the errors terms ε_{it} in the ADF equation, has a chi-square distribution with $2N$ degrees of freedom. In essence, we choose these tests because they do not require strongly balanced data, and the individual series can have gaps.

Then we control for the (eventual) cross-section dependence in the data. The parametric testing procedure proposed by Pesaran (2004) tests the hypothesis of cross-sectional independence in panel data models with small T and large N.

Furthermore, we adopted the t-test for unit roots in heterogeneous panels with cross-section dependence, proposed by Pesaran (2003). Parallel to the IPS test, it is based on the mean of individual DF (or ADF) t-statistics of each unit in the panel. Null hypothesis assumes that all series are non-stationary.

We test for cointegration among the I(1) variables using two tests. The first test we show is due to Westerlund (2007). As for these tests, the G_a and G_t statistics test H_0: $a_i = 0$ for all i versus H_1: $a_i < 0$ for at least one i. While the P_a and P_t test statistics pool information over all the cross-sectional units to test H_0: $a_i = 0$ for all i against the alternative $a_i < 0$ for all i. The test developed by Pedroni (2004) provided seven test statistics that can be used to test the null of no cointegration in the multivariate case. These test statistics are grouped into two categories: "Group mean" statistics that average the results of individual country test statistics, and "panel" statistics that pool the statistics along the within-dimension. Within both groups, Pedroni develops test statistics that are non-parametric (*rho* and *pp*) and parametric (ADF, as well as panel *v*) (Neal, 2014).

The concept of mean-group estimates suggests that while individual country regression estimates may be unreliable, by averaging across the estimates we obtain a more reliable measure of the average relationship across groups/countries (Pesaran and Smith, 1995). The pooled mean group (PMG) estimator allows the intercepts, short-run coefficients, and error variances to be different across groups, but the long-run coefficients are con-strained to be homogeneous. There are good reasons to believe that the long-run equilibrium relationship amongst variables should be identical across groups, while the short-run dynamics are heterogeneous. This dynamic estimator is more likely to capture the true nature of the data. Finally, the null hypothesis of long-run slope homogeneity in the coefficients is tested using the Hausman's test.

Granger causality tests (Granger, 1969) are statistical tests of causality in the sense of determining whether lagged observations of another variable have incremental forecasting power when added to a univariate autoregressive representation of a variable. X_t is Granger causal for y_t if x_t helps predict y_t at some stage in the future. It should be noticed, however, that Granger causality is not causality in a deep sense of the word. It just talks about linear prediction, and it only has "teeth" if one thing happens before another.

The empirical investigation in this study is carried out using panel methodologies for EU member countries[1]. The data have yearly frequency (from 1980 to 2013), and were provided by AMECO[2] and TED databases[3]. Here, GDP is the total GDP, in millions of 1990 US$ (converted at Geary Khamis PPPs), general government expenditure (GGE) represents the cyclically adjusted GGE (percentage of GDP), tangible common equity is the cyclically adjusted total current expenditure (percentage of GDP), and IE is the cyclically adjusted total investment expenditure (percentage of GDP). Moreover, Appendix give supplementary graphical descriptions of these data. In addition, it should be underlined that by using cyclically adjusted figures, we manage to better disentangle short-run dynamics related to business cycle fluctuations and to concentrate the analysis on relations of structural nature. This also permits to contain the issue of reverse causation in interpreting results.

4. EMPIRICAL FINDINGS

In Table 1, some descriptive statistics are given. As a preliminary step, we calculated the log-transformation of the variables. Interestingly, all our variables seem to have a normal distribution, since the mean, median and 10-Trim values are similar for each series, the skewness is near 0, and the kurtosis near 3. The only exception should be the investment expenditure.

A standard assumption in panel data models is that the error terms are independent across cross-sections. Empirical results in Table 2 show that, at a 1% significance level, the null hypothesis of cross-sectional independence in our panel is rejected for all four series.

To eliminate the cross-dependence, the standard DF (or ADF) regressions are augmented with the cross-section averages of lagged levels and first-differences of the individual series (covariate-ADF statistics). Here, when cross-dependence problem is taken into account, the null hypothesis that all the series are non-stationary largely holds (Table 3).

The panel cointegration tests point to the existence of a long-run relationship between government expenditure items and GDP. As for these tests, the G_a and G_t statistics test H_0: $a_i = 0$ for all i versus H_1: $a_i < 0$ for at least one i. While the P_a and P_t test statistics pool information over all the cross-sectional units to test H_0: $a_i = 0$ for all i against the alternative $a_i < 0$ for all i. Here, the null of absence of cointegration is clearly rejected by all Westerlund (2007) tests,

1 Croatia was not included for data availability.
2 See the website: http://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm.
3 See the website: https://www.conference-board.org/data/economydatabase/index.cfm?id=27762.

Table 1: Exploratory data analysis

Variable	Mean	Median	Standard deviation	Skewness	Kurtosis	IQR	10-Trim
GDP	11.4923	11.5009	1.5371	−0.0879	2.5765	1.9340	11.510
GGE	3.8230	3.8307	0.1598	−0.2162	2.8522	0.2281	3.827
TCE	3.7169	3.7210	0.1800	−0.2443	2.5821	0.2756	3.722
IE	1.4439	1.4375	0.3436	0.7168	5.8964	0.4229	1.435

TCE: Tangible common equity, GDP: Gross domestic product, GGE: General government expenditure, IE: Investment expenditure, IQR: Interquartile range

Table 2: Panel cross-section dependence tests

Variable	1	2	3
GDP	50.533 (0.0000)	81.42 (0.000)	340.931 (0.0000)
GGE	24.039 (0.0000)	18.39 (0.000)	116.848 (0.0000)
TCE	35.047 (0.0000)	20.29 (0.000)	155.137 (0.0000)
IE	2.195 (0.0281)	6.49 (0.000)	39.458 (0.0441)

1=Pesaran (2004) cross-sectional dependence in panel data models test,
2=Pesaran (2004) CD test for cross-section dependence in panel time-series data,
3=Friedman (1937) test for cross-sectional dependence by using Friedman's χ^2 distributed statistic. *P* values in parentheses. Tests include the intercept,
TCE: Tangible common equity, GDP: Gross domestic product, GGE: General government expenditure, IE: Investment expenditure

Table 3: Panel unit root test in presence of cross-section dependence tests

Variable	Constant	Constant and trend
GDP	3.280 (0.999)	4.173 (1.000)
GGE	2.853 (0.998)	3.487 (1.000)
TCE	3.199 (0.999)	4.020 (1.000)
IE	1.448 (0.926)	3.231 (0.999)

Z-t-bar or *t*-bar statistics, *P* values in parentheses, TCE: Tangible common equity, GDP: Gross domestic product, GGE: General government expenditure, IE: Investment expenditure

at 5% level (Table 4). Thus, panel data findings reveal the existence of a long-run relationship between government expenditure items and GDP.

As regards the Pedroni's panel cointegration tests, the results overall indicate a cointegrating relationship between our variables. Statistical inference is straightforward because all the test statistics are distributed $N(0,1)$. All test statistics are at least significant at the 10% level, with the more trustworthy panel and group ADF test statistics being rejected at the 1% significance level everywhere. Therefore, the panel dynamic ordinary least squares results support the long-run hypothesis (Table 5).

Given the presence of cointegration in our panel, the dynamic online learning support (DOLS) technique for heterogeneous cointegrated panels is estimated (Table 6), in order to determine the long-run equilibrium relationship (Kao and Chiang, 2000). Emulating Pedroni (2004) original use of the program for this empirical application, we set the number of lags and leads in the DOLS regression to 4, and the number of lags used in the Bartlett kernel for the Newey and West (1994) long-run variance of the residuals to 4. No common time dummies were used for the individual country results. Some coefficients are close to one. In general, the theoretical positive sign is found, confirming the Wagner's law prescription. Interestingly, this is the case for several EU countries as regards the relationship between investment expenditure and GDP. While other estimated coefficients are notably higher or lower. More in detail, for EU-27 countries the results indicate that, in the long-run, a 1% point increase in GDP tends to determine a raise in government expenditure/GDP ratio share between 0.01 (Hungary) and 0.62 (Slovakia) percentage point. This effect is restrained when one considers the former member of association, with an estimated coefficient equals to 0.70.

Pooled estimates of the long-run elasticity and the adjustment coefficient are reported in Table 7 under the PMG, the MG and the dynamic fixed effect (DFE) method. The lags of both variables are chosen according to the Schwarz-Bayesian information criterion and are allowed to vary across countries. However, due to data constraints on the time series dimension of the data set, we impose for both variables a maximum lag of 2 years. The DFE allows for individual intercepts to vary across countries, and is similar to the GMM procedure. The PMG computations were obtained using the Newton-Raphson algorithm without a common time trend. The constraint of common long-run coefficients (i.e., from MG to PMG) has yielded lower standard errors and slower speed of adjustment. This outcome is expected given that the MG estimators are known to be inefficient.

The long-run elasticity is estimated at a value just above unity, which is however significantly larger than one. In fact, due to a very small standard error, which in turn hints to a high estimation precision, even the estimated coefficient of 1.04 turns out to be statistically larger than one, and thus support the strict Wagner's law. In the long-run, an increase of real GDP is associated to a more than proportional increase in GGE. The same evidence derives from the alternative MG and FE estimates. In fact, in both cases the long-run elasticity of government expenditure with respect to GDP is significantly larger than one. The addition of a linear time trend does not change this striking feature.

The adjustment coefficient is, as expected, negative and statistically different from zero, thus suggesting that any deviation of public expenditure from the value implied by the long-run equilibrium relationship with real GDP brings about a correction in the opposite direction. In particular, the error correction coefficient is −0.38 under the PMG framework, suggesting a relatively slow adjustment from lung-run disequilibria nearby 3 years. Slightly larger is the same coefficient when estimated with the MG procedure (2 years). Finally, the Hausman test could not reject the null of equality of PMG and MG estimates, thus sustaining the homogeneous long-run coefficient hypothesis underling the PMG procedure and giving support to a broad validity of Wagner's law across countries. Thus, we can conclude that the PMG estimator, which is the efficient estimator under the null, ought to be preferred. The DFE model further restricts the speed of adjustment coefficient and the short-run coefficients to be

Table 4: Westerlund's panel cointegration tests

Variables	Group statistics and panel statistics	Constant		Constant and trend	
		Value	*P* value	Value	*P* value
GGE, GDP	G_t	−36.974	0.000***	−9.491	0.000***
	G_a	−5.516	0.947	−5.043	1.000
	P_t	−17.470	0.000***	−10.748	0.606
	P_a	−7.515	0.000***	−4.607	1.000
TCE, GDP	G_t	−16.377	0.000***	−13.284	0.000***
	G_a	−3.788	1.000	−4.727	1.000
	P_t	−18.992	0.000***	−10.193	0.820
	P_a	−6.963	0.002***	−5.225	0.999
IE, GDP	G_t	−8.723	0.000***	−6.835	0.000***
	G_a	−6.426	0.767	−7.584	1.000
	P_t	−15.057	0.000***	−13.763	0.000***
	P_a	−9.204	0.000***	−10.181	0.147

Panel cointegration tests include intercept; *P<0.10, **P<0.05, ***P<0.01, TCE: Tangible common equity, GDP: Gross domestic product, GGE: General government expenditure, IE: Investment expenditure

Table 5: Pedroni's panel cointegration tests

Variables	Test statistics	Panel (within dimension)	Group (between dimension)
GGE, GDP	v	2.39	
	rho	−2.898	−1.888
	t	−3.377	−4.321
	adf	−3.494	−5.666
TCE, GDP	v	0.7217	
	rho	−0.9114	0.5498
	t	−1.499	−1.595
	adf	−2.3	−4.759
IE, GDP	v	4.553	
	rho	−8.953	−6.939
	t	−8.938	−10.37
	adf	−8.017	−9.284

Panel cointegration tests include intercept, TCE: Tangible common equity, GDP: Gross domestic product, GGE: General government expenditure, IE: Investment expenditure

equal. In our case, the Hausman test suggests that the MG model is preferred to the DFE. Interestingly, our results are in line with those in Arpaia and Turrini (2008); Lamartina and Zaghini (2011); and Bayrak and Esen (2014).

In Table 8, we show the results for causality tests. We perform Granger causality tests to investigate whether lagged values of government expenditure help in forecasting aggregate income, and *viz*.

Empirical findings listed in Table 9 suggest a bidirectional flow (with a feedback mechanism) only for three countries. Wagner's law (if causality runs from aggregate income to public expenditure) holds for eight countries. On the other hand, we find a unidirectional causality, running from expenditure to GDP, in line with the Keynesian hypothesis, in four countries. Finally, the majority of our panel (12 countries) exhibits the absence of any causal relationship (neutrality hypothesis).

These results confirm the predominance of Wagner's law in the European area, as shown also in Magazzino (2012a); Abdullah and Maamor (2010); Verma and Arora (2010); Kumar (2009); Kumar et al. (2009); Sideris (2007); Chow et al. (2002); Karagianni et al. (2002); Asseery et al. (1999); Thornton (1999).

Table 6: Individual DOLS results

Country	*β*	*t*
GGE, GDP		
Austria	0.0568	−20.96
Belgium	0.3077	−58.07
Bulgaria	0.1664	−21.89
Cyprus	0.4428	−23.84
Czech Republic	0.0962	−10.10
Denmark	0.0408	−19.93
Estonia	0.0368	−13.26
Finland	0.0652	−9.39
France	0.1134	−30.32
Germany	0.6021	−41.35
Greece	0.2632	−19.90
Hungary	0.0123	−137.50
Ireland	0.1633	−20.07
Italy	0.3748	−9.37
Latvia	0.3017	−4.83
Lithuania	0.4043	−34.51
Luxembourg	0.0599	−122.50
Malta	0.1914	−52.37
Netherlands	0.4923	−26.01
Poland	0.0226	−35.54
Portugal	0.2730	−11.24
Romania	0.4632	−20.89
Slovakia	0.6176	−26.54
Slovenia	0.1515	−53.09
Spain	0.3752	−147.20
Sweden	0.5540	−137.50
UK	0.0525	−17.43
TCE, GDP		
Austria	0.0120	−18.30
Belgium	0.3063	−62.70
Bulgaria	0.3446	−20.06
Cyprus	0.5031	−28.78
Czech Republic	0.2595	−29.45
Denmark	0.0540	−22.73
Estonia	0.0453	−11.97
Finland	0.1230	−8.34
France	0.1540	−32.99
Germany	0.3238	−26.71
Greece	0.3686	−19.05
Hungary	0.0262	−19.77
Ireland	0.2572	−34.77
Italy	0.2872	−7.43
Latvia	0.1976	−5.82
Lithuania	0.3765	−43.48

(Contd)

Table 6:(*Continued...*)

Country	β	t
Luxembourg	0.0826	−96.13
Malta	0.3499	−84.13
Netherlands	0.4728	−25.48
Poland	0.1110	−74.32
Portugal	0.2603	−11.18
Romania	0.2822	−31.07
Slovakia	0.3965	−38.42
Slovenia	0.0416	−42.49
Spain	0.4470	−126.40
Sweden	0.5407	−180.70
UK	0.0426	−26.60
IE, GDP		
Austria	0.8147	−11.56
Belgium	0.3650	−8.87
Bulgaria	0.9606	1.53
Cyprus	0.0887	−9.70
Czech Republic	0.9497	−6.45
Denmark	0.1582	−4.37
Estonia	0.0661	−16.46
Finland	0.7000	−29.30
France	0.3412	−10.48
Germany	0.9830	−11.02
Greece	0.5660	−16.46
Hungary	0.0854	−4.37
Ireland	0.5123	−2.57
Italy	0.9313	−7.57
Latvia	0.9162	0.62
Lithuania	0.2825	−11.64
Luxembourg	0.0240	−19.54
Malta	0.9376	−22.72
Netherlands	0.7410	−11.06
Poland	0.2038	−3.59
Portugal	0.3824	−3.17
Romania	0.9701	14.95
Slovakia	0.9031	−16.23
Slovenia	0.7974	−24.41
Spain	0.1283	−97.56
Sweden	0.9007	−49.92
UK	0.3360	−14.68

TCE: Tangible common equity, GDP: Gross domestic product, GGE: General government expenditure, DOLS: Dynamic online learning support

Table 7: PMG, MG, and DFE models

Dependent variable: GGE	Estimator		
	PMG	MG	DFE
Long-run coefficient	1.0385*** (0.0008)	1.1645** (0.5222)	1.2598*** (0.0150)
Adjustment coefficient	−0.3806*** (0.0494)	−0.4817*** (0.0313)	
N	685	685	685
Hausman test	0.25 (0.6186)	53.96 (0.0000)	

Standard errors in parentheses. For DFE estimates, the standard errors are heteroskedasticity consistent. For the diagnostic tests, P values are reported. Significance levels: ***P<0.01, **P<0.05, and *P<0.10, DFE: Dynamic fixed effects, GGE: General government expenditure, PMG: Pooled mean-group, MG: Mean-group

Table 8: Results for granger causality tests

Country	Granger causality	χ^2	P value
Austria	GDP→GGE	2.48	0.2890
	GGE→GDP	5.81	0.0548*
Belgium	GDP→GGE	0.96	0.6200
	GGE→GDP	2.11	0.3489
Bulgaria	GDP→GGE	5.63	0.0599*
	GGE→GDP	0.86	0.6509
Cyprus	GDP→GGE	11.70	0.0029***
	GGE→GDP	14.37	0.0008***
Czech Republic	GDP→GGE	0.38	0.8253
	GGE→GDP	3.92	0.1409
Denmark	GDP→GGE	1.15	0.5628
	GGE→GDP	9.51	0.0086***
Estonia	GDP→GGE	7.59	0.0225**
	GGE→GDP	12.09	0.0024***
Finland	GDP→GGE	1.21	0.5469
	GGE→GDP	5.26	0.0721*
France	GDP→GGE	11.80	0.0027**
	GGE→GDP	3.50	0.1736
Germany	GDP→GGE	10.30	0.0058***
	GGE→GDP	3.46	0.1773
Greece	GDP→GGE	4.86	0.0882*
	GGE→GDP	0.04	0.9797
Hungary	GDP→GGE	0.66	0.7184
	GGE→GDP	1.17	0.5579
Ireland	GDP→GGE	22.35	0.0000***
	GGE→GDP	0.02	0.9907
Italy	GDP→GGE	2.12	0.3465
	GGE→GDP	1.67	0.4346
Latvia	GDP→GGE	1.05	0.5920
	GGE→GDP	4.68	0.0964
Lithuania	GDP→GGE	2.11	0.3481
	GGE→GDP	1.39	0.4991
Luxembourg	GDP→GGE	6.01	0.0496**
	GGE→GDP	8.06	0.0178**
Malta	GDP→GGE	1.58	0.4530
	GGE→GDP	2.89	0.2353
Netherlands	GDP→GGE	3.24	0.1975
	GGE→GDP	0.26	0.8784
Poland	GDP→GGE	0.39	0.8248
	GGE→GDP	6.66	0.0358**
Portugal	GDP→GGE	19.79	0.0001***
	GGE→GDP	0.61	0.7359
Romania	GDP→GGE	1.84	0.3979
	GGE→GDP	0.09	0.9574
Slovakia	GDP→GGE	2.27	0.3208
	GGE→GDP	0.44	0.8033
Slovenia	GDP→GGE	5.46	0.0652*
	GGE→GDP	0.07	0.9656
Spain	GDP→GGE	5.51	0.0637*
	GGE→GDP	3.48	0.1752
Sweden	GDP→GGE	3.14	0.2084
	GGE→GDP	4.02	0.1340
UK	GDP→GGE	2.01	0.3669
	GGE→GDP	0.19	0.9073

*P<0.10, **P<0.05, ***P<0.01, GDP: Gross domestic product, GGE: General government expenditure

5. CONCLUDING REMARKS

The aim of this paper is to contribute to the literature on the relationship between public expenditure and GDP in the European countries, using recent panel econometric techniques. Wagner's law is empirically tested employing panel data analyses. Thus, we studied the relationship between real GDP and GGE, total current expenditure and investment expenditure for 27 EU member countries, using annual data for the period 1980-2013. After having checked for the presence of cross-section dependence, the stationarity properties of our variables have been investigated. Empirical results indicate that all the series are clearly I(1) processes. Cointegration tests revealed that the

Table 9: Summary of granger causality tests results

Hypothesis	Causality flow	Countries
Feedback	GDP↔GGE	3: Cyprus, Estonia, Luxembourg
Wagner's law	GDP→GGE	8: Bulgaria, France, Germany, Greece, Ireland, Portugal, Slovenia, Spain
Keynes's hypothesis	GGE→GDP	4: Austria, Denmark, Finland, Poland
Neutrality	-	12: Belgium, Czech Republic, Hungary, Italy, Latvia, Lithuania, Malta, Netherlands, Romania, Slovakia, Sweden, UK

GDP: Gross domestic product, GGE: General government expenditure

three expenditure series share a common trend - and a long-run relationship - with real aggregate income. Therefore, results show that the assumption of a common long-run elasticity is accepted by the data. The DOLS technique for heterogeneous cointegrated panels indicate that, in the long-run, a 1% point increase in GDP tends to determine a raise in government expenditure/GDP ratio share between 0.01% and 0.62% point. Furthermore, pooled estimates of the long-run elasticity and the adjustment coefficient shows that the error correction coefficient varies between −0.38 (for PMG estimates) and −0.48 for MG estimates, signaling that any deviation of public expenditure from the value implied by the long-run equilibrium relationship with real GDP brings about a correction in the opposite direction. Interestingly, these findings are similar to those of previous studies. Finally, Granger causality tests results show mixed results, though the relationship between the three items of government expenditure and national income seems to be more Wagnerian than Keynesian.

REFERENCES

Abdullah, H., Maamor, S. (2010), Relationship between national product and Malaysian Government development expenditure: Wagner's law validity application. International Journal of Business Management, 5(1), 88-97.

Afonso, A., Jalles, J.T. (2014), Causality for the government budget and economic growth. Applied Economics Letters, 21(17), 1198-1201.

Alam, S., Sultana, A., Butt, M.S. (2010), Does social expenditures promote economic growth? A multivariate panel cointegration analysis for Asian countries. European Journal of Social Sciences, 14(1), 44-54.

Ansari, M.I., Gordon, D.V., Akuamoah, C. (1997), Keynes versus Wagner: Public expenditure and national income in three African countries. Applied Economics, 29, 543-550.

Arpaia, A., Turrini, A. (2008), Government expenditure and economic growth in the EU: Long-run tendencies and short-term adjustment. European Economy – Economic Papers, 300, February.

Arreaza, A., Sørensen, B.E., Yosha, O. (1999), Consumption smoothing through fiscal policy in OECD and EU countries. In: Poterba, J.R., Von Hagen, J., editors. Fiscal Institutions and Fiscal Performance. Chicago: University of Chicago Press.

Asseery, A.A., Law, D., Perdikis, N. (1999), Wagner's law and public expenditure in Iraq: A test using disaggregated data. Applied Economics Letters, 6(1), 39-44.

Barrios, S., Schaechter, A. (2008), The quality of public finances and economic growth. European Economy – Economic Papers, 337, September.

Bayrak, M., Esen, Ö. (2014), Examining the validity of Wagner's law in the OECD Economies. Research in Applied Economics, 6(3), 1-16.

Bird R.M. (1971), Wagner's Law: A Pooled time series and cross section comparison, in "National Tax Journal", 38, 209-218.

Chow, Y.F., Cotsomitis, J.A., Kwan, A.C.C. (2002), Multivariate cointegration and causality tests of Wagner's hypothesis: Evidence from the UK. Applied Economics, 34(13), 1671-1677.

Granger, C.W.J. (1969), Investigating causal relations by econometric models and cross-spectral methods. Econometrica, 37, 424-438.

Gupta, S. (1967), Public expenditure and economic growth: A time series analysis. Public Finance, 22, 423-461.

Henrekson, M. (1993), Wagner's law – A spurious relationship? Public Finance, 48(2), 406-415.

Im, K.S., Pesaran, M.H., Shin, Y. (2003), Testing for unit roots in heterogeneous panels. Journal of Econometrics, 115(1), 53-74.

Kao, C., Chiang, M.H. (2000), On the estimation and inference of a cointegrated regression in panel data. Advances in Econometrics, 15, 179-222.

Karagianni, S., Pempetzoglou, M., Strikou, S. (2002), Testing Wagner's law for the European union economies. The Journal of Applied Business Research, 18(4), 107-114.

Keynes, J.M. (1936), The General Theory of Interest, Employment and Money. London: McMillan.

Kumar, S. (2009), Further Evidence on Public Spending and Economic Growth in East Asian Countries, MPRA Paper, 19298.

Kumar, S., Webber, D.J., Fargher, S. (2009), Wagner's Law Revisited: Cointegration and Causality tests for New Zealand, University of the West of England Discussion Papers, 0917.

Lamartina, S., Zaghini, A. (2011), Increasing public expenditure: Wagner's law in OECD countries. German Economic Review, 12(2), 149-164.

Maddala, G., Wu, S. (1999), A comparative study of unit root tests and a new simple test. Oxford Bulletin of Economics and Statistics, 61, 631-652.

Magazzino, C. (2011), Disaggregated public spending, GDP and money supply: Evidence for Italy. European Journal of Economics, Finance and Administrative Sciences, 41, 118-131.

Magazzino, C. (2012a), Wagner's law and augmented Wagner's law in EU-27. A time-series analysis on stationarity, cointegration and causality. International Research Journal of Finance and Economics, 89, 205-220.

Magazzino, C. (2012b), Wagner versus Keynes: Public spending and national income in Italy at a disaggregated level. Journal of Policy Modeling, 34(6), 890-905.

Narayan, P.K., Nielsen, I., Smyth, R. (2008), Panel data, cointegration, causality and Wagner's law: Empirical evidence from Chinese provinces. China Economic Review, 19, 297-307.

Neal, T., (2014), Panel cointegration analysis with xtpedroni, The Stata Journal, 14, 3, 684-692.

Newey, Whitney K., West, Kenneth D. (1994). "Automatic lag selection in covariance matrix estimation". Review of Economic Studies 61 (4): 631-654.

Peacock, A.T., Scott, A. (2000), The curious attraction of Wagner's law. Public Choice, 102(1-2), 1-17.

Peacock, A.T., Wiseman, J. (1961), The Growth of Public Expenditure in the United Kingdom, London: Oxford University Press.

Peacock, A.T., Wiseman, J. (1979), Approaches to the analysis of Government expenditure growth. Public Finance Quarterly, 7, 3-23.

Pedroni, P. (2004), Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. Econometric Theory, 20, 597-625.

Pesaran, M.H. (2003), A Simple Panel Unit Root Test in the Presence of Cross Section Dependence, Cambridge Working Papers in Economics, 0346.

Pesaran, M.H. (2004), General Diagnostic Tests for Cross Section Dependence in Panels, CESifo Working Paper, 1229.

Pesaran, M.H., Smith, R.P. (1995), Estimating long-run relationships from dynamic heterogeneous panels. Journal of Econometrics, 68(1), 79-113.

Sideris, D. (2007), Wagner's Law in 19th Century Greece: A Cointegration and Causality Analysis, Bank of Greece Working Papers, 64, December.

Singh, B., Sahni, B.S. (1984), Causality between public expenditure and national income. The Review of Economics and Statistics, 66(4), 630-644.

Thornton, J. (1999), Cointegration, causality and Wagner's law in 19th century Europe. Applied Economic Letters, 6(7), 413-416.

Verma, S., Arora, R. (2010), Does the Indian economy support Wagner's law? An econometric analysis. Eurasian Journal of Business and Economics, 3(5), 77-91.

Wahab, M. (2004), Economic growth and government expenditure: Evidence from a new test specification. Applied Economics, 36(19), 2125-2135.

Wagner, A.H. (1883), Finanzwissenschaft. Leipzig: C. F. Winter.

Westerlund, J. (2007), Testing for error correction in panel data. Oxford Bulletin of Economics and Statistics, 69, 709-748.

Yu, B., Fan, S., Saurkar, A. (2009), Does Composition of Government Spending Matter to Economic Growth? International Association of Agricultural Economists 2009 Conference, August 16-22, Beijing, China.