

Voracity effect and Wagner's law in the PIIGS

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Abstract. The paper provides direct empirical evidence on cyclicality and the short-term and long-term relationship between government expenditure and output in the PIIGS (Portugal, Ireland, Italy, Greece, Spain) in a period 1990-2010. We follow Akitoby et al. and apply Johansen cointegration test and the error correction model on annual data of GDP and government expenditure in compliance with the COFOG international standard. The government expenditure functions are procyclical in most PIIGS countries (68% cases in the sample). Output and government expenditure are cointegrated for at least six of the expenditure categories in every country and it implies a long-term relationship between government expenditure and output consistent with Wagner's law. Average value of long-run elasticity coefficients is 1.30 for all expenditure functions, 1.17 for total government expenditure. The values of the coefficients for the short-run relationship between expenditure and output confirm the voracity hypothesis, as they suggest that in response to a given shock to real GDP, government expenditure rises by even more in percentage points.

Keywords: government expenditure, cyclicality, voracity effect, long-run elasticity, short-run elasticity.

JEL Classification: C32, H50, E62

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1 Introduction

Government expenditure and factors of their growth are a serious problem of many countries. As Mutascu and Milos [16] mention, the economic theory provides two main categories of arguments that explain the public sector size in time and among countries. The first category has as starting point the Wagner law, according to which the elasticity of government expenditure compared to GDP is greater than one. As countries become more developed, the demand for public goods raises and is consistent with the increasing ability to collect the necessary funds. On the other hand, the "Baumol cost disease", explains that the percentage of government expenditure increases because the raise of public servants' salaries is higher than their productivity, while the price related to public services demand is relatively non)elastic. The second category of arguments is political. For election purposes, the fiscal policy, especially those concerning the government expenditure tends to be inconsistent in time and focuses on greater deficits and greater public sectors.

We can find a view that government expenditure should act as a stabilizing force and move in a countercyclical direction. Contrary to the theory (it implies that government expenditure is countercyclical), many of empirical studies found evidence that government expenditure is procyclical. See Hercowitz and Strawczynski [11], Kaminsky et al. [13], Alesina et al. [3], Rajkumar and Swaroop [18], Hamerníková [10], Ganelli [7] or Szarowska [19] for more details. Talvi and Vegh [20] show that fiscal procyclicality is evident in a much wider sample of countries. Analysis of Lane [14] finds procyclicality in a single-country time series study of Irish fiscal policy. Lane [15] also shows that the level of cyclicality varies across expenditure categories and across OECD countries. Abbott and Jones [1] test differences in the cyclicality of government expenditure across functional categories. Their evidence from 20 OECD countries suggests that procyclicality is more likely in smaller functional budgets, but capital expenditure is more likely to be procyclical for the larger expenditure categories. Many of researches as Gavin et al. [8], Gavin and Perotti [9] focused on Latin America. On the one hand, Galí [6] shows in his research that expenditure is countercyclical. However, other papers show no discernible pattern. Fiorito and Kollintzas [5] document for G7 countries, the correlation between government consumption and output indeed appears to show no pattern and be clustered around zero. The differences in these results depend on the components of expenditure being measured. Government transfers and subsidies are found to have become substantially more countercyclical.

Economic performance is greatly influenced by the level and the structure of government expenditure. It is not only a potential automatic stabilizer, but it is also a tool of political actions. In fact, development of government expenditure is often associated with Wagner's law and voracity effect. Wagner's law states that government activity increases as economies grow, with the pace of increase being different for different branches of

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government. Voracity effect occurs if a positive shock to income leads to a more than proportional increase in public expenditure, even if the shock is expected to be temporary. The voracity is usually attributed to weak institutions and ethnic fractionalization, manifested in the presence of multiple interest groups seeking to secure a greater share of national wealth by demanding larger public expenditure on their behalf. The existing literature testing Wagner's law varies considerably in terms of the dependent and independent variables chosen to “test” the law. Wagner originally proposed that as industrialization or social progress proceeded, public sectors would grow in relative importance. In practice, researchers use different measures of national income as a measure of this social progress. Peacock and Scott [17] point out on the fact that there are at least 14 different measures of government expenditure that have been used in the literature, and at least 13 different measures of output, including output per capita. In this paper we adopt the simplest formulation of Wagner's law by focusing on the relationship between aggregate economic activity and government expenditure in compliance with the COFOG international standard. Most studies analyzing the cyclicity of government expenditure and output have used a panel data methodology that has not fully exploited the time-series properties of the data. On the other hand, studies testing for a long-run relationship, such as Wagner's law, have ignored the short-term aspects of this relationship. In the literature on cyclicity, many studies use panel data models that are not well suited to exploring short-term versus long-term relationships. We exploit both the time-series and cross-sectional aspects using an error-correction framework.

The aim of the paper is to provide direct empirical evidence on cyclicity and the short-term and the long-term relationship between government expenditure and output in five selected European countries. Although the theory implies that government expenditure is countercyclical, recent evidence suggests that it is procyclical. Previously published studies are weakly supported by the data from PIIGS countries in which results can vary. We follow Akitoby et al. [2] and apply Johansen cointegration test [12] and the error correction model on annual data of GDP and government expenditure during 1990–2010. The article is organized as follows. In the next section, we describe the dataset and empirical techniques used. Then, we present the results of government expenditure cyclicity and long-run and short-run relationship between output and government expenditure. We conclude with a summary of key findings.

2 Data and methodology

The dataset consists of annual data on GDP and government expenditure in compliance with the COFOG international standard during the period 1990–2010. It is not possible to use higher frequently time series data as COFOG classification analyzes and reports only annual data. We use data about expenditure and output from Eurostat and OECD database, GDP deflators in 2005 values are taken from the World Bank. The countries included in the analysis are Portugal, Ireland, Italy, Greece and Spain. The series for GDP and total government expenditure and its subcomponent are adjusted at constant prices. In line with Akitoby et al. [2], we investigated fiscal and output co-movements by the approach proposed by Lane [15]. We estimated the elasticity of government expenditure with respect to output, based on country-by-country time-series regressions. Next we used an error-correction approach, which allows us to distinguish between the short-term effect of output on government expenditure and any longer-term effect between these two variables. Most of the results were calculated in econometric program Eviews 7.

Many studies point out that using non-stationary macroeconomic variable in time series analysis causes superiority problems in regression. Thus, a unit root test should precede any empirical study employing such variables. We decided to make the decision on the existence of a unit root through Augmented Dickey–Fuller test (ADF test). The equation (1) is formulated for the stationary testing.

$$\Delta x_t = \delta_0 + \delta_1 t + \delta_2 x_{t-1} + \sum_{i=1}^k \alpha_i \Delta x_{t-i} + u_t \quad (1)$$

ADF test is used to determine a unit root x_t at all variables in the time t . Variable Δx_{t-i} expresses the lagged first difference and u_t estimate autocorrelation error. Coefficients δ_0 , δ_1 , δ_2 and α_i are estimated. Zero and the alternative hypothesis for the existence of a unit root in the x_t variable are specified in (2).

$$H_0: \delta_2 = 0, H_a: \delta_2 < 0 \quad (2)$$

The result of ADF test confirm the stationary of all time series at the first difference. Testing the stationary is the essential assumption for implementation of cointegration approach. It is necessary to confirm that time series are non-stationary at level data but stationary at first difference.

We suppose there is a steady-state relationship between government expenditure and output given by (3).

$$G = AY^\delta \quad (3)$$

G represents government expenditure, Y means output and Eq. (3) can also be written in linear form:

$$\log G = a + \delta \log Y, a = \log A \quad (4)$$

If the adjustment of expenditure G to its steady-state \bar{G} is gradual, then the level of expenditure will respond to transitory changes in output, and G will move gradually toward its steady-state, or equilibrium level. To capture this gradual move, we specify a general autoregressive distributed lag specification for expenditure category i in period t :

$$\log G_{it} = \mu + \alpha \log G_{it-1} + \beta_0 \log Y_t + \beta_1 \log Y_{t-1} + \varepsilon_t, \quad |\alpha| < 1 \quad (5)$$

We can solve for the static, steady-state equilibrium by assuming that output is at its steady-state level \bar{Y} and ignoring the error term:

$$\log \bar{G} = \frac{\mu}{1-\alpha} + \frac{\beta_0 + \beta_1}{1-\alpha} \log \bar{Y}, \quad \delta = 1 - \alpha \quad (6)$$

More generally, we could allow output to grow at rate g . In this case, the only difference is that the constant term becomes $\frac{\mu + (\beta_0 - \delta)g}{1-\alpha}$, which depends on g . To reflect the steady state, (5) can be rearranged as the error correction model (7).

$$\log G_{it} = \mu + \beta_0 \log Y_t + \gamma (\log G_{it-1} - \delta \log Y_{t-1}) + \varepsilon_t \quad (7)$$

In (7), we can interpret $\beta_0 \log Y_t$ as the short-term impact of output on expenditure and β_0 as the short-run elasticity of government expenditure with respect to output. The error correction term $\gamma (\log G_{it-1} - \delta \log Y_{t-1})$ captures deviations from the steady-state, or long-run equilibrium, where δ is the long-run elasticity of government expenditure with respect to output, and γ is the rate at which government expenditure adjusts to past disequilibrium. μ is constants of the model, ε_t means residual component of long-term relationship.

Moreover, (7) can be rewritten as (8) and then used to test if there is a long-run relationship between government expenditure and output. In particular, following [4], if γ is significantly different from zero in (8), then output and government expenditure are cointegrated.

$$\log G_{it} = \mu + \beta_0 \log Y_t + \gamma \log G_{it-1} - \varphi \log Y_{t-1} + \varepsilon_t \quad (8)$$

where $\varphi = \gamma\delta$. The above derivation makes clear the underlying assumption that there is a elasticity relationship between output and expenditure, while the transitory deviations are random.

3 Structure and cyclicity of government expenditure

Government expenditure can help in overcoming the inefficiencies of the market system in the allocation of economic resources. It also can help in smoothing out cyclical fluctuations in the economy and influences a level of employment and price stability. We used government expenditure in compliance with the COFOG international standard (Classification of the Functions of Government) in our analysis. Total government expenditure is divided into 10 basic divisions:

- CF01: General public services
- CF02: Defense
- CF03: Public order and safety
- CF04: Economic affairs
- CF05: Environment protection
- CF06: Housing and community amenities
- CF07: Health
- CF08: Recreation; culture and religion
- CF09: Education
- CF10: Social protection

3.1 The structure of government expenditure

Firstly we analyzed the structure of government expenditure in a period 1995–2010. Results in Table 1 show the average share of government expenditure by functions on total expenditure and the average share of total government expenditure on GDP in each country during the analyzed period.

	CF01	CF02	CF03	CF04	CF05	CF06	CF07	CF08	CF09	CF10	Gtotal /GDP
Greece	23.86%	6.11%	2.58%	11.19%	1.17%	0.81%	11.50%	0.85%	7.19%	34.73%	46.43%
Spain	13.95%	2.77%	4.67%	12.03%	2.13%	2.53%	13.63%	3.51%	10.99%	33.80%	40.85%
Ireland	10.72%	1.61%	4.51%	13.70%	2.34%	4.33%	17.64%	1.81%	13.17%	30.18%	38.05%
Italy	21.66%	2.67%	3.99%	8.58%	1.65%	1.72%	12.73%	1.71%	9.47%	35.81%	50.13%
Portugal	15.18%	3.29%	4.21%	10.42%	1.43%	1.78%	14.72%	2.68%	14.50%	31.81%	43.77%
Average	17.08%	3.29%	3.99%	11.18%	1.74%	2.24%	14.04%	2.11%	11.06%	33.27%	43.85%

Table 1 Government expenditure - COFOG classification (in % of total G)

Five expenditure functions (Social protection, Economic affairs, Health, General public services and Education), on average, account nearly 87% of the total expenditure. The Social protection expenditure (CF10) is the

highest expenditure function in every country and it takes the third of total government expenditure. It contains, for example, expenditure on sickness and disability, old age, survivors, family and children, unemployment, housing, social exclusion and R&D social protection. The value of General public services (CF01) is the second highest category (17%). We can find the highest value of CF01 (23.86%) in Greece, followed by Italy (21.66%); it is due to a high expenditure on public debt services. On the other hand, Ireland has the smallest CF01 expenditure (less than 11%). Economics affairs (CF04) and (CF09) Education expenditure are in average very similar (11.18% resp. 11.06%), but the share differs in each country. Education expenditure are twice as high in Portugal as in Greece. The value of total government expenditure is the smallest in Ireland (38.05% GDP), the highest in Italy (50.13% GDP), and the average of all countries is 43.77% GDP; that expresses significant differences in size and importance of public sector in the sample of countries.

3.2 The cyclicity of government expenditure

As was already noted, government expenditure is a possible automatic stabilizer. The cyclicity of government expenditure is typically defined in terms of how expenditure moves with the output gap. If government expenditure increases when there is a positive output gap (i.e. output is below its potential), then expenditure is counter-cyclical. If potential output were observable or easy to estimate, one could define counter-cyclicity as above-average expenditure to output ratio whenever output was below its potential. As Akitoby et al. [2] mention, measuring potential output is difficult. As a consequence, it is not easy to discuss business cycles or cyclicity per se. Therefore we focus on co-movements of government expenditure and output as a proxy for cyclicity.

	G total	CF01	CF02	CF03	CF04	CF05	CF06	CF07	CF08	CF09	CF10
Greece	-0.91* (0.45)	0.32* (0.09)	-0.60* (0.22)	-0.25 (0.34)	-1.28* (0.30)	-0.01 (0.12)	-0.49 (0.31)	0.03 (0.11)	-0.80* (0.28)	-1.10* (0.45)	-0.39* (0.20)
Spain	0.23* (0.06)	0.37* (0.15)	-0.37* (0.19)	0.41 (0.41)	-1.18* (0.34)	-0.29 (0.21)	-0.17 (0.32)	-0.17* (0.07)	-0.35 (0.25)	-0.04* (0.02)	0.05* (0.03)
Ireland	0.29 (0.18)	-0.01* (0.00)	-0.32* (0.14)	0.23* (0.12)	1.41 (1.03)	-0.04 (0.05)	-0.91* (0.39)	-0.18** (0.11)	0.28 (0.36)	-0.06* (0.02)	-0.28* (0.07)
Italy	-0.00 (0.03)	-0.56** (0.18)	-0.27* (0.11)	-0.07* (0.34)	-0.62* (0.24)	-0.39* (0.16)	-0.66* (0.30)	-0.31** (0.08)	-0.13 (0.24)	-0.31* (0.11)	-0.34** (0.09)
Portugal	-0.01 (0.11)	-0.69** (0.14)	-1.11* (0.37)	-0.06 (0.19)	-0.40 (0.43)	-0.23* (0.13)	-0.52* (0.14)	-0.02 (0.23)	-0.48* (0.24)	-0.56* (0.23)	-0.16** (0.05)
Average	0.57	0.39	0.53	0.23	1.2	0.31	0.69	0.22	0.64	0.41	0.24
Share significant	40%	100%	100%	20%	60%	40%	60%	60%	40%	100%	100%

Table 2 The value of adjustment coefficient γ

Symbols *and ** denote significance at the 5% and 1% level, standard deviation are in parenthesis. Average means the average absolute values of significant coefficients only. Share significant means share of significant cases. Table 2 reports the estimates of the adjustment coefficient γ from equation (7), which is estimated by OLS with a correction for an autoregressive error term. γ is the rate at which government expenditure adjusts to past disequilibrium. In cases where γ is significant, we can conclude there is a cointegrating relationship between government expenditure and output. The results indicate significant difference across expenditure functions. There is a long-term relationship between total government expenditure and output consistent with Wagner's law, the share of significant results is 68% for all categories in all countries. Although the error correction term is not significant for all expenditure functions in any country of the sample, all countries have a significant error correction term for at least six of the expenditure functions (six in Greece and Spain, seven in Ireland and Portugal and eight in Italy). Moreover, the error correction term for General public services (CF01), Defense (CF02) Education (CF09) and Social protection (CF10) are significant in all countries. As expected, the adjustment coefficients are mostly negative (in 86% of cases), indicating dynamic stability. The implication of a significant error correction term is that there is in fact a long-term relationship between government expenditure and output. But it is suitable to point out that the existence of cointegration does not imply causality, which is consistent with Wagner's view that there is not necessarily a cause and effect relationship between economic development and government activity.

Table 3 summarizes the results about the long- run elasticity of expenditure with respect to output. Symbols *and ** denote significance at the 5% and 1% level, standard deviation are in parenthesis. Average means the average absolute values of significant coefficients only. Share significant means share of significant cases. It contains only significant coefficients; the long-run elasticity coefficient δ is significant in 84% cases. A positive value of δ is consistent with a wider interpretation of Wagner's law, as it implies that government expenditure

rises with national income. If δ is higher than one then this would be consistent with a narrow interpretation of Wagner's law, where government expenditure rises faster than national income.

	G total	CF01	CF02	CF03	CF04	CF05	CF06	CF07	CF08	CF09	CF10
Greece	1.02* (0.06)	-1.50* (0.27)	1.43* (0.55)	4.20** (0.32)	0.88** (0.14)	0.58 (0.01)	1.19** (0.23)	0.76** (0.01)	2.69* (0.30)	2.07** (0.15)	0.78** (0.09)
Spain	-0.06 (0.13)	-0.65** (0.14)	0.74** (0.09)	0.81** (0.07)	1.23** (0.09)	1.37** (0.07)	-0.20 (0.32)	1.94** (0.33)	0.98** (0.10)	2.85* (0.93)	0.91** (0.01)
Ireland	0.36* (0.15)	1.38** (0.21)	0.55** (0.01)	0.14 (0.14)	0.56** (0.08)	0.13 (0.59)	1.11** (0.09)	1.20** (0.05)	0.79** (0.09)	2.46** (0.61)	0.86** (0.01)
Italy	0.94** (0.01)	-1.97** (0.18)	1.36* (0.62)	3.13** (0.41)	0.77** (0.01)	1.66** (0.18)	0.58** (0.00)	2.37** (0.27)	1.96** (0.21)	0.78** (0.00)	0.88** (0.14)
Portugal	2.34** (0.40)	0.77** (0.01)	0.64* (0.0)	0.68** (0.02)	0.73** (0.00)	-0.22** (0.72)	0.58** (0.01)	2.55** (0.25)	0.63** (0.00)	0.77** (0.00)	0.89** (0.02)
Average	1.17	1.26	0.95	2.20	0.83	1.08	0.86	1.76	1.41	1.79	0.86
Share significant	80%	100%	100%	80%	100%	60%	80%	100%	100%	100%	100%

Table 3 The long-run elasticity coefficient δ

The long-term elasticity of government expenditure and output δ is mostly positive (in 92% of cases), and it is the highest for Public order and safety (CF03) due to the extremely high δ in Italy (it greatly increased the average). Moreover, δ is for total expenditure larger than one (1.17), average value is 1.30 for all expenditure functions. It is consistent with the narrow interpretation of Wagner's law and indicating that in the long-term, the public sector is increasing in relative importance. The coefficient for long-run elasticity was significant in all countries for all expenditure functions with the exception of Public order and safety (CF03), Environment protection (CF05) and Housing and community amenities (CF06). In Table 3, we can also find the long-run δ lower than one, it means that the expenditure function rises slower than national income.

	G total	CF01	CF02	CF03	CF04	CF05	CF06	CF07	CF08	CF09	CF10
Greece	-0.54 (1.14)	2.34* (0.83)	5.97* (2.07)	4.23* (2.36)	0.96 (1.73)	1.92* (0.80)	0.96 (1.38)	3.45* (1.33)	-4.02 (2.56)	0.12 (1.62)	0.47 (0.62)
Spain	1.21** (0.21)	1.01* (0.54)	0.19 (0.34)	2.11* (1.10)	-0.29 (0.76)	-0.65 (0.88)	0.38 (2.28)	0.79* (0.33)	-0.29 (1.24)	0.89** (0.22)	1.21* (0.51)
Ireland	-0.20 (0.70)	-0.63 (0.39)	0.83* (0.31)	1.39* (0.48)	1.11 (4.68)	1.43* (0.60)	-1.65 (1.52)	-1.25* (0.49)	2.92* (1.50)	0.55* (0.15)	-1.44* (0.58)
Italy	0.44* (0.23)	1.05* (0.50)	-0.43 (0.77)	0.18 (0.89)	0.52 (1.53)	0.64 (0.38)	-0.35 (5.01)	-0.55 (0.36)	1.14* (0.55)	0.60* (0.27)	-0.67** (0.22)
Portugal	0.07 (0.35)	-0.69** (0.14)	1.00 (0.76)	-2.63* (1.24)	0.49 (1.14)	0.19 (0.91)	4.38* (1.30)	1.13* (0.57)	0.49 (0.84)	0.42 (0.88)	-1.34* (0.69)
Average	0.83	1.27	3.40	2.59	-	1.68	4.38	1.65	2.3	0.68	1.16
Share significant	40%	80%	40%	80%	0%	40%	20%	80%	40%	60%	80%

Table 4 The short-run elasticity coefficient β

Table 4 summarizes results about the short-run elasticity of expenditure with respect to output. Symbols *and ** again denote significance at the 5% and 1% level, standard deviation are in parenthesis. Average means the average absolute values of significant coefficients only. The results and conclusions for the short-run elasticity are not so unequivocal. For all expenditure categories, the average coefficient is 2.09. Although the short-run elasticity is positive for 79% of the cases in the sample, it's needed to points out on 51% statistical significant of results. However, the coefficient value above one is consistent with the voracity hypothesis, as it suggests that in response to a given shock to real GDP, government expenditure rises by even more in percentage points.

4 Conclusion

The aim of this article was to provide direct empirical evidence on cyclicity and the long-term and short-term relationship between government expenditure and output in five selected European countries (namely Portugal, Ireland, Italy, Greece and Spain) in a period 1990–2010. We analyzed annual data on government expenditure in compliance with the COFOG international standard. Although the theory implies that government ex-

penditure is countercyclical, our research does not prove that. The results confirm cyclical development of government expenditure on GDP, Wagner's law and voracity effect in PIIGS countries during 1990–2010.

We used Johansen cointegration test and the error correction model. Output and government expenditure are cointegrated for at least six of the expenditure functions in every country and it implies a long-term relationship between government expenditure and output. The government expenditure functions are procyclical in most countries (68% cases in the sample). Average value of long-run elasticity coefficient is 1.30 for all expenditure functions, 1.17 for total government expenditure. It is consistent with the interpretation of Wagner's law and indicates that the public sector is increasing in relative importance in the long-term. The δ coefficient was significant in all countries for all expenditure functions with the exception of CF03, CF05 and CF06.

We also analyzed the short-run relationship between expenditure and output. Results are not unambiguous due to a relatively low statistical significance (51%). However, the coefficient values (average is 2.09) confirm the voracity hypothesis, as they suggest that in response to a given shock to real GDP, government expenditure rises by even more in percentage points.

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