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Long-term and Short-term Relationship between Government Expenditure and GDP in the EU15: Cointegration Approach[1]

Introduction

Due to the economic recession which started in 2008, many governments started to focus their attention on government expenditure as it and its growth are often seen as an essential problem of public finance. Actually, 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 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.

On the other hands, government expenditure is an important tool for national governments to mitigate the uneven economic development and economic shocks across individual countries. From a Keynesian perspective, government expenditure should act as a stabilizing force and move in a countercyclical direction. Serven (1998) pointed that procyclical fiscal policy is generally regarded as potentially damaging for welfare: it can raise macroeconomic volatility, depress investment in real and human capital, hamper growth, and harm the poor. If expansionary fiscal policies in "good times" are not fully offset in "bad times", they may also produce a large deficit bias and lead to debt unsustainability and eventual default. If a government respects a basic prescription that fiscal tools

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[1] This paper was supported by the Ministry of Education, Youth and Sports Czech Republic within the Institutional Support for Long-term Development of a Research Organization.

should function counter-cyclical, the optimal fiscal policy involves a decreasing of government spending in "good times" and increasing of government spending in "bad times."

The aim of the article is to examine the trends of government expenditure in the core member states of the European Union (EU15) in the period 1995–2010 and provide direct empirical evidence on cyclicality and the short-term and the long-term relationship between government expenditure and output. 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 EU15 in which results can vary. The research is based on direct empirical evidence about the cyclicality and the short-term and the long-term relationship between government expenditure and output. We apply cointegration approach on adjusted annual data of GDP and government expenditure in compliance with the COFOG international standard. The paper is organized as follows. The first section presents literature review. In the second section, we describe the dataset and used empirical techniques. Next we discuss the results of government expenditure cyclicality and long-run and short-run relationship between output and government expenditure. We conclude with a summary of key findings.

1. Literature review

As Mutascu and Milos (2009) mentioned, the economic theory provides us with 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's Law, according to which the elasticity of government expenditure with respect to GDP is greater than one. As countries become more developed, the demand for public goods rises and is consistent with the increasing ability to collect the necessary funds. The "Baumol cost disease" explains that the percentage of government expenditure increases because the rise in public servants' salaries is higher than their productivity, while the price related to public services is relatively non-elastic. The second category of arguments is political. For election purposes, the fiscal policy, especially that concerning government expenditure tends to be inconsistent in time and focuses on greater deficits and greater public sectors.

The relationship between government expenditure and output has often been debated in economic literature. Wagner (1911) proposed that there is a long-run tendency for government activities to grow relative to total economic activity. Wagner stated that during the industrialization process, as the real income per capita of a country increases, the share of its public expenditure in total expenditure increases. Three main reasons are argued to support this hypothesis: the administrative and regulatory functions of the state, the cultural and welfare services and the state participation to finance large-scale projects for technological needs.

It means that government grows because there is an increasing demand for public goods and for the control of externalities.

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 proceed, public sectors would grow in relative importance. As Sideris (2007) summed up, the empirical works on Wagner's Law can be divided in two groups, based on the different types of econometric methodology used: (i) studies which are performed until the mid–1990s assume stationary data series and apply simple OLS (ordinary least squares) regressions to test alternative versions of the law; (ii) cointegration-based studies, which are performed from the mid–1990s on, test for cointegration mostly between government expenditure and national income. Early studies of this group use the Engle and Granger (1987) methodology, whereas more recent works mostly apply the Johansen (1988) technique. Many recent studies also perform Granger causality tests to indicate the direction of causality between the variables.

The empirical studies have produced mixed and sometimes contradictory results. Some of these conflicting conclusions have been attributed to the different econometric methodology and the different features of individual economies during alternative time periods. Above that, Peacock and Scott (2000) pointed out to the fact that there are at least 14 different measures of government expenditure that have been used in the literature (e.g. government expenditure at current prices, government expenditure plus transfers at current prices, government expenditure at constant prices, government expenditure plus transfers at constant prices, government consumption expenditure at current prices, government consumption expenditure at constant prices, central government expenditure only, government capital expenditure at constant prices, etc.), and at least 13 different possible measures of output (e.g. total output *Y*, output per capita, proportion of *Y* generated in manufacturing sector, proportion of *Y* generated in primary sector, permanent income, total commercial energy consumption per capita, exports plus imports divided by *Y*).

Clethsos and Kollias (1997) investigated empirically the traditional Wagner's hypothesis in the case of Greece using disaggregated data of public expenditures and employing an error correction approach. The empirical findings confirmed Wagner's Law only in the case of military expenditure. Thornton (1999) analysed the experience of six developed economies (Denmark, Germany, Italy, Norway, Sweden and the UK) from the mid–19th century to 1913, and reported results in accordance with the Wagner's Law. Karagianni et al. (2002) applied six alternative functional forms, using data for the EU–15 countries over the time period 1949–1998. The results are ambiguous accordingly to the method applied. The major points that emerge from the ngle and Granger test are that in most of the EU countries, no long term relationship has been observed, except for some subcases in Finland, Italy and the Netherlands. In contrast, the Johansen test supports the existence of Wagner's Law in most EU countries, with the exception of France and Italy. As far as the Granger causality test is concerned, patterns of

causality between income and government expenditure display dramatic differences across various countries. Moreover, there is limited support for the pattern of causality; Wagner's Law was completely verified only for Finland and Italy. Florio and Colautti (2005) analyzed the evidence of the USA, United Kingdom, France, Germany and Italy for the period 1870–1990. They observed that the increase in the public expenditure to national income ratio is faster for the period until the mid–20th century and they developed a model based on Wagner's Law.

Akitoby et al. (2006) examined the short- and long-term behaviour of government spending with respect to output in 51 developing countries using an error--correction model. They find evidence that is consistent with the existence of cyclical ratcheting and voracity in government spending in developing countries, resulting in a tendency for government spending to rise over time. They presented three main policy conclusions of the research: (i) the long-term and short-term elasticity of capital spending in relation to GDP is relatively high; (ii) there may be scope for fiscal rules or fiscal responsibility laws in some countries that limit the discretion for pro-cyclical fiscal policy; (iii) in many countries, there is a long--term relationship between the level of output and government spending. Sideris (2007) investigates the long-run tendency for government expenditure to grow relative to national income using Greek data from 1833 to 1938. Cointegration analysis validates the existence of long-run relationship between the variables, as expressed by the six most popular versions of the Law. Moreover, Granger causality tests indicate causality running from the variables approximating income to the government expenditure variable.

Lamartina and Zaghini (2008) analysed the development of public expenditure and aggregate income in 23 OECD countries. Using panel cointegration, the empirical evidence shows a structural positive correlation between public spending and per capita income, consistent with the Wagner's Law. The correlation is usually higher in countries with lower per capita income, suggesting that the period of catching-up is characterized by a stronger development of public activities than in more mature economies.

Magazzino (2010) studied the linkages between public expenditure and GDP for Italy. Empirical evidence suggests that only for gross public investment expenditure the hypothesis is satisfied. Instead, Granger-causality brings unclear results. Next Magazzino (2012) examined the empirical evidence of Wagner's Law and of Augmented Wagner's Law, according to which there is a long-term relationship between public expenditure on one side and aggregate income and public deficit on the other side. He has employed six alternative functional forms of Wagner's Law, using data for the EU–27 countries over the time period of 1970–2009. With regard to Keynesian hypothesis, he has found no clear evidence of government expenditure causing national income to grow and he has concluded that the Keynesian proposition of government expenditure as a policy instrument to encourage and lead growth in the economy is not supported by the data used.

Szarowská (2012) provided direct empirical evidence on cyclicality and the long-term and short-term relationship between government spending and output

in eight Central and Eastern European countries in the period 1995–2009. The results confirm cyclical effect of government spending on GDP, Wagner's Law and voracity effect in the most CEE countries.

The literature testing the cyclicality of government expenditure also brings a variety of results. Many researchers, as Gavin et al. (1996), Gavin and Perotti (1997), focused on Latin America. On the one hand, Galí (1994) showed in his research that expenditure is countercyclical. However, other papers have shown no discernible pattern. Fiorito and Kollintzas (1994) documented for G7 countries that 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.

Contrary to the theory, many of empirical studies have found evidence that government expenditure is procyclical. Analysis of Lane (1998) found procyclicality in a single-country time series study of Irish fiscal policy. Lane (2003) also showed that the level of cyclicality varies across expenditure categories and across OECD countries. Talvi and Vegh (2005) concluded that fiscal procyclicality is evident in a much wider sample of countries. Hercowitz and Strawczynski (2004), Kaminsky et al. (2004), Alesina et al. (2008), Rajkumar and Swaroop (2008) or Ganelli (2010) presented similar conclusions. Abbott and Jones (2011) tested 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.

2. Data and methodology

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 cyclicality 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 cyclicality, 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 dataset consists of EU15 annual data on GDP and government expenditure in compliance with the COFOG international standard during the period 1995–2010. It is not possible to use longer and higher frequency time series data as COFOG classification analyzes and reports only annual data for a limited pe-

riod. The countries included in the analysis are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom. All time series are collected from the Eurostat database and adjusted at constant prices (deflators in 2005 prices are taken from the World Bank). In line with Akitoby et al. (2006), we investigated fiscal and output co-movements by the approach proposed by Lane (2003). 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 spending 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 a 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 stationarity testing.

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

ADF test is used to determine a unit root xt at all variables in the time t. Variable Δx_{t-i} expresses the lagged first difference and ut 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).

$$H_0: \delta_2 = 0, H_\varepsilon: \delta_2 < 0. \tag{2}$$

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 stationarity at first difference. The results of ADF test confirmed the stationarity of all time series on the first diference.

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

$$G = AY^{\delta}. \tag{3}$$

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

$$\log G = a + \delta \log Y, a = \log A. \tag{4}$$

If the adjustment of government expenditure G to its steady-state $\bar{G}$ is gradual, then the level of government 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 spending category i in period t:

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

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

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

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):

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

In (7), we can interpret $\beta_0 \Delta \log Y_t$ as the short-term impact of output on government 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.

Above that, (7) can be rewritten as (8) and then used to test if there is a long--run relationship between government spending and output. In particular, following Ericsson and McKinnon (2002), if γ is significantly different from zero in (8), then output and government spending are cointegrated.

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

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

3. Results and discussion

3.1. The structure of government expenditure

The structure and amount of government expenditure is very important for economic policy of each country as it can help in overcoming the inefficiencies of the market as well as in smoothing out cyclical fluctuations in the economy. We used government expenditure in compliance with the COFOG (Classification of the Functions of Government) international standard in our analysis. The COFOG is one of the four classifications of expenditure according to purpose (functional classifications) used in the national accounts. COFOG classifies government expenditure into ten main categories / 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

We analyzed development and structure of government expenditure in the period 1995–2010. Results in Table 1 show the average share of government expenditure by functions, the average of total expenditure and the share of total government expenditure in GDP in each EU15 member state during the analyzed period. Table 1 also presents the average values of variables in the whole EU15.

Generally, government expenditure relative to GDP progressively decreased between 1995 and 2000, next stagnated till 2006, followed by a rise in 2007 and 2008 and a more emphatic increase in 2009. The development is influenced by the consequences of the economic and financial crisis. The related need for public intervention are the main factors behind the upward trend between 2008 and 2009, and its remaining high level in 2010, as the breakdown of expenditure by functions confirms. The main contributors to the increase in expenditures were social protection and health (for details look at Eurostat database). Government expenditure reached 67% of GDP in Ireland in 2010, whereas it was among the countries with the lowest levels until 2008. This jump is largely explained by government support to banks during the financial crisis, in the form of capital injections. This type of support is classified as government expenditure in certain conditions (it belongs to CF04).

The average value of total government expenditure is the smallest in Ireland (38.5% GDP), the highest in Sweden (55.6% GDP), while the average is 48% GDP in the whole EU15. It means that the average value of total expenditure in PIIGS[2], except Italy, is lower than the average value in the EU15, although these countries are often criticized for the excessive government expenditure.

Table 1 also states sizeable differences in importance of public sector and a priority of government expenditure functions and confirms that the EU15 is not a homogenous group of countries. The three biggest expenditure functions, on average, account for more than 66% of the total expenditure: social protection, health and general public services. In the EU15 as a whole as well as in all individual member states, social protection is the most important function of government expenditure. Social protection expenditure (CF10) takes more than the third of all government expenditure in average. Surprisingly, the highest va-

[2] Due to the economic recession which started in 2008, several members of the European Union became historically known as PIIGS. These states include Portugal, Italy, Ireland, Greece and Spain. The reason why these countries were grouped together is the substantial instability of their economies, which was an evident problem in 2009.

Table 1

COFOG Government expenditure (% of total *G*; % of GDP for total *G*)

Country	CF01	CF02	CF03	CF04	CF05	CF06	CF07	CF08	CF09	CF10	totalG
Austria	14.35	1.71	2.91	10.31	1.08	1.50	15.09	1.91	10.65	40.47	51.98
Belgium	21.30	2.52	3.07	9.42	1.23	0.64	12.93	2.01	11.56	35.33	51.47
Denmark	15.41	3.02	1.83	6.13	0.97	1.19	12.73	2.91	13.09	42.70	55.51
Finland	13.23	3.02	2.61	10.57	0.59	0.93	12.30	2.29	11.96	42.50	53.27
France	14.01	3.75	2.89	6.68	1.62	3.31	13.94	2.26	10.99	40.55	53.58
Germany	13.35	2.56	3.38	9.12	1.58	1.93	13.81	1.74	8.93	43.60	47.40
Greece	23.21	6.16	2.73	11.15	1.18	0.80	11.96	0.91	7.34	34.56	46.67
Ireland	9.64	1.45	4.33	15.60	2.37	4.34	17.58	1.79	12.82	30.08	38.49
Italy	21.55	2.67	3.99	8.58	1.65	1.71	12.78	1.72	9.46	35.89	49.96
Luxembourg	10.98	0.97	2.24	11.23	2.94	2.04	11.87	4.29	11.56	41.87	40.76
Netherlands	14.28	3.34	3.85	11.00	3.45	1.84	12.83	3.54	11.33	34.56	47.36
Portugal	15.00	3.25	4.24	10.30	1.42	1.75	14.75	2.66	14.43	32.19	43.92
Spain	13.65	2.74	4.68	12.07	2.14	2.53	13.75	3.54	11.00	33.91	40.80
Sweden	15.09	3.54	2.48	7.78	0.54	2.07	11.93	2.31	12.68	41.58	55.60
United Kingdom	10.90	6.43	5.42	6.69	1.61	2.46	14.63	2.33	12.65	36.88	43.48
Average	15.06	3.14	3.38	9.78	1.63	1.94	13.53	2.41	11.36	37.78	48.02

Source: authors' compilation based on data from Eurostat.

lue of CF10 is in Germany, the smallest one in Ireland. It contains, for example, expenditure on sickness and disability, old age, survivors, family and children, unemployment, housing, social exclusion and social protection. The next most important functions in terms of government expenditure are general public services and health amounting to 15% and 13.5% respectively of total expenditure in the EU15. Education (11.4%) and economic affairs (9.8%) follow. The remaining functions – composed of defense, public order and safety, environmental protection, housing and culture – represented on average 12.5% of EU15 total expenditure.

However, the EU15 is not a homogenous group of countries, and development of government expenditure and its components differs in individual countries. The highest average value of general public services (CF10) is in Italy, although the value decreased by 10 p.p. points in the selected period (from 26.7% to 16.4%). We can find very similar values and development in Belgium. On the other hand, the average value is less than a half in Ireland. There are significant differences in the value of health expenditure (CF07). The highest average value (17.6%) is in Ireland (the country with the smallest total government expenditure). The

smallest values are in Luxembourg and Sweden (11.9%), even if it is an example of welfare state. As Table 1 presents, the share of other expenditure functions differs between EU15 member states. Portugal has the highest education expenditure (14.8%), its share is more than the twice value of Greece (7.3%). Contrary, Greece and United Kingdom have absolutely highest expenditure compare to the rest of EU15 on defense (CF02) in the analyzed period.

3.2. Cyclicality of government expenditure

As it was already noted, government expenditure is a possible automatic stabilizer. The cyclicality of government expenditure is typically defined in terms of how expenditure moves with the output gap (i.e. output is below its potential). If government expenditure increases when there is a positive output gap, then expenditure is countercyclical. If potential output were observable or easy to estimate, one could define counter-cyclicality as above-average expenditure to output ratio whenever output was below its potential. As Akitoby et al. (2006) mention, measuring potential output is difficult. As a consequence, it is not easy to discuss business cycles or cyclicality per se. Therefore we focus on co-movements of government expenditure and output as a proxy for cyclicality.

Table 2 reports the estimates of the adjustment coefficient γ from equation (7), which is estimated by OLS (ordinary least squares) 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 of analysis indicate significant difference across expenditure functions. For most countries (80%), there is a cointegrating relationship between total government expenditure and output consistent with Wagner's Law, the share of significant results is 77% for all categories in all EU15 member states. The error correction term is significant for all expenditure functions in France only. All EU15 member states have a significant error correction term for at least six of the expenditure functions (six in Greece and Spain, seven in Ireland, Portugal, Austria, Germany, Netherlands, eight in Italy, Belgium, Denmark, Luxembourg and nine in Finland and United Kingdom). But the error correction term is not significant for any identical expenditure function in a whole EU15. The value γ expresses that government expenditure adjusts to past disequilibrium in two years on average.

As expected, the adjustment coefficient γ is mostly negative (in 96% of significant cases), indicating procyclical development. It means that governments do not use government expenditure as a countercyclical fiscal tool, although already Serven (1998) pointed to harmfulness of procyclical fiscal policy. The findings are in line with Akitoby et al. (2006) as they have found that all adjustment coefficients are negative and although the error correction term is significant in about 30% of countries in the sample for all expenditure aggregates, 70% of

Table 2

The value of adjustment coefficient γ

Country	*G* total	CF01	CF02	CF03	CF04	CF05	CF06	CF07	CF08	CF09	CF10
Greece	1.02*	–1.50*	1.43*	4.20**	0.88**	0.58	1.19**	0.76**	2.69*	2.07**	0.78**
	(0.06)	(0.27)	(0.55)	(0.32)	(0.14)	(0.01)	(0.23)	(0.01)	(0.30)	(0.15)	(0.09)
Spain	–0.06	–0.65**	0.74**	0.81**	1.23**	1.37**	–0.20	1.94**	0.98**	2.85*	0.91**
	(0.13)	(0.14)	(0.09)	(0.07)	(0.09)	(0.07)	(0.32)	(0.33)	(0.10)	(0.93)	(0.01)
Ireland	0.36*	1.38**	0.55**	0.14	0.56**	0.13	1.11**	1.20**	0.79**	2.46**	0.86**
	(0.15)	(0.21)	(0.01)	(0.14)	(0.08)	(0.59)	(0.09)	(0.05)	(0.09)	(0.61)	(0.01)
Italy	0.94**	–1.97**	1.36*	3.13**	0.77**	1.66**	0.58**	2.37**	1.96**	0.78**	0.88**
	(0.01)	(0.18)	(0.62)	(0.41)	(0.01)	(0.18)	(0.00)	(0.27)	(0.21)	(0.00)	(0.14)
Portugal	2.34**	0.77**	0.64*	0.68**	0.73**	–0.22**	0.58**	2.55**	0.63**	0.77**	0.89**
	(0.40)	(0.01)	(0.0)	(0.02)	(0.00)	(0.72	(0.01	(0.25)	(0.00)	(0.00)	(0.02)
Austria	–1.07*	–0.77*	–1.75**	–0.61	–1.21*	–1.39**	–1.11**	–0.71*	–0.08	–0.04	–0.61**
	(0.37)	(0.39)	(0.33)	(0.38)	(0.42)	(0.06)	(0.14)	(0.30)	(0.22)	(0.04)	(0.20
Belgium	–0.29*	0.02	–0.63**	–0.78**	–1.07*	–0.15*	–0.87*	–0.37	–0.50*	–0.32*	–0.26*
	(0.14)	(0.55)	(0.13)	(0.13)	(0.39)	(0.05)	(0.38)	(0.21)	(0.23)	(0.16)	(0.09)
Germany	–0.95*	–0.40*	–0.37**	–0.27*	–0.02	–0.40	0.00	–0.73**	–0.50*	–0.45*	–0.14*
	(0.32)	(0.21)	(0.09)	(0.13)	(0.06)	(0.40)	(0.00)	(0.26)	(0.18)	(0.23)	(0.05)
Denmark	–0.21*	–0.12	–0.56*	–0.37**	–0.17*	–0.22**	–0.53*	–0.10*	–0.51	–0.57**	–0.18*
	(0.02)	(0.13)	(0.28)	(0.15)	(0.07)	(0.05)	(0.24)	(0.05)	(0.35)	(0.13)	(0.06)
Finland	–0.16**	–0.22	–0.35*	–0.58*	–0.46*	–0.42*	–0.51*	–0.20*	–0.89**	–0.51*	–0.37**
	(0.06)	(0.16)	(0.16)	(0.28)	(0.21)	(0.13)	(0.19)	(0.08)	(0.18)	(0.17)	(0.10)
France	–0.23*	–0.71*	–0.26*	–0.72**	–0.38**	–0.11*	–0.21**	–0.29*	–0.09*	–0.47*	–0.06**
	(0.12)	(0.39)	(0.14)	(0.22)	(0.12)	(0.05)	(0.07)	(0.16)	(0.04)	(0.25)	(0.01)
Luxembourg	–0.53**	–0.31**	–0.12	–0.35*	–0.69*	–0.81*	–0.94	–0.51*	–0.24*	–0.66**	–0.59**
	(0.16)	(0.09)	(0.08)	(0.16)	(0.31)	(0.26)	(0.23)	(0.21)	(0.07)	(0.13)	(0.12)
Netherlands	–0.08*	–0.01	–0.24	–0.48*	–1.97*	–0.23*	–0.46	–0.05*	–0.62*	–0.73**	–0.15*
	(0.03)	(0.06)	(0.14)	(0.19)	(0.53)	(0.11)	(0.52)	(0.02)	(0.24)	(0.14)	(0.07)
Sweden	–0.50*	–0.55*	–0.48*	–0.38*	–0.64*	–0.55	–0.24**	–0.46*	–0.17	–0.76*	–0.53*
	(0.22)	(0.36)	(0.25)	(0.17)	(0.20)	(0.35)	(0.05)	(0.20)	(0.11)	(0.40)	(0.26)
United Kingdom	–0.20*	–0.21*	–0.20*	–0.30**	0.04	–0.79**	–0.12*	–0.36*	–0.40*	–0.28*	–0.21*
	(0.09)	(0.06)	(0.04)	(0.11)	(0.04)	(0.22)	(0.03)	(0.10)	(0.15)	(0.10)	(0.06)
Average	0.45	0.45	0.56	0.45	0.88	0.47	0.57	0.34	0.5	0.49	0.29
Share significant	80%	73%	87%	67%	73%	67%	67%	80%	60%	93%	100%

Note: Symbols *and ** and denote significance at the 1% and 5% level, standard deviation are in parenthesis. Average means average absolute values of significant coefficients only. Share significant means share of significant cases.

Source: authors' calculations.

the sample countries have a significant error correction term for at least one of spending aggregates. Similarly, with the error correction term not significant for all expenditure functions in any CEE country of the sample, all countries have a significant error correction term for at least four of the spending functions and the adjustment coefficients are mostly negative (Szarowská 2012).

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. Results show that the long-run elasticity coefficient δ is significant in 91% 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.

The long-term elasticity of government expenditure and output δ is mostly positive (in 87% 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 for total expenditure is 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 EU15 member states only for health (CF07) and education (CF09). The public order and safety expenditure (CF03) indicates the highest long-run elasticity, with a mean coefficient of 2.20 for the 93% of cases where the coefficient is significant. This implies that governments cut and expand CF03 expenditure proportionally more during recessions and expansions, respectively, than other types of expenditure in the long term.

In Table 3, we can also find the long-run lower than one. It means that the expenditure functions as defense (CF02), economic affairs (CF04) and housing and community amenities (CF06) rise slower than national income in the long term.

Table 4 summarizes findings about the short-run elasticity of government expenditure with respect to output. In this case, the results and conclusions for the short-run elasticity are not so unequivocal. The short-run elasticity is positive for 48% of statistically significant cases in the sample, with a mean coefficient above unity. It's needed to point out 35% statistical significance of results only. The statistical significance is the highest for social protection (60%) what it is important because of its share in total government expenditure.

Estimated elasticity coefficients confirm conclusions of earlier studies (Thornton, 1997; Lane, 2003; Akitoby et al., 2006; Sideris, 2007; Abbot and Jones, 2011; Szarowská, 2012). But the size of the elasticity with respect to output varies gre-

Table 3

The long-run elasticity coefficient δ

Country	*G* total	CF01	CF02	CF03	CF04	CF05	CF06	CF07	CF08	CF09	CF10
Greece	1.02*	–1.50*	1.43*	4.20**	0.88**	0.58	1.19**	0.76**	2.69*	2.07**	0.78**
	(0.06)	(0.27)	(0.55)	(0.32)	(0.14)	(0.01)	(0.23)	(0.01)	(0.30)	(0.15)	(0.09)
Spain	–0.06	–0.65**	0.74**	0.81**	1.23**	1.37**	–0.20	1.94**	0.98**	2.85*	0.91**
	(0.13)	(0.14)	(0.09)	(0.07)	(0.09)	(0.07)	(0.32)	(0.33)	(0.10)	(0.93)	(0.01)
Ireland	0.36*	1.38**	0.55**	0.14	0.56**	0.13	1.11**	1.20**	0.79**	2.46**	0.86**
	(0.15)	(0.21)	(0.01)	(0.14)	(0.08)	(0.59)	(0.09)	(0.05)	(0.09)	(0.61)	(0.01)
Italy	0.94**	–1.97**	1.36*	3.13**	0.77**	1.66**	0.58**	2.37**	1.96**	0.78**	0.88**
	(0.01)	(0.18)	(0.62)	(0.41)	(0.01)	(0.18)	(0.00)	(0.27)	(0.21)	(0.00)	(0.14)
Portugal	2.34**	0.77**	0.64*	0.68**	0.73**	–0.22**	0.58**	2.55**	0.63**	0.77**	0.89**
	(0.40)	(0.01)	(0.0)	(0.02)	(0.00)	(0.72	(0.01	(0.25)	(0.00)	(0.00)	(0.02)
Austria	0.67**	–0.01	–0.31**	0.76**	1.29**	0.88**	–0.72**	0.73**	0.47	0.79**	0.88**
	(0.05)	(0.08)	(0.08)	(0.06)	(0.33)	(0.13)	(0.18)	(0.23)	(0.31)	(0.01)	(0.00)
Belgium	0.93**	–0.58**	–0.58**	1.64**	1.70**	–0.98	1.77**	1.66**	2.45**	0.99**	0.95**
	(0.13)	(0.03)	(0.03)	(0.05)	(0.19)	(0.68)	(0.27)	(0.12)	(0.21)	(0.07)	(0.10)
Germany	0.61**	0.40**	–0.30	0.74**	0.90**	–1.56**	0.46**	1.57**	0.99**	0.59**	–1.07*
	(0.12)	(0.12)	(0.26)	(0.12)	(0.05)	(0.36)	(0.08)	(0.09)	(0.18)	(0.11)	(0.40)
Denmark	0.25	–0.91*	0.70**	1.27**	–0.78*	–1.81*	–1.15*	2.27**	1.22**	0.98*	0.06
	(0.15)	(0.31)	(0.00)	(0.16)	(0.35)	(0.89)	(0.40)	(0.41)	(0.09)	(0.09)	(0.28)
Finland	0.79**	0.75**	0.48*	0.85**	–0.07	0.52**	- 0.53	1.60**	0.59**	0.77**	0.60**
	(0.15)	(0.16)	(0.20)	(0.05)	(0.23)	(0.00)	(0.29)	(0.18)	(0.06)	(0.06)	(0.09)
France	1.08**	0.33**	0.72**	1.40**	0.77**	0.69**	0.73**	1.50**	0.71**	0.84**	0.94**
	(0.05)	(0.07)	(0.00)	(0.08)	(0.00)	(0.01)	(0.00)	(0.07)	(0.01)	(0.07)	(0.01)
Luxembourg	0.85**	0.72**	1.50	1.27**	0.63**	0.56**	0.18*	0.90**	0.64**	0.89**	0.89**
	(0.04)	(0.01)	(1.22)	(0.11)	(0.21)	(0.04)	(0.09)	(0.07)	(0.01)	(0.03)	(0.03)
Netherlands	2.71*	–2.10*	0.68**	1.93**	0.78**	1.72**	–1.19**	0.89**	1.31**	1.29**	0.85*
	(0.81)	(0.63)	(0.00)	(0.07)	(0.00)	(0.23)	(0.35)	(0.04)	(0.16)	(0.04)	(0.00)
Sweden	–0.55**	–0.34*	–0.59*	0.71**	1.04**	3.46**	0.67**	1.33**	0.18**	0.90**	0.69**
	(0.19)	(0.15)	(0.19)	(0.00)	(0.16)	(0.39)	(0.01)	(0.06)	(0.32)	(0.05)	(0.07)
United Kingdom	1.35**	0.05	1.36**	1.47**	0.86**	2.53**	4.80**	1.84**	1.47**	1.96**	0.99**
	(0.25)	(0.43)	(0.37)	(0.12)	(0.04)	(0.17)	(1.24)	(0.11)	(0.14)	(0.12)	(0.13)
Average	1.17	1.26	0.95	2.20	0.84	1.08	0.86	1.77	1.41	1.79	0.87
Share significant	87%	87%	93%	93%	93%	80%	87%	100%	93%	100%	93%

Note: Symbols *and ** and denote significance at the 1% and 5% level, standard deviation are in parenthesis. Average means average absolute values of significant coefficients only. Share significant means share of significant cases.

Source: authors' calculations.

Table 4

The short-run elasticity coefficient δ

Country	*G* total	CF01	CF02	CF03	CF04	CF05	CF06	CF07	CF08	CF09	CF10
Greece	–0.54	2.34*	5.97*	4.23*	0.96	1.92*	0.96	3.45*	–4.02	0.12	0.47
	(1.14)	(0.83)	(2.07)	(2.36)	(1.73)	(0.80)	(1.38)	(1.33)	(2.56)	(1.62)	(0.62)
Spain	1.21**	1.01*	0.19	2.11*	–0.29	–0.65	0.38	0.79*	–0.29	0.89**	1.21*
	(0.21)	(0.54)	(0.34)	(1.10)	(0.76)	(0.88)	(2.28)	(0.33)	(1.24)	(0.22)	(0.51
Ireland	–0.20	–0.63	0.83*	1.39*	1.11	1.43*	–1.65	–1.25*	2.92*	0.55*	–1.44*
	(0.70)	(0.39)	(0.31)	(0.48)	(4.68)	(0.60)	(1.52)	(0.49)	(1.50)	(0.15)	(0.58)
Italy	0.44*	1.05*	–0.43	0.18	0.52	0.64	–0.35	–0.55	1.14*	0.60*	–0.67**
	(0.23)	(0.50)	(0.77)	(0.89)	(1.53	(0.38)	(5.01)	(0.36)	(0.55)	(0.27)	(0.22)
Portugal	0.07	–0.69**	1.00	–2.63*	0.49	0.19	4.38*	1.13*	0.49	0.42	–1.34*
	(0.35)	(0.14)	(0.76)	(1.24)	(1.14)	(0.91)	(1.30)	(0.57)	(0.84)	(0.88)	(0.69)
Austria	–0.91*	0.02	1.45*	–0.11	–2.85	–1.92*	–2.16*	–0.37	0.76	0.32	–0.26
	(0.41)	(0.44)	(0.54)	(0.35)	(2.35)	(0.83)	(1.01)	(0.81)	(0.80)	(0.37)	(0.24)
Belgium	–0.14	0.79	–0.15	–0.79*	–1.54	–0.49	0.89	0.21	–1.01	–0.05	–0.23
	(0.34)	(0.47)	(0.39)	(0.33)	(1.62)	(0.68)	(1.87)	(0.51)	(0.95)	(0.26)	(0.22)
Germany	–0.55	–0.12	0.01	–0.17	–0.33	0.28	–0.63	–0.77	–0.28	–0.34	–0.34
	(0.51)	(0.23)	(0.33)	(0.14)	(4.72)	(1.44)	(0.67)	(0.45)	(0.37	(0.26	(0.30
Denmark	–0.40	0.09	1.04	–0.26	–0.67	0.64	2.33	–0.05	0.13	–0.81*	–0.66*
	(0.21)	(0.40)	(0.70)	(0.35)	(0.40)	(0.86)	(1.46)	(0.27)	(0.50)	(0.28)	(0.26)
Finland	–0.17	–0.15	–0.16	–0.24	–0.53	0.82*	–0.04	0.12	–0.56*	–0.14	–0.80**
	(0.17)	(0.34)	(0.35)	(0.31)	(0.49)	(0.31)	(0.69)	(0.19)	(0.32)	(0.22)	(0.24)
France	–0.21	0.88*	–0.14	–0.90	–0.06	0.30	1.65*	–0.02	–0.08	0.04	–0.46**
	(0.17)	(0.41)	(0.58)	(0.57)	(0.35)	(0.65)	(0.66)	(0.28)	(0.03)	(0.25)	(0.18)
Luxembourg	–0.34*	–0.66	–0.85*	–2.17	–0.35	–0.17	–0.52	–0.08	–0.47	–0.47*	–0.50*
	(0.19)	(0.44)	(0.43)	(1.27)	(0.35)	(1.02)	(0.42)	(0.33)	(0.50)	(0.17)	(0.14)
Netherlands	0.35	–0.58	0.75	0.07	–6.05*	–0.07	1.63	0.09	–0.41	–0.65*	0.55*
	(0.25)	(0.52)	(0.48)	(0.39)	(2.08)	(0.34)	(5.91)	(0.85)	(0.67)	(0.26)	(0.19)
Sweden	–0.19	0.28	–0.08	–0.10	–1.10*	0.86	–0.11	–0.18	–1.18	–0.20	–0.00
	(0.17)	(0.69)	(0.60)	(0.41)	(0.52)	(1.70)	(0.77)	(0.32)	(1.47)	(0.36)	(0.26)
United Kingdom	–0.21	–1.64*	–0.46	0.06	3.70	–3.07**	–0.33	–0.72*	0.06	–0.27	–0.18
	(0.41)	(0.70)	(0.46)	(0.34)	(2.30)	(1.35)	(1.07)	(0.39)	(0.49)	(0.33)	(0.25)
Share significant	27%	40%	33%	40%	20%	40%	20%	40%	27%	40%	60%

Note: Symbols *and ** and denote significance at the 1% and 5% level, standard deviation are in parenthesis. Average means average absolute values of significant coefficients only. Share significant means share of significant cases.

Source: authors' calculations.

atly across countries. Following Lane (2003) and Akitoby et al. (2006), we also have tried to explain the cross-country variation in the short-term elasticity, using a wide range of variables, including output volatility, index for power dispersion, per capita GDP, the standard deviation of terms of trade volatility or financial risk. However, the obtained results have not been statistically significant. On the other hand, Magazzino (2012) did not find clear correlation between government expenditure and GDP, but he used panel data instead of separate time series.

Conclusion

The aim of this paper was to to examine the development and trends of government expenditure in the core member states of the European Union in a period 1995–2010 and provide direct empirical evidence on cyclicality and the short-term and the long-term relationship between government expenditure and output. We analyzed adjusted annual Eurostat data on government expenditure in compliance with the COFOG international standard. We used Johansen cointegration test and the error correction model for the analysis.

Generally, total government expenditure amounted to 48% GDP of EU15 on average during analyzed period. Two thirds are devoted to social protection, health and general public services. The other functions of government expenditure mainly concern education and economic affairs. But the results document significant differences in importance of public sector and a priority of government expenditure functions in individual countries of the EU15.

Although already Serven (1998) pointed to harmfulness of procyclical fiscal policy, there is some evidence of procyclical development of government expenditure. The adjustment coefficient γ is mostly negative (in 96% of significant cases) and it indicates dynamic stability. The government expenditure functions are procyclical in most countries. It means that governments do not use government expenditure as a countercyclical fiscal tool.

On the contrary, findings verify the existence of Wagner's Law in the EU15 in the selected period. Output and government expenditure are cointegrated for at least six of the expenditure functions and it implies a relationship between government expenditure and output. Average value of a long-run elasticity coefficient is 1.30 for all expenditure functions, and 1.17 for total government expenditure. It is consistent with the narrow interpretation of Wagner's Law and it indicates that the public sector is increasing in relative importance in the long-term. Results varied across member states and categories but the long-run elasticity coefficient δ was significant for health (CF07) and education (CF09) in the whole EU15. This means that the long-run relation between health and education government expenditure and output exists in all EU15 member states.

The research focused also on short-run relationship between government expenditure and output. Results are not unambiguous due to a relatively low

statistical significance (35%). Findings also include the short-run elasticity coefficient β above one, which is consistent with the voracity hypothesis, but voracity effect cannot be verified because of a very low statistical significance.

We can conclude that although the theory implies that government expenditure is countercyclical, our research does not prove that. The results confirm procyclical development of government expenditure on GDP and Wagner's Law in the EU15 during 1995–2010. Our result is consistent with the empirical literature using the identical methodology.

Received: 29 August 2012 (the revised version on 3 December 2013).

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DŁUGOOKRESOWA I KRÓTKOOKRESOWA ZALEŻNOŚĆ MIĘDZY WYDATKAMI PAŃSTWA I PKB W KRAJACH UE15: PODEJŚCIE KOINTEGRACYJNE

Streszczenie

Artykuł ten dotyczy cyklicznych wahań i tendencji rozwojowych (trendów) wydatków państwowych w „starych" krajach członkowskich Unii Europejskiej (UE15). Celem jest empiryczne zbadanie cyklicznych zmian tych wydatków oraz długo- i krótkookresowej relacji między wydatkami państwowymi a PKB. W analizie wykorzystano poprawione dane roczne o PKB i wydatkach państwowych publikowane przez Eurostat, zgodne z międzynarodowym systemem klasyfikacji wydatków państwowych (COFOG). Pod-

stawowym narzędziem analizy był test kointegracji Johansena i model korekty błędu (ECM).

Badanie potwierdziło procykliczne oddziaływanie wydatków państwa na wielkość PKB. Oznacza to, że rządy nie wykorzystywały swych wydatków jako narzędzia antycyklicznej polityki fiskalnej. Przeciwnie, rezultaty analizy potwierdzają działanie prawa Wagnera w badanej grupie krajów we wskazanym okresie. Wyniki analizy ujawniają również istotne różnice w znaczeniu sektora publicznego oraz priorytetowych funkcjach wydatków państwowych w poszczególnych krajach.

Słowa kluczowe: wydatki państwa, wahania cykliczne, prawo Wagnera, klasyfikacja COFOG, elastyczność długookresowa i krótkookresowa

ДОЛГОСРОЧНАЯ И КРАТКОСРОЧНАЯ ЗАВИСИМОСТЬ МЕЖДУ РАСХОДАМИ ГОСУДАРСТВА И ВВП В СТРАНАХ ЕС15: КОИНТЕГРАЦИОННЫЙ ПОДХОД

Резюме

Эта статья касается циклических колебаний и тенденций развития (трендов) расходов государства в "старых" странах-членах ЕС (ЕС15). Целью статьи является эмпирическое исследование изменения указанных расходов, а также долго- и краткосрочного соотношения между расходами государства и ВВП. Для анализа были использованы актуальные годовые данные о ВВП и о государственных расходах, публикуемых Евростатом в соответствии с международной системой классификации государственных расходов (COFOG).Основным инструментом анализа был тест коинтеграции Йохансена и модель коррекции ошибки (ECM).

Исследование подтвердило проциклическое воздействие расходов государства на размер ВВП. Это означает, что правительства не использовали своих расходов в качестве инструмента антициклической фискальной политики. Напротив, результаты анализа подтверждают функционирование закона Вагнера в исследуемой группе стран в названный период. Анализ выявляет тоже существенные различия в значении публичного сектора, а также в приоритетных функциях государственных расходов в отдельных странах.

Ключевые слова: расходы государства, циклические колебания, закон Вагнера, классификация COFOG, долгосрочная и краткосрочная гибкость