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PUBLIC SPENDING AND WAGNER'S LAW IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

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Abstract

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This paper provides 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 a period 1995–2009. We analyzed annual data on government spending in compliance with the COFOG international standard. Although the theory implies that government spending is countercyclical, our research does not prove that. The results confirm cyclical development of government spending on GDP, Wagner's law and voracity effect in the CEE countries during 1995–2009.

We used Johansen cointegration test and the error correction model. Output and government spending are cointegrated for at least 4 from 10 spending functions in every country and it implies a long-term relationship between government spending and output. The government spending functions are procyclical in most CEE countries (93% cases in the sample). Average value of long-run elasticity coefficient is 1.74 for all spending functions, 1.02 for total government spending. We also analyzed the short-run relationship between spending and output. The coefficient values (average is 2.89) confirm the voracity hypothesis, as they suggest that in response to a given shock to real GDP, government spending rises by even more in percentage points.

government spending, cyclicality, voracity effect, long-run elasticity, short-run elasticity, cointegration, error correction term

The economy of the country is greatly influenced by the level and the structure of government spending. Government spending plays important role in a fiscal policy of each country as a possible automatic stabilizer as from a Keynesian perspective, there is a view that government spending should act as a stabilizing force and move in a countercyclical direction (procyclical fiscal policy is conversely policy expansionary in booms and contractionary in recessions). Contrary to the theory (it implies that government spending is countercyclical), many of empirical studies found evidence that government spending is procyclical. See Hercowitz and Strawczynski (2004), Kaminsky *et al.* (2004), Alesina *et al.* (2008), Rajkumar and Swaroop (2008), Hamerníková *et al.* (2009), Ganeli (2010) or Szarowská (2011) for more details. Talvi and Vegh (2005) show that fiscal procyclicality is evident in a much wider sample of countries. Lane (1998) finds procyclicality in a single-country time series study of Irish fiscal policy. Lane (2003) also shows that the level of cyclicality varies across spending categories and across OECD countries. Abbot and Jones (2011) test differences in the cyclicality of government spending across functional categories. Their evidence from 20 OECD countries suggests that procyclicality is more likely in smaller functional budgets, but capital spending is more likely to be procyclical for the larger spending categories. Many of researches as Gavin *et al.* (1996), Gavin and Perotti (1997) focused on Latin America. On the one hand, Galí, (1994) shows in his research that spending is countercyclical. However, other papers show no discernible pattern. Fiorito and Kollintzas (1994)

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 spending being measured. Government transfers and subsidies are found to have become substantially more countercyclical.

In fact, development of government spending 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 spending, 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 spending 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 (1911) 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 (2000) point out on the fact that there are at least 14 different measures of government spending 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 spending in compliance with the COFOG international standard.

Most studies analyzing the cyclicality of government spending 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 aim of the paper is to provide direct empirical evidence on cyclicality and the short-term and long-term relationship between government spending and output in eight Central and Eastern European countries. We follow Akitoby *et al.* (2006) and we apply Johansen cointegration test (1991) and the error correction model on annul data of GDP and government spending the period 1995–2009 from Eurostat. The article is organized as follows. In the next section, we describe the dataset and empirical techniques used. In Section 3, we present the results of government spending cyclicality and long-run and short-run relationship between output and government spending. In Section 4, we conclude with a summary of key findings.

MATERIALS AND METHODS

The dataset consists of annual data on GDP and government spending in compliance with the COFOG international standard during the period 1995–2009. It is not possible to use higher frequently time series data as COFOG classification analyzes and reports only annual data. The countries included in the analysis are Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Romania, Slovakia, and Slovenia. Poland and Lithuania had to be excluded from the sample due to insufficient number of observations. All the data are collected from the Eurostat database. The series for GDP and total government spending and its subcomponent are adjusted at constant prices. 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 spending 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 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.

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

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).

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

The result of ADF test, which confirms the stationary of all time series on the first difference, is available on request. 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 spending and output given by (3).

$$G = AY^{\delta}, \quad (3)$$

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

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

If the adjustment of spending *G* to its steady-state is gradual, then the level of spending 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*:

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

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

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

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).

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

In (7), we can interpret $\beta_0 \Delta \log Y_t$ as the short-term impact of output on spending and β_0 as the short-run elasticity of government spending 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 spending with respect to output, and γ is the rate at which government spending 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 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.

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

where φ = γδ. The above derivation makes clear the underlying assumption that there is a elasticity relationship between output and expenditure, while the transitory deviations are random.

RESULTS AND DISCUSSION

Government spending 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. Thus, government spending plays a crucial role in the economic growth of a country. We used government spending in compliance with the COFOG international standard (Classification of the Functions of Government) in our analysis. Total government spending is divided into 10 basic divisions:

- G10: General public services
- G20: Defense
- G30: Public order and safety
- G40: Economic affairs
- G50: Environment protection
- G60: Housing and community amenities
- G70: Health
- G80: Recreation; culture and religion
- G90: Education
- G100: Social protection.

The structure of government spending

Firstly we analyzed the structure of government spending in a period 1995–2009. Results in Tab. I show the average share of government spending by functions, the average on total spending and the share of total government spending on GDP in each country during the analyzed period. Tab. I also presents the average of variables in all countries. Data confirm significant

I: *Development of government spending function (in % of total G)*

	G10	G20	G30	G40	G50	G60	G70	G80	G90	G100	G as% GDP
CZ	10.2%	3.4%	5.1%	19.3%	2.3%	2.7%	14.7%	2.7%	10.2%	29.4%	44.7%
HU	21.1%	2.4%	4.0%	12.3%	1.4%	2.0%	10.5%	3.1%	10.8%	32.5%	49.9%
SK	14.4%	4.6%	5.9%	15.3%	1.9%	2.2%	13.4%	2.4%	8.9%	30.9%	43.3%
BG	17.5%	6.0%	6.8%	11.5%	2.6%	1.8%	10.9%	2.0%	10.4%	30.7%	39.2%
EE	9.5%	3.9%	6.8%	11.3%	2.1%	1.3%	12.0%	5.8%	18.2%	29.2%	37.2%
LV	10.9%	3.0%	6.6%	13.7%	1.3%	3.3%	10.4%	3.6%	15.7%	31.5%	37.8%
RO	14.6%	5.8%	4.9%	17.0%	0.7%	4.4%	9.3%	2.4%	10.3%	30.6%	36.1%
SI	12.6%	2.9%	3.8%	10.0%	1.7%	1.4%	14.0%	3.0%	13.9%	36.7%	45.8%
Average	13.8%	4.0%	5.5%	13.8%	1.8%	2.4%	11.9%	3.1%	12.3%	31.4%	41.8%

Source: Authors' calculations based on data from Eurostat

differences between countries and spending functions as well. Five spending functions, on average, account for more than 83% of the total spending: Social protection, Economic affairs, Health, General public services and Education. The Social protection spending (G100) is the highest spending function in every country and it takes nearly the third of all government spending. It contains, for example, spending on sickness and disability, old age, survivors, family and children, unemployment, housing, social exclusion and R&D social protection.

The total average spending of General public services (G10) and Economics affairs (G40) is the same (13.8%), but the share differs in each country. The highest value of G10 is in Hungary, it is due to a higher spending on public debt services then in other countries. Estonia has the highest Education spending (G90), it's share is more than the twice value of Slovakia. The value of total government spending is the smallest in Romania (36.1% GDP), the highest in Hungary (49.9% GDP), and the average of all countries is 41.8% GDP, that expresses significant differences in size and importance of public sector in the sample of countries.

The cyclicality of government spending

As was already noted, government spending is a possible automatic stabilizer. The cyclicality of government spending is typically defined in terms of how spending moves with the output gap. If government spending increases when there is a positive output gap (i.e. output is below its potential), then spending is countercyclical. If potential output were observable or easy to estimate, one could define counter-cyclicality as an above-average spending 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 spending and output as a proxy for cyclicality.

Tab. II 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 spending adjusts to past disequilibrium. In cases where γ is significant, we can conclude there is a cointegrating relationship between government spending and output. The results indicate significant difference across spending functions. For most countries (62.5%), there is a long-term relationship between total government spending and output consistent with Wagner›s law. Although the error correction term not significant for all spending functions in any country of the sample, all countries have a significant error correction term for at least four of the spending functions. For example, adjustment coefficient is significant for 8 from 10 spending functions in Romania and Slovenia. Moreover, the error correction term for Housing and community

II: *The adjustment coefficient* γ

	G total	G10	G20	G30	G40	G50	G60	G70	G80	G90	G100
CR	0.03	–0.14	–0.37	–1.14*	–0.41	–0.45*	–0.85*	–0.35	–0.80*	–0.22	–0.19
	(0.03)	(0.32)	(0.62)	(0.36)	(0.25)	(0.16)	(0.49)	(0.33)	(0.27)	(0.27)	(0.21)
HU	–0.63	–0.15	0.27	0.45	–1.70*	–1.21**	–0.16*	–0.12	–0.33	0.30*	–0.36
	(0.45)	(0.09)	(0.70)	(0.28)	(0.46)	(0.26)	(0.08)	(0.36)	(0.195)	(0.32)	(0.25)
SK	–0.90*	–2.04**	–1.21*	–0.29	–0.03	–1.29*	–1.67**	–1.09**	–1.05*	0.03	–1.33**
	(0.40)	(0.44)	(0.57)	(0.53)	(0.37)	(0.45)	(0.24)	(0.42)	(0.31)	(0.17)	(0.27)
BG	–2.72**	–1.00	0.04	0.31	–2.00*	–1.15*	–1.20*	–0.06	–2.22*	–0.52	–0.52*
	(0.48)	(0.56)	(0.04)	(0.36)	(0.76)	(0.58)	(0.37)	(0.34)	(0.64)	(0.42)	(0.27)
EE	–0.45	–1.51*	–0.57	–1.52*	–0.20	–1.25*	–1.25*	–0.38	–0.84*	–1.91*	–0.81*
	(0.33)	(0.47)	(0.35)	(0.49)	(0.23)	(0.46)	(0.54)	(0.21)	(0.40)	(0.49)	(0.29)
LV	–1.00**	–0.09	–0.12	–0.64*	–0.91*	–0.14	0.12*	–0.85*	–0.76*	–1.51*	–0.68*
	(0.23)	(0.08)	(0.55)	(0.20)	(0.29)	(0.23)	(0.05)	(0.27)	(0.29)	(0.39)	(0.26)
RO	–0.16	–0.56*	–0.85**	–1.27*	–1.27*	–1.38**	–0.46*	–0.12	–1.73**	–1.35	–0.05*
	(0.20)	(0.20	(0.17)	(0.61)	(0.35)	(0.15)	(0.23)	(0.13)	(0.27)	(0.84)	(0.02)
SI	–1.12*	–1.75**	0.09*	–0.69*	–1.53*	–0.64**	0.97*	–0.97**	1.55*	–0.24	0.02
	(0.30)	(0.15)	(0.02)	(0.22)	(0.50)	(0.15)	(0.50)	(0.19)	(0.68)	(0.38)	(0.05)
Average	1.15	1.47	0.71	0.93	1.48	1.5	0.84	0.97	1.28	1.24	0.68
Share significant	62.5%	50.0%	37.5%	75.0%	62.5%	87.5%	100.0%	37.5%	87.5%	37.5%	62.5%

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

amenities (G60) is significant in all countries. As expected, the adjustment coefficients are mostly negative, indicating dynamic stability. The implication of a significant error correction term is that there is in fact a long-term relationship between government spending 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.

Tab. III summarizes the results about the long-run elasticity of spending with respect to output. 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 spending 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 spending and output δ is positive (in 93% cases), and it is the highest for Defense spending (G20) due to the extremely high δ coefficient in Bulgaria (it greatly increased the average). Moreover, δ is for total spending larger than one (1.02), average value is 1.74 for all spending 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 cases (countries) for total spending, Economic affairs (G40), Health (G70), Recreation; culture and religion (G80) and Social protection (G100). This is important as these spending functions include more than 60% of total government spending. The average long-run elasticity coefficient δ is lower than one (0.83) only in the case of General public services (G10), it means that G10 rises slower than national income. This development is influenced especially by decreasing spending on basic research, R&D related to general public services, public debt services and transfers of a general character between different levels of government.

We also analyzed the short-term elasticity between government spending and output. Significant results are in Tab. IV.

The results for the short-run elasticity of government spending to output are not so unequivocal. For all spending categories, the average coefficient is 2.89. Although the short-run elasticity of spending functions is positive for 70% of the countries in the sample, it's needed to points out only 29% 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 spending rises by even more in percentage points.

III: *The long-run elasticity coefficient* δ

	G total	G10	G20	G30	G40	G50	G60	G70	G80	G90	G100
CR	1.62**	1.54**		0.50**	–0.46*		2.01*	1.94**	1.80**	1.62**	1.36**
	(0.10)	(0.26)		(0.07)	(0.16)		(0.53)	(0.15)	(0.21)	(0.24)	(0.19)
HU	1.06**	1.33*	1.79**	1.92**	0.91**	1.05**	3.06*	1.31**	1.85**	1.65**	1.60**
	(0.05)	(0.42)	(0.08)	(0.14)	(0.13)	(0.22)	(1.19)	(0.11)	(0.21)	(0.10)	(0.18)
SK	0.46**	0.32*	–0.21*		–1.27*		0.09*	1.20**	0.52*		0.54**
	(0.10)	(0.11)	(0.08)		(0.39)		(0.12)	(0.07)	(0.23)		(0.06)
BG	0.86**		7.27**	2.07**	1.49**		4.37**	2.95**	0.99**	1.33**	0.61**
	(0.02)		(1.19)	(0.31)	(0.14)		(0.29)	(0.62)	(0.08)	(0.08)	(0.04)
EE	0.79**	0.41**	1.34**	0.59**	0.65*	1.34**	–1.14*	0.80**	1.01**	0.72**	0.91**
	(0.04)	(0.05)	(0.10)	(0.04)	(0.22)	(0.07)	(0.46)	(0.06)	(0.04)	(0.01)	(0.05)
LV	0.82**		1.95**	0.48*	1.11**	3.48**	4.74**	0.96**	1.12**	0.97**	0.37**
	(0.05)		(0.06)	(0.13)	(0.07)	(0.27)	(1.03)	(0.13)	(0.08)	(0.04)	(0.06)
RO	1.84**		–1.49*	1.23**	2.14**	1.88*		3.02*	2.84**	1.45**	11.99**
	(0.31)		(0.70)	(0.28)	(0.26)	(0.49)		(1.28)	(0.24)	(0.12)	(2.36)
SI	0.69**	0.53**	9.07**		0.70**			0.64**	0.63**	1.05**	1.10**
	(0.02)	(0.04)	(1.68		(0.08)			(0.04)	(0.13)	(0.08)	(0.03)
Average	1.02	0.83	3.30	1.13	1.09	1.94	2.57	1.60	1.34	1.26	2.31
Share significant	100.0%	62.5%	87.5%	75.0%	100.0%	50.0%	75.0%	100.0%	100.0%	87.5%	100.0%

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

IV: *The short-run elasticity coefficient* β

	G total	G10	G20	G30	G40	G50	G60	G70	G80	G90	G100
CR				1.41*	2.34*	5.45**	0.81*				
				(0.66)	(1.28)	(2.16)	(3.57)				
HU		0.31*				0.09*	0.48*				
		(1.03)				(2.68)	(2.35)				
SK		7.33**						2.58*			1.65*
		(1.18)						(1.38)			(0.56)
BG	–2.39*										
	(–0.75)										
EE								0.96*	1.06*		
								(–0.32)	(–0.41)		
LV			2.80*								
			(–1.22)								
RO		–2.39*	7.65**		–1.923*	12.68**		–1.51*	–7.63**		
		(–1.12)	(–1.56)		(–1.05)	(–1.53)		(–0.81)	(–1.60)		
SI		–0.90*	–5.72*						7.22*	1.89*	
		(–0.45)	(–1.94)						(–3.37)	(–0.81)	
Average	2.39	2.73	5.39	1.41	2.13	6.07	0.64	1.69	5.31	1.89	1.65
Share significant	12.5%	50.0%	37.5%	12.5%	25.0%	37.5%	25.0%	37.5%	37.5%	12.5%	12.5%

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

CONCLUSION

The aim of this article was to fulfill the gap in literature and provide 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 a period 1995–2009. We analyzed annual data on government spending in compliance with the COFOG international standard. Although the theory implies that government spending is countercyclical, our research does not prove that. The results confirm cyclical development of government spending on GDP, Wagner's law and voracity effect in the CEE countries during 1995–2009.

We used Johansen cointegration test and the error correction model. Output and government spending are cointegrated for at least four of the spending functions in every country and it implies a long-term relationship between government spending and output. The government spending functions are procyclical in most CEE countries (93% cases in the sample). Average value of long-run elasticity coefficient is 1.74 for all spending functions, 1.02 for total government spending. 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 coefficient for long-run elasticity was significant for total spending, Economic affairs (G40), Health (G70), Recreation, culture and religion (G80) and Social protection (G100) in all cases (countries). This is important as these spending functions include more than 60% of total government spending.

We also analyzed the short-run relationship between spending and output. The coefficient values (average is 2.89) confirm the voracity hypothesis, as they suggest that in response to a given shock to real GDP, government spending will rise by even more in percentage points.

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