# The validity of Wagner's Law in Romania during 1995-2015

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## Abstract

The aim of this paper is to investigate the relationship between government expenditure and economic growth commonly known as Wagner's law for one single Central and Eastern European country namely Romania. Using a dataset ranging from 1995 to 2015, we apply latest econometric time series techniques such as unit root test, Johansen cointegration and Granger causality test. The cointegration tests indicate support for Wagner's hypothesis in all of its five versions, thus suggesting the existence of long-run relationship between government spending and national outcome. The causality tests show the absence of any short-run relationship from economic outcome to government expenditure in three out of five versions. However, taking into consideration that in its original formulation Wagner's law explored the secular correlation between output and government commitments, we can state that the long run cointegration is more consistent with Adolph Wagner's perspective.

**Keywords:** Wagner's Law; government expenditure; economic growth; time series; Romania

**JEL codes:** H5, C21

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## 1.Introduction

In the modern mixed economies, government sector plays an important role in one country development and progress by participating to the creation of the infrastructure and to capital formation, to the development of the human resources through the provision of generic named 'public goods', and by stimulating saving and investment. In this sense, Pereira (2001) emphasized that that the emerging economies in Europe based their development strategies on massive public investments, whilst African countries will be condemned to poverty due weak infrastructure. Hyman (2011) also indicated that industrial nations have large government sectors and for most the government expenditures account for 25% to 50% of GDP.

The issue on the government size has raised considerable interest and has generated extensive debate among economists particularly on its controversial effects on economic growth. Ram (1986) argued that a larger government size is likely to be detrimental to economic growth because government operations are often conducted inefficiently, the regulatory process imposes excessive burdens and costs on economic system and many of government's fiscal and monetary policies distort economic incentives and lower productivity. On the other hand, he asserted that larger government size can also be a powerful engine of economic development because of its role in harmonizing private and social interests, in preventing the exploitation of one country by foreigners and in securing an increase in productive investments and in providing a social optimal direction for growth and development. Carr (1989) also suggested that a government less efficient than the private sector, specifically in the production of collective goods may lead to a slower growth whilst if government provides an optimal level of public goods that would be unavailable if there were only private producers, than increased in government activity may results in a higher economic growth.

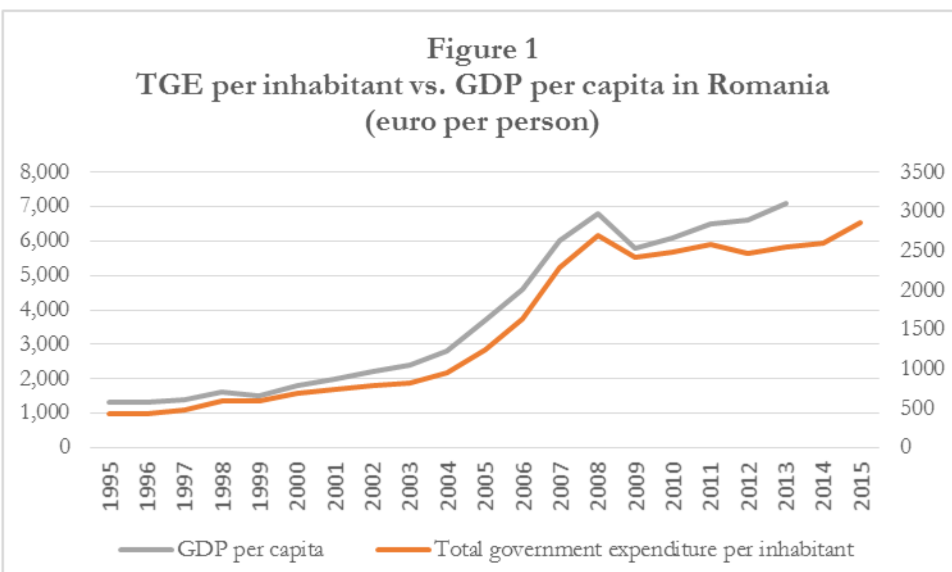
One of the oldest way in explaining government sector growth is commonly known as 'Wagner's law' or as 'law of increasing state activities' was postulated by Adolf Wagner (1883; see Wagner 1958) who stated that public expenditure is an inevitable outcome of economic growth and implied that public expenditure increases faster than economic growth. Peacock and Scott (2000) considered that Wagner's law entails that there is both and absolute and relative expansion of public sector within the national economy, particularly of government services for communal purposes. According to Cullis and Jones (1998) this law predicts that this relationship will continue because the state would need to expand administration and law and order services, there would be a concern with the distributional issues and there also would be a greater need to control private monopolies. Recently, Afonso and Alves (2016) indicated two additional hypotheses which can also explain the dynamic nature of the relationship between government expenditures and economic growth: (i) Fiscal Stimulus Hypothesis where government can run counter-cyclical policies to reduce the business cycle; and (ii) the Budget Stickiness Hypothesis arguing that public spending should not change since the public expenditures policies are targeted in the long-run perspective.

There is a rich literature investigating Wagner's law. Among the earliest studies, we can mention the paper of Peacock and Wiseman (1961) who were the first trying to shed some light on this hypothesis. Acknowledging Wagner's work, they also developed a new theory which is better known as the 'displacement effect'. The contribution of the earlier studies is important, particularly if we take into account the fact that Adolf Wagner was not technically explicit in the formulation of his hypothesis and made clear that this law based on empirical observation for a number of countries for which he noticed a common rising trend of output per capita, and thus he explained the expanding state activity. The subsequent studies brought a 'modern formulation on Wagner's law'. Musgrave (1969) analysed the relationship between public sector growth and per capita income by making a clear distinction between government consumption, investment spending and transfers and in each case found no explicit reason for expecting income elastic demand. Bird (1971) found considerable support for the relationship between the relative growth of the public sector and the increase in per capita income. Wagner and Weber (1977) undertook a cross-sectional analysis for 34 countries over the post-World War II period and examined the correlation between growth of income and growth of government both absolute and relative. They found that there were almost as many countries for which Wagner's law can be rejected as there are countries for which it can be accepted. Over the past two decades, the increase in the government spending has been attracted again the interest of many economists in the study of Wagner's law which has been reinforced also with the help of new econometric techniques. The most important contribution over the 90s and early 2000 are the following: Henrekson (1993), Bairam (1997), Dutt and Ghosh (1997), Peacock and Scott (2000), Dluhosch and Zimmermann (2006). These studies provides empirical evidence but also bring new political and economic foundations of Wagner's law. We also found recent studies which are more concerned in the empirical investigation of Wagner's hypothesis particularly for panel data. In this sense, we note Lamartina and Zaghini (2011) who conducted a panel cointegration analysis for 23 OECD countries over the period 1970-2006 and found empirical support for the existence of a long-run positive relationship between government spending and economic growth. Magazzino, Giolli and Mele (2015) undertook an extensive analysis of the government spending-economic growth relationship for a panel consisting of 27 European Union countries over 1980-2013. They studied the correlation between real GDP and general government expenditure, total government expenditure and investment expenditure and revealed that there the expenditures share a common trend and a long run relationship with real national income, hence supporting the validity of Wagner's law. More recent, Afonso and Alves (2016) examined Wagner's hypothesis using panel model and Seemingly Unrelated Regression methods to estimate public expenditures-income elasticities for 14 European countries during 1996 and 2013. They showed that some functions of government spending for few countries such as Austria, France, the Netherlands and Portugal do validate Wagner's law.

Regarding the validity of Wagner's law for Central and Eastern European countries, we found that there are only few studies examined this nexus between government expenditure and economic growth. Paparas and Richter (2015) made an outstanding survey of the literature exploring Wagner's hypothesis. They reviewed 126 articles and found only one examining the law of expanding state activity for the case of Slovenia over the period 1992-2007 (Dolenc, 2009). The results supported Wagner's law and indicated that the political orientation in Slovenia at that time did not change significantly the trend in public finances. Szarowska (2012) also conducted an analysis in 8 Central and Eastern European countries in period 1995-2009 and found elasticity coefficient greater than one for all spending functions as well as for total government expenditures which is consistent with the interpretation of Wagner's law. We can also note Magazzino, Giolli and Mele (2015) who provided empirical results for Central and Eastern European economies as country-specific. We believe that there are some reasons explaining the reduced interest in investigating this hypothesis for this group of countries. One important constrain in applying simple or advanced econometric techniques for single time series is limited data availability. In the view of Peacock and Wiseman (1961), Adolph Wagner was concerned with the secular behavior of expenditure rather that with short-run change. This implies, that the trend in the relationship between government spending and economic growth should be observed on longer term which requires large number of observations. Given the fact that previously to 1990, all these countries were governed by the communist regime and that the public sector was ponderous and government controlled much of the means of production and regulated most economic activity and investment and production decisions where embodied in a plan of production established by the political leaders and prices were set by the planners., we believe that studying the increasing state activity hypothesis during that period is to some extent against of Wagner's philosophical foundations of his law. In addition to our belief, Kolodko (2001) argued that all of these economies had been growing over the four decades before 1990, but the growth was of a 'bad quality' and despite a high growth rate in the region the living standard was not improving very fast and that the communist model of development was based on an expansion of heavy industries and an investment drive, with consumption growing always on a slower rate. One main reason that lies at the ground of Wagner's expanding state activity was that the growth in real income will lead to a relative expansion of cultural and welfare expenditures (Henrekson, 1993). To some extent, the situation of the communist countries and their development was contrary to Wagner's rationale on economic growth. Thus, for most of the Central and Eastern European countries the most relevant data starts in 1990 which makes the analysis difficult at least from technical perspective.

However, the aim of our study is to explore the validity of Wagner's law for one single Eastern European country namely Romania. To some extent our work represents also an attempt to reassess previous literature with regard to this hypothesis for Romania's case. The earliest study that we found is of Panaite, Vasilescu and Stoian (2001) who investigated Wagner's law for the total government expenditures as well as for government functions over the period 1990-2001. The results were mixed also because of the small number of observations. Andrei et al. (2009) examined the hypothesis for total government expenditure as well as for the military spending for a period ranged from 1985 to 2000 and showed support for Wagner's law for both expenditure. The main shortcoming of this study besides the small number of observations is that it used data before 1990 when Romania was a centrally planned economy. Moreover, Ben-Ner and Montias (1989) also pointed out that unlike other East European countries, Romania did not decentralize decision-making to the level of government-owned enterprises, had no significant private sector and did not rely on markets. Thus, we believe that is not totally consistent with Wagner's original view on government role in economy. We also can mention Magazzino, Giolli and Mele (2015) who used the dynamic online learning support technique for heterogeneous cointegrated panel and the results provided for Romania's case supported Wagner's law. However, Granger causality test indicated the existence of a neutral relationship between gross domestic product and general government expenditure in the short-run. The authors conducted their analysis over 1980-2013 which means that they included the communist regime period. We also express our doubts on data availability with Ameco before 1990, which suggest that the author relied on a dataset consisting at most 19 observations.

The contribution of our study to the existing literature is that we use the largest dataset so far ranged from 1995 to 2015 and focus our investigation only on the period after 1990 when Romania made an important turn from the communist regime to capitalism. From the economic perspective, this change led to the establishment of a market oriented economy based on the private ownership and where investment, production and distribution decisions are driven by the supply and demand in the market as well as the prices. Consequently, the role of the government has changed and should be in accordance with the market economy principles which imply a limited but active government as in modern interpretation (Sobel, 2005). Moreover, Romania presents some features by comparison with the rest of the European Union countries that make it an interested case to be explored particularly from Wagner's hypothesis perspective (see Tables 1 to 5 in the Appendix). Romania is the second largest country in Central and Eastern Europe next to Poland and one of the largest in Europe as regards the total population. It is situated in the upper quartile next to Germany, Spain, France, Italy and the United Kingdom (Table 1 in the Appendix). But, the GDP per capita is low and is placed in the lower quartile (Table 2 in the Appendix). Excepting the Czech Republic which ranks in the 2nd quartile, all of the ex-communist countries are positioned next to Romania which reflects the status of these countries as emerging economies in Europe. Kolodko (2001) emphasized that after a short-period of transitional contraction it was expected that the new system will lead to recovery and then o fast growth. But, the transitional recession lasted much than expected and instead of a rapid and robust growth the depression continued in some countries over the whole decade which explains to some extent the current situation. However, Romania was one of the fastest growing economies in Europe being positioned in the 3rd quartile next to Estonia, Latvia, Poland and Slovakia which indicates country's potential in achieving development (Table 3 in the Appendix). By comparison, government total expenditure as share to GDP and per inhabitant rank in the lower quartile (Table 4 and Table 5 in the Appendix). Nevertheless, we are interested in the dynamic relationship between government expenditure and economic growth and if we look to the evolution of the total government expenditure per inhabitant and GDP per capita over 1995 and 2015, we can observe an increasing tendency for both indicators as presented in Figure 1.




Note: the data available for the gross domestic product per capita ranges from 1995 to 2013.

This provides support and motivation for our investigation. Furthermore, we believe that the expanding government sector could be a natural effect of development. When higher industrialization, modernization and accompanying urbanization will emerge, this will require government expenditure on law and order, and to control natural monopolies in order to enhance economic efficiency (Henrekson, 1993).

For the purpose of our study, we organize the paper as follows: in Section 2 we describe the methodology of investigation and the dataset. Section 3 presents and discusses the results and the final section comprises of the main concluding remarks and policy recommendations.

## 2.Methodology

Peacock and Wiseman (2000) made the first attempt to synthetize the methodological approaches in investigating Wagner's law. But, maybe the most important issue to consider for modelling time series data nowadays is to test for stationarity of the collected data, since the series are stationary we start the analysis. Brooks (2002) implied that when we use non-stationary data can lead to a spurious regression. The empirical results may seem in accordance with theory and the tested hypotheses, however, results are without meaning.

The unit root test is a test of stationarity and non-stationarity that has become generally popular over the last decades. Several tests for a presence of unit roots in time-series data have appeared in literature, some of them are Dickey and Fuller (1979), Phillips-Perron (1988) and Kwiatkowski et al. (1992).

There are several methods to test for cointegration between two or more variables (Engle and Granger, 1987). Cointegration tests should reveal whether the national income and government spending move together over a long time period. First it is important to distinguish between the univariate and the multivariate approach.

The univariate approach to cointegration implies a pairwise analysis of the different variables that measure national income and government spending. The Engle-Granger single-equation method is applied to perform pairwise analysis of those variables. It allows only for one endogenous and one exogenous variable. We will also apply the Johansen method for pairwise cointegration to check the consistency and reliability of the results achieved with the Engle-Granger method.

The multivariate approach to cointegration tests whether there is cointegration in a system of more than two variables. The Johansen method is widely used to perform this analysis (Juselius, 2006). It improves some of the drawbacks with the Engle-Granger method (Brooks, 2008). The Johansen method allows for all variables to be endogenous and makes it possible to determine all cointegrating relationships between the examined variables.

The Engle-Granger test is a single-equation method used to determine whether there is a cointegrating relationship between two variables (Engle and Granger, 1987). The precondition to examine cointegration is that the variables are both non-stationary and integrated of the same order.

The Engle-Granger cointegration test is very popular mostly because it is easy to estimate the regression using OLS and the error correction model provides valuable information about the speed of adjustment to equilibrium. Therefore it is often used when testing for pairwise cointegration (Richards, 1995; Jang and Sul, 2003).

However, there are several problems with this method. One of the drawbacks with using OLS regression in general is that it can identify only one cointegrating vector even when there are many variables in the system (Dolado et al., 1990). On the other hand, the Johansen method makes it possible to detect all cointegrating relationship in a system of variables.

Other problems with the EG tests are linked to the usual small sample problems and unit root testing (Harris and Sollis, 2003): lack of power in stationarity tests, which is a typical ADF test problem; standard inference cannot be used, as the included variables are non-stationary; potentially biased results, which usually occurs if a variable that belongs to the model is omitted from the regression.

There could be more than one cointegrating vector in a system of variables and the Johansen method can discover all such cointegrating relations (Juselius, 2006; Johansen and Juselius, 1990; Kasa, 1992). The Johansen method relies on a vector autoregression (VAR) model. A VAR is a system regression model which includes more than one dependent variable. Every variable is regressed on a combination of its own lagged values and lagged values of other variables from the system.

Cointegration indicates existence of a long-run relationship between variables. Even when the variables are not cointegrated in the long-run, they might still be related in the short-run. In order to understand short-run interdependence among stock markets, Granger causality tests will be performed.

Granger causality test is based on a standard F-test which seeks to determine if changes in one variable cause changes in another variable. A variable X is said to 'Granger cause' variable Y, if the previous values of X could predict the current value of Y.

We conduct our analysis on a dataset comprising annual data on absolute (G) and relative (GGDP) total government expenditure, on gross domestic product (GDP) and on gross domestic product per capita (GDPP) and on total population (P) spanning from 1995 to 2015. The data was provided by Ameco. The descriptive statistics for the dataset are reported in Table 6 in the Appendix.

## 3.Results

### *3.1.Unit root tests*

Several tests for a presence of unit roots in time-series data have appeared in literature, some of them are Dickey and Fuller (1979), Phillips-Perron (1988) tests. The first step of our analysis is to verify the order of integration of the variables since the causality tests are only valid if the variables have the same order of integration. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are applied in order to determine the order of integration of the tested variables. The tested series are LG (total government expenditure), LGDP (gross domestic product), LP (population), L(GDPP) (GDP per capita), L(GGDP) (total government expenditure as a share of real GDP) and L(GP) (total government expenditure per capita) for the period of 1995-2015 in natural logarithms. Our empirical results are reported in Table 1. The ADF and PP tests statistics for all variables do not exceed the critical values in absolute terms, indicating that the tested variables are *I*(0) and their levels are stationary[12].

**Table 1 Results of ADF and PP unit root tests**

| Test | ln *G* | ln *GDP* | ln *GDPP* | ln *GGDP* | ln *GP* |
|---|---|---|---|---|---|
| ADF Statistic | -7.38* [1**] | -8.28* [0] | -8.15* [0] | -3.75* [2] | -7.19* [0] |
| PP Statistic | -7.22* [0***] | -18.39* [9] | -19.52* [10] | -3.92* [2] | -7.19* [0] |

Note: The ADF and PP critical confidence values at 5% are -3.029 and -3.020, respectively. * indicate rejection of the null hypothesis at the 5% level of significance. .** parentheses in ADF indicate the lag length based on SIC.***Parentheses in PP indicate the Bandwith, Newey-West using Barlett kernel.

*3.2.Unit root test with breaks*

The long–run relationship between two tested variables can be affected by the presence of structural breaks in the data. These possible breaks can be a result of economic regime or a change in the factors (government spending, taxation, population etc.) that determine and affect the tested series. Hence, if structural breaks are not taken into account when investigating the existence of a long–run relationship, there is a possibility that linear methods may fail to confirm the relationship when in fact it does exist.

Zivot and Andrews (1992) recursive approach is used in order to examine the null hypothesis that series have a unit root agaianst the alternative of stationarity with structural change at some unknown break date denoted by $T_b$. The break date is chosen endogenously as the value, over all possible break points, which minimises the test statistic for testing $\rho = 1$ for the following regression:

$$\mathbf{Y_t = \mu + \beta t + \rho Y_{t-1} + \theta DU_t + \gamma DT_t + \delta D(T_b)_t + \sum_{i=1}^{k} c_i \Delta Y_{t-1} + \varepsilon_t} \qquad (1)$$

Where $DT_t$ is the shift in trend and is equal with t-$T_b$if t > $T_b$ and 0 otherwise, $DU_t$ is the shift in the mean and $DU_t = 1$ if t > $T_b$and 0 otherwise. $T_b$ is equals one at the observation after the break point, while the additional one-time dummy $D(T_b)_t$=*1* if *t*= $T_b$+*1* and 0 otherwise. This "innovational outlier" model specifies that the change to the new trend function is gradual.

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[1] The null hypothesis is non-stationarity in series, while the alternative hypothesis is stationarity. The null hypothesis of non-stationarity is rejected in favor of the alternative hypothesis, if the test statistics is more negative than the critical values. The optimal lag lengths as well as the ADF test results obtained from the software package EViews.

[2] As the ADF test is sensitive to the chosen lag length, a sensitivity analysis was performed for different lag lengths. The test results showed no sensitivity to the chosen, optimal lag length. If we increase or reduce the lag length, the results will still show non-stationarity of stock markets.

**Table 2 Unit root tests with structural breaks**

| Variable | Break date | Test Statistic | P-Value | Critical Value 5% |
|---|---|---|---|---|
| **LG** | 2014 | -7.036 | <0.01 | -4.443 |
| **LGDP** | 2010 | -9.912 | <0.01 | -4.443 |
| **LGDPP** | 2010 | -9.68 | <0.01 | -4.443 |
| **LGGDP** | 2008 | -5.26 | <0.01 | -4.443 |
| **LP** | 2014 | -7.024 | <0.01 | -4.443 |

The results of the Zivot-Andrews unit root test, which is able to capture the impact of structural breaks, are given in Table 2. The Zivot-Andrews test with one structural break finds no additional evidence against the unit root null hypothesis relative to the unit root tests without a structural break. In other words, in models the null hypotheses are not rejected for the variables.

*3.3.Cointegration Approach*

Johansen's cointegration approach uses the maximum likelihood estimation in a VAR model. There are two statistics created by this approach: the trace statistic and maximum Eigenvalue. The Trace statistic examine the null hypothesis that there is at most r number of cointegrating vectors and the alternative hypothesis of r or more than r number of cointegrating vectors. The maximum Eigenvalue statistics examine for r number of cointegrating vectors against the alternative of r+1 number of cointegrating vectors. The Johansen's cointegration test will demonstrate if there exists a long run relationship between government spending and national income.

We found evidence from ADF and PP tests that all the series are integrated of order zero (I(0)). We will test the five specifications of the Wagner's law that are available in the literature. The results of Johansen approach are reported at tables 3, 4, 5, 6, and 7 for all the models and indicate that there is one cointegration vector between the tested series during 1995-2015. This happens because we reject the null hypothesis that r=0, so we have at least one cointegrating vector.

**Table 3 Cointegration test on Peacock Version, Wagner's law**

| **1995-2015** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Unrestricted Cointegration Rank Test (Trace)** | | | | | **Unrestricted Cointegration Rank Test (Maximum Eigenvalue)** | | | | |
| **Hypothesized** | | **Trace** | **0.05** | | **Hypothesized** | | **Max-Eigen** | **0.05** | |
| **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** | **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** |
| **r=0*** | 0.718044 | 23.33246 | 12.32090 | 0.0005 | **r=0*** | 0.718044 | 22.78805 | 11.22480 | 0.0003 |
| **r=1** | 0.029792 | 0.544414 | 4.129906 | 0.5230 | **r=1** | 0.029792 | 0.544414 | 4.129906 | 0.5230 |

Note: * indicate rejection of the null hypothesis at the 5% level of significance. **MacKinnon-Haug-Michelis (1999) p-values.

**Table 4 Cointegration test on Goffman Version, Wagner's law**

| 1995-2015 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Unrestricted Cointegration Rank Test (Trace)** | | | | | **Unrestricted Cointegration Rank Test (Maximum Eigenvalue)** | | | | |
| **Hypothesized** | | **Trace** | **0.05** | | **Hypothesized** | | **Max-Eigen** | **0.05** | |
| **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** | **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** |
| **r=0*** | 0.592880 | 16.17596 | 12.32090 | 0.0108 | **r=0*** | 0.592880 | 16.17565 | 11.22480 | 0.0063 |
| **r=1** | 1.71E-05 | 0.000308 | 4.129906 | 0.9902 | **r=1** | 1.71E-05 | 0.000308 | 4.129906 | 0.9902 |

Note: * indicate rejection of the null hypothesis at the 5% level of significance. **MacKinnon-Haug-Michelis (1999) p-values.

**Table 5 Cointegration test on Musgrave Version, Wagner's Law**

| 1995-2015 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Unrestricted Cointegration Rank Test (Trace)** | | | | | **Unrestricted Cointegration Rank Test (Maximum Eigenvalue)** | | | | |
| **Hypothesized** | | **Trace** | **0.05** | | **Hypothesized** | | **Max-Eigen** | **0.05** | |
| **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** | **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** |
| **r=0*** | 0.515481 | 13.40410 | 12.32090 | 0.0328 | **r=0*** | 0.515481 | 13.04278 | 11.22480 | 0.0237 |
| **r=1** | 0.019873 | 0.361321 | 4.129906 | 0.6107 | **r=1** | 0.019873 | 0.361321 | 4.129906 | 0.6107 |

Note: * indicate rejection of the null hypothesis at the 5% level of significance. **MacKinnon-Haug-Michelis (1999) p-values.

**Table 6 Cointegration test on Gupta Version, Wagner's law**

| 1995-2015 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Unrestricted Cointegration Rank Test (Trace)** | | | | | **Unrestricted Cointegration Rank Test (Maximum Eigenvalue)** | | | | |
| **Hypothesized** | | **Trace** | **0.05** | | **Hypothesized** | | **Max-Eigen** | **0.05** | |
| **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** | **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** |
| **r=0*** | 0.712904 | 23.28225 | 12.32090 | 0.0005 | **r=0*** | 0.712904 | 22.46292 | 11.22480 | 0.0004 |
| **r=1** | 0.044498 | 0.819335 | 4.129906 | 0.4213 | **r=1** | 0.044498 | 0.819335 | 4.129906 | 0.4213 |

Note: * indicate rejection of the null hypothesis at the 5% level of significance. **MacKinnon-Haug-Michelis (1999) p-values.

**Table 7 Cointegration test on Mann Version, Wagner's law**

| 1995-2015 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Unrestricted Cointegration Rank Test (Trace)** | | | | | **Unrestricted Cointegration Rank Test (Maximum Eigenvalue)** | | | | |
| **Hypothesized** | | **Trace** | **0.05** | | **Hypothesized** | | **Max-Eigen** | **0.05** | |
| **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** | **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.**** |
| **r=0*** | 0.517064 | 13.32865 | 12.32090 | 0.0338 | **r=0*** | 0.517064 | 13.10167 | 11.22480 | 0.0231 |
| **r=1** | 0.012530 | 0.226972 | 4.129906 | 0.6915 | **r=1** | 0.012530 | 0.226972 | 4.129906 | 0.6915 |

Note: * indicate rejection of the null hypothesis at the 5% level of significance. **MacKinnon-Haug-Michelis (1999) p-values.

The indication is that there is one cointegrating vector in each of these 4 pairs at 5% significance level. Both Trace and Max test confirm this conclusion.

*3.5.Granger causality tests*

If two variables are cointegrated, we can use the Granger causality test (Granger 1969) in order to check the short run relationship between variables. The Granger causality test examine whether variable Y's current value can be explained by its own past value and whether the explanatory power could be improved by adding the past value of another variable X. If the coefficient of X is statistically significant, X is said to Granger cause Y.

The Granger causality test is very sensitive to the lags used in the OLS regressions (Gujarati 2003). In our analysis, various lag length selection criteria are used in order to determine the lags for Granger causality test. The tests we use are the following: LR – sequential modified LR test statistic, FPE – Final prediction error, AIC – Akaike information criterion, SC – Schwarz information criterion and HQ – Hannah-Quinn information criterion. These tests determined one lag.

We run the Granger causality test for all the versions of the law by using 2 lags for all versions in order to ensure uncorrelated residuals. We found in the previous section that there is one cointegration vector for all the models, so we can define the Granger causality tests as joint test (F-tests) for the significance of the lagged value of the assumed exogenous variable and for the significance of the error correction term.

**Table 8 Granger causality test, Wagner's Law**

| 1995-2015 | | | | | | |
|---|---|---|---|---|---|---|
| | | **F-stat** | **P-value** | | **F-stat** | **P-value** |
| **Peacock Version** | **LGDP causes LG** | 4.852* | 0.025 | **LG causes LGDP** | 0.739 | 0.495 |
| **Goffman Version** | **L(GDPP) causes LG** | 3.004 | 0.082 | **LG causes L(GDPP)** | 0.629 | 0.547 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Musgrave Version** | **L(GDPP) causes L(GGDP)** | 0.110 | 0.896 | **L(GGDP) causes L(GDPP)** | 0.687 | 0.519 |
| **Gupta Version** | **L(GDPP) causes L(GP)** | 4.576* | 0.029 | **L(GP) causes L(GDPP)** | 0.687 | 0.519 |
| **Mann Version** | **LGDP causes L(GGDP)** | 0.145 | 0.866 | **L(GGDP) causes LGDP** | 0.739 | 0.495 |

Note: * indicate rejection of the null hypothesis at the 5% level of significance.

The results are reported in Table 8 and indicate that Granger causality is running from income to spending in Peacock and Gupta versions and so provide support of the validity of Wagner's law. In Goffman, Musgrave and Mann version there is evidence of no causality between the two tested variables.

## 4.Concluding remarks

This paper uses the latest time series techniques to study the relationship between government expenditure and economic growth in Romania. First, we study the unit root properties of the variables. We find that logarithms of government expenditure and GDP in their various formulations (like total, per capita) are stationary in their levels.

Next, we conduct Johansen cointegration tests for pairs of variables which do not involve log of the government expenditure as a percentage of GDP. The results indicate all pairs of variables are cointegrated and the number of cointegrating vector is equal to one in each case. The cointegrating vectors show that all three pairs of variables have a long run positive relationship as expected, while all the calculated income elasticities are according to the theory and support the validity of Wagner's Law.

Finally, we conduct the augmented Granger causality tests between pairs of variables. The results show that no matter what lag is used, causality does not flow in any direction in any of the cases.

Thus, the results indicate that the growth of GDP does not cause growth of government expenditure. This result is possible if non-economic factors are more important in explaining the growth of government expenditure than economic factors.

The policy implication is that the present structure of government expenditure is not very conducive to economic growth. However, it is quite possible that a different structure of government expenditure can contribute more effectively to economic growth. Thus, while the presence of a long run relationship between GDP and government expenditure (in their various forms) support the Wagner's Law, causality tests tell another story. However, In other words, causality tests indicate the absence of short run relationship whereas the presence of cointegration indicates long run relationship.

The relationship between government spending and national output is important for many policy-related issues. For instance, recessionary (expansionary) periods impede (enhance) central authorities' abilities to stimulate their economy via fiscal measures unless the share of government spending to GDP increases (reduces). Long run estimates of the relationship between government expenditure and national output would permit the identification of a benchmark against which one can identify the fiscal policy stance adopted by particular governments. The government spending and national output relationship is also relevant for the debate on the sustainability of public finances, especially during the phase when governments struggle to restrain government spending. Therefore, the identification of this relationship provides a theoretical framework against which to formulate and judge fiscal policy adjustment plans concerning medium term budgetary objectives.

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**Appendix**

**Table 1 Descriptive statistics of total population (1000 persons) during 1995-2015**

| Country | average | stdev | median | min | max | q1 | q2 | q3 | q4 |
|---|---|---|---|---|---|---|---|---|---|
| Belgium | 10596.55 | 394.79 | 10478.62 | 10136.81 | 11286.58 | 10251.25 | 10478.62 | 10920.27 | 11286.58 |
| Bulgaria | 7738.99 | 411.93 | 7658.97 | 7180.59 | 8406.07 | 7395.60 | 7658.97 | 8170.17 | 8406.07 |
| Czech Republic | 10344.25 | 124.86 | 10304.13 | 10194.00 | 10546.40 | 10238.91 | 10304.13 | 10474.41 | 10546.40 |
| Denmark | 5441.15 | 132.05 | 5419.43 | 5233.37 | 5684.11 | 5339.62 | 5419.43 | 5547.68 | 5684.11 |
| Germany | 81877.77 | 621.85 | 82047.20 | 80425.82 | 82534.18 | 81678.05 | 82047.20 | 82349.93 | 82534.18 |
| Estonia | 1360.28 | 36.00 | 1354.78 | 1312.05 | 1436.63 | 1331.48 | 1354.78 | 1388.12 | 1436.63 |
| Ireland | 4166.68 | 383.87 | 4159.91 | 3608.84 | 4644.93 | 3805.17 | 4159.91 | 4560.16 | 4644.93 |
| Greece | 10904.55 | 166.99 | 10928.07 | 10562.15 | 11121.34 | 10805.81 | 10928.07 | 11045.01 | 11121.34 |
| Spain | 43375.52 | 2962.36 | 43653.16 | 39387.02 | 46773.06 | 40263.22 | 43653.16 | 46442.77 | 46773.06 |
| France | 62866.37 | 2330.38 | 63001.25 | 59418.72 | 66472.73 | 60762.17 | 63001.25 | 64818.79 | 66472.73 |
| Croatia | 4356.33 | 118.47 | 4308.29 | 4216.25 | 4620.03 | 4296.35 | 4308.29 | 4396.57 | 4620.03 |
| Italy | 58456.69 | 1495.79 | 58190.59 | 56884.67 | 60789.14 | 56982.54 | 58190.59 | 59829.62 | 60789.14 |
| Cyprus | 755.01 | 73.40 | 738.54 | 650.87 | 863.95 | 694.02 | 738.54 | 829.45 | 863.95 |
| Latvia | 2233.04 | 161.28 | 2238.80 | 1977.83 | 2485.06 | 2097.56 | 2238.80 | 2367.55 | 2485.06 |
| Lithuania | 3294.20 | 239.95 | 3322.53 | 2905.00 | 3629.10 | 3097.28 | 3322.53 | 3499.54 | 3629.10 |
| Luxembourg | 474.19 | 48.23 | 465.16 | 408.63 | 566.68 | 436.30 | 465.16 | 506.95 | 566.68 |
| Hungary | 10094.37 | 148.98 | 10087.07 | 9839.30 | 10328.97 | 10000.02 | 10087.07 | 10210.97 | 10328.97 |
| Malta | 400.94 | 18.53 | 403.83 | 370.43 | 431.21 | 385.81 | 403.83 | 414.51 | 431.21 |
| Netherlands | 16259.24 | 452.26 | 16319.87 | 15459.01 | 16940.39 | 15925.51 | 16319.87 | 16615.39 | 16940.39 |
| Austria | 8216.90 | 209.70 | 8227.83 | 7948.28 | 8618.44 | 8011.57 | 8227.83 | 8363.40 | 8618.44 |
| Poland | 38237.37 | 222.65 | 38165.45 | 38009.65 | 38663.48 | 38063.26 | 38165.45 | 38258.63 | 38663.48 |
| Portugal | 10387.75 | 176.39 | 10457.30 | 10026.18 | 10573.10 | 10289.90 | 10457.30 | 10522.29 | 10573.10 |
| Romania | 21270.55 | 1040.72 | 21319.69 | 19866.45 | 22684.27 | 20246.87 | 21319.69 | 22442.97 | 22684.27 |
| Slovenia | 2015.24 | 30.41 | 2000.47 | 1981.63 | 2063.53 | 1989.87 | 2000.47 | 2048.58 | 2063.53 |
| Slovakia | 5387.30 | 16.77 | 5383.29 | 5362.00 | 5422.43 | 5373.37 | 5383.29 | 5396.02 | 5422.43 |
| Finland | 5271.26 | 117.15 | 5246.10 | 5107.79 | 5479.88 | 5176.21 | 5246.10 | 5363.35 | 5479.88 |
| Sweden | 9146.97 | 313.62 | 9029.60 | 8826.90 | 9799.20 | 8872.10 | 9029.60 | 9378.10 | 9799.20 |
| United Kingdom | 60901.18 | 2314.28 | 60401.21 | 58019.03 | 65113.29 | 58892.51 | 60401.21 | 62766.37 | 65113.29 |
| EU-28 | 17708.24 | 22371.79 | 8722.67 | 370.43 | 82534.18 | 3624.04 | 8722.67 | 17671.90 | 82534.18 |

Source: Ameco, 2016.

**Table 2 Descriptive statistics of gross domestic product per capita (euro per inhabitant) during 1995-2013**

| Country | average | stdev | median | min | max | q1 | q2 | q3 | q4 |
|---|---|---|---|---|---|---|---|---|---|
| Belgium | 27921.05 | 4628.00 | 28000.00 | 21400.00 | 34500.00 | 24000.00 | 28000.00 | 32000.00 | 34500.00 |
| Bulgaria | 3026.32 | 1619.27 | 2600.00 | 800.00 | 5500.00 | 1600.00 | 2600.00 | 4600.00 | 5500.00 |
| Czech Republic | 9747.37 | 3909.87 | 9000.00 | 4300.00 | 14800.00 | 5950.00 | 9000.00 | 13900.00 | 14800.00 |
| Denmark | 36431.58 | 6042.45 | 36500.00 | 26600.00 | 44400.00 | 31600.00 | 36500.00 | 42150.00 | 44400.00 |
| Germany | 27326.32 | 3265.96 | 26600.00 | 23200.00 | 33300.00 | 24650.00 | 26600.00 | 29800.00 | 33300.00 |
| Estonia | 7726.32 | 3938.53 | 7200.00 | 2000.00 | 13900.00 | 4200.00 | 7200.00 | 11400.00 | 13900.00 |
| Ireland | 31594.74 | 8623.06 | 35200.00 | 14400.00 | 43100.00 | 25950.00 | 35200.00 | 36350.00 | 43100.00 |
| Greece | 15261.11 | 4269.89 | 16200.00 | 8500.00 | 20800.00 | 11250.00 | 16200.00 | 18700.00 | 20800.00 |
| Spain | 18773.68 | 4274.58 | 19700.00 | 11600.00 | 23900.00 | 15050.00 | 19700.00 | 22550.00 | 23900.00 |
| France | 26294.74 | 3801.97 | 26500.00 | 20200.00 | 31300.00 | 23200.00 | 26500.00 | 29750.00 | 31300.00 |
| Croatia | 7594.74 | 2571.31 | 7700.00 | 3600.00 | 11000.00 | 5150.00 | 7700.00 | 10150.00 | 11000.00 |
| Italy | 22842.11 | 3366.55 | 24000.00 | 15200.00 | 26300.00 | 20450.00 | 24000.00 | 25650.00 | 26300.00 |
| Cyprus | 16873.68 | 3796.32 | 17300.00 | 10800.00 | 21800.00 | 13800.00 | 17300.00 | 20600.00 | 21800.00 |
| Latvia | 6031.58 | 3401.48 | 4900.00 | 1500.00 | 11600.00 | 3250.00 | 4900.00 | 9100.00 | 11600.00 |
| Lithuania | 6131.58 | 3345.32 | 5400.00 | 1400.00 | 11700.00 | 3250.00 | 5400.00 | 8900.00 | 11700.00 |
| Luxembourg | 61042.11 | 16128.25 | 59900.00 | 38600.00 | 83400.00 | 48200.00 | 59900.00 | 76900.00 | 83400.00 |
| Hungary | 7310.53 | 2554.71 | 8100.00 | 3400.00 | 10500.00 | 4650.00 | 8100.00 | 9700.00 | 10500.00 |
| Malta | 12300.00 | 2924.99 | 11800.00 | 7500.00 | 17200.00 | 10500.00 | 11800.00 | 14500.00 | 17200.00 |
| Netherlands | 29842.11 | 5570.39 | 30200.00 | 20700.00 | 36200.00 | 25350.00 | 30200.00 | 35100.00 | 36200.00 |
| Austria | 29405.26 | 4819.92 | 28700.00 | 23000.00 | 37000.00 | 25450.00 | 28700.00 | 33550.00 | 37000.00 |
| Poland | 6426.32 | 2463.02 | 5600.00 | 2800.00 | 10100.00 | 4500.00 | 5600.00 | 8700.00 | 10100.00 |
| Portugal | 13678.95 | 2439.62 | 14200.00 | 9000.00 | 16300.00 | 12100.00 | 14200.00 | 15850.00 | 16300.00 |
| Romania | 3763.16 | 2247.52 | 2800.00 | 1300.00 | 7100.00 | 1700.00 | 2800.00 | 6050.00 | 7100.00 |
| Slovenia | 13626.32 | 3528.75 | 13600.00 | 8100.00 | 18400.00 | 10650.00 | 13600.00 | 17150.00 | 18400.00 |
| Slovakia | 7489.47 | 3948.54 | 6300.00 | 2800.00 | 13300.00 | 3900.00 | 6300.00 | 11750.00 | 13300.00 |
| Finland | 28715.79 | 5500.43 | 29100.00 | 19600.00 | 35600.00 | 24600.00 | 29100.00 | 33650.00 | 35600.00 |
| Sweden | 32331.58 | 6199.29 | 31500.00 | 22000.00 | 43800.00 | 27950.00 | 31500.00 | 36500.00 | 43800.00 |
| United Kingdom | 26942.11 | 4955.28 | 28100.00 | 15600.00 | 34200.00 | 25000.00 | 28100.00 | 29900.00 | 34200.00 |
| EU-28 | 19166.29 | 13949.51 | 16300.00 | 800.00 | 83400.00 | 8400.00 | 16300.00 | 27900.00 | 83400.00 |

Source: Eurostat, 2016.

**Table 3 Descriptive statistics of real GDP growth rate (%) during 1995-2015**

| Country | average | stdev | median | min | max | q1 | q2 | q3 | q4 |
|---|---|---|---|---|---|---|---|---|---|
| Belgium | 1.79 | 1.48 | 1.80 | -2.28 | 3.71 | 0.81 | 1.80 | 2.69 | 3.71 |
| Bulgaria | 2.75 | 3.74 | 2.97 | -6.69 | 7.68 | 1.28 | 2.97 | 5.65 | 7.68 |
| Czech Republic | 2.58 | 2.91 | 2.71 | -4.84 | 6.88 | 1.44 | 2.71 | 4.29 | 6.88 |
| Denmark | 1.36 | 1.99 | 1.26 | -5.09 | 3.80 | 0.47 | 1.26 | 2.90 | 3.80 |
| Germany | 1.35 | 2.04 | 1.69 | -5.62 | 4.08 | 0.71 | 1.69 | 1.99 | 4.08 |
| Estonia | 4.27 | 5.95 | 5.32 | -14.72 | 11.80 | 2.46 | 5.32 | 7.58 | 11.80 |
| Ireland | 5.15 | 4.46 | 5.83 | -5.64 | 11.18 | 2.59 | 5.83 | 8.91 | 11.18 |
| Greece | 0.93 | 4.39 | 2.86 | -9.13 | 5.79 | -0.34 | 2.86 | 3.92 | 5.79 |
| Spain | 2.14 | 2.51 | 3.17 | -3.57 | 5.29 | 1.12 | 3.17 | 3.77 | 5.29 |
| France | 1.58 | 1.50 | 1.95 | -2.94 | 3.88 | 0.82 | 1.95 | 2.36 | 3.88 |
| Croatia | 2.20 | 3.56 | 3.43 | -7.38 | 6.65 | -0.36 | 3.43 | 5.15 | 6.65 |
| Italy | 0.60 | 2.04 | 1.29 | -5.48 | 3.71 | 0.15 | 1.29 | 1.69 | 3.71 |
| Cyprus | 2.43 | 3.50 | 3.23 | -5.94 | 9.92 | 1.36 | 3.23 | 4.60 | 9.92 |
| Latvia | 4.02 | 6.02 | 5.40 | -14.35 | 11.90 | 2.36 | 5.40 | 8.34 | 11.90 |
| Lithuania | 4.33 | 5.33 | 5.15 | -14.81 | 11.09 | 3.03 | 5.15 | 7.41 | 11.09 |
| Luxembourg | 3.57 | 3.39 | 4.07 | -5.38 | 8.44 | 1.52 | 4.07 | 5.68 | 8.44 |
| Hungary | 2.19 | 2.68 | 3.24 | -6.56 | 4.94 | 0.84 | 3.24 | 3.85 | 4.94 |
| Malta | 3.26 | 2.07 | 3.54 | -2.46 | 6.41 | 2.54 | 3.54 | 4.06 | 6.41 |
| Netherlands | 1.96 | 2.14 | 2.03 | -3.77 | 5.05 | 1.01 | 2.03 | 3.57 | 5.05 |
| Austria | 1.82 | 1.68 | 2.14 | -3.80 | 3.62 | 0.88 | 2.14 | 2.81 | 3.62 |
| Poland | 4.16 | 1.80 | 3.92 | 1.25 | 7.20 | 3.28 | 3.92 | 5.14 | 7.20 |
| Portugal | 1.22 | 2.37 | 1.55 | -4.03 | 4.79 | 0.20 | 1.55 | 2.49 | 4.79 |
| Romania | 2.97 | 4.25 | 3.75 | -7.07 | 8.46 | 0.64 | 3.75 | 5.59 | 8.46 |
| Slovenia | 2.65 | 3.24 | 3.30 | -7.80 | 6.94 | 2.84 | 3.30 | 4.16 | 6.94 |
| Slovakia | 4.05 | 3.38 | 4.52 | -5.49 | 10.83 | 2.52 | 4.52 | 5.84 | 10.83 |
| Finland | 2.26 | 3.25 | 2.78 | -8.27 | 6.25 | 0.72 | 2.78 | 4.21 | 6.25 |
| Sweden | 2.54 | 2.43 | 2.82 | -5.18 | 5.99 | 1.56 | 2.82 | 4.23 | 5.99 |
| United Kingdom | 2.16 | 1.71 | 2.59 | -4.19 | 3.80 | 2.16 | 2.59 | 3.00 | 3.80 |
| EU-28 | 2.58 | 3.43 | 2.81 | -14.81 | 11.90 | 1.14 | 2.81 | 4.31 | 11.90 |

Note: the real GDP growth rate was calculated as the percent variation of the gross domestic product at 2010 reference levels as in national currency. The data about the gross domestic product was provided by Ameco, 2016.

**Table 4 Descriptive statistics of total government expenditure per inhabitant (euro per person) during 1995-2015**

| Country | average | stdev | median | min | max | q1 | q2 | q3 | q4 |
|---|---|---|---|---|---|---|---|---|---|
| Belgium | 15168.79 | 3085.12 | 15001.70 | 11317.52 | 19638.19 | 12355.93 | 15001.70 | 17815.77 | 19638.19 |
| Bulgaria | 1311.08 | 700.94 | 1153.41 | 362.83 | 2489.75 | 719.24 | 1153.41 | 1900.85 | 2489.75 |
| Czech Republic | 4548.39 | 1776.94 | 4479.95 | 2084.37 | 6831.58 | 2622.45 | 4479.95 | 6286.51 | 6831.58 |
| Denmark | 20824.16 | 3723.30 | 20123.40 | 15817.71 | 26386.28 | 17565.25 | 20123.40 | 24840.95 | 26386.28 |
| Germany | 13432.32 | 1515.86 | 12985.45 | 11473.37 | 16290.59 | 12416.83 | 12985.45 | 14909.08 | 16290.59 |
| Estonia | 3247.80 | 1781.68 | 2824.75 | 827.86 | 6164.79 | 1607.32 | 2824.75 | 4881.55 | 6164.79 |
| Ireland | 13090.24 | 4640.71 | 13639.83 | 5989.98 | 23920.88 | 8794.45 | 13639.83 | 16078.14 | 23920.88 |
| Greece | 8052.59 | 2171.50 | 8262.07 | 4558.18 | 11561.34 | 6142.76 | 8262.07 | 9913.41 | 11561.34 |
| Spain | 8161.66 | 2013.64 | 8165.96 | 5277.32 | 10691.43 | 6273.92 | 8165.96 | 9994.62 | 10691.43 |
| France | 14954.30 | 2624.28 | 14872.55 | 11229.61 | 18705.47 | 12498.11 | 14872.55 | 17402.70 | 18705.47 |
| Croatia | 4340.19 | 785.21 | 4839.42 | 2738.66 | 5096.84 | 3751.74 | 4839.42 | 4929.43 | 5096.84 |
| Italy | 11740.12 | 1772.56 | 12069.22 | 8153.80 | 13609.19 | 9894.98 | 12069.22 | 13398.85 | 13609.19 |
| Cyprus | 7276.03 | 2165.22 | 7958.26 | 3591.91 | 9932.27 | 5335.91 | 7958.26 | 9235.70 | 9932.27 |
| Latvia | 2533.21 | 1431.70 | 2102.08 | 592.87 | 4582.63 | 1354.73 | 2102.08 | 3827.72 | 4582.63 |
| Lithuania | 2547.48 | 1394.37 | 2154.20 | 488.23 | 4493.13 | 1406.16 | 2154.20 | 3894.13 | 4493.13 |
| Luxembourg | 27279.17 | 7696.53 | 28134.83 | 16432.70 | 38200.35 | 20002.06 | 28134.83 | 34971.27 | 38200.35 |
| Hungary | 3871.66 | 1337.51 | 4448.91 | 1811.99 | 5605.38 | 2366.33 | 4448.91 | 5030.58 | 5605.38 |
| Malta | 5606.50 | 1579.51 | 5436.53 | 2989.24 | 8840.45 | 4580.42 | 5436.53 | 6538.31 | 8840.45 |
| Netherlands | 14770.44 | 2914.43 | 14146.38 | 10567.75 | 18302.73 | 11866.00 | 14146.38 | 17975.79 | 18302.73 |
| Austria | 16028.83 | 2742.50 | 15791.68 | 12212.70 | 20267.90 | 13390.65 | 15791.68 | 18582.12 | 20267.90 |
| Poland | 3059.75 | 1150.24 | 2857.14 | 1343.96 | 4667.94 | 2044.46 | 2857.14 | 4337.73 | 4667.94 |
| Portugal | 6656.11 | 1611.21 | 7050.52 | 3869.70 | 8818.33 | 5323.99 | 7050.52 | 8131.39 | 8818.33 |
| Romania | 1539.31 | 939.89 | 1244.83 | 425.74 | 2867.35 | 696.97 | 1244.83 | 2477.20 | 2867.35 |
| Slovenia | 6786.14 | 1988.55 | 6563.88 | 3740.65 | 10506.06 | 5086.03 | 6563.88 | 8549.51 | 10506.06 |
| Slovakia | 3469.61 | 1726.32 | 2891.10 | 1370.35 | 6569.43 | 1970.63 | 2891.10 | 5245.82 | 6569.43 |
| Finland | 16154.52 | 3570.69 | 15440.43 | 12091.37 | 22029.87 | 12639.56 | 15440.43 | 19101.11 | 22029.87 |
| Sweden | 18633.34 | 2820.23 | 18042.38 | 14522.57 | 23762.75 | 16227.31 | 18042.38 | 20137.14 | 23762.75 |
| United Kingdom | 12417.36 | 2865.57 | 13281.22 | 6815.94 | 17059.51 | 10826.76 | 13281.22 | 14377.66 | 17059.51 |
| EU-28 | 9607.36 | 7106.66 | 8205.95 | 362.83 | 38200.35 | 4022.14 | 8205.95 | 14267.32 | 38200.35 |

Notes: the total government expenditure per inhabitant was calculated by dividing the total government expenditure as in mrd.euro to total population; the data on total government expenditure and on total population was provided by Ameco, 2016; for Croatia, data was available starting 2001.

**Table 5 Descriptive statistics of total government expenditure as share to GDP (% GDP) during 1995-2015**

| Country | average | stdev | median | min | max | q1 | q2 | q3 | q4 |
|---|---|---|---|---|---|---|---|---|---|
| Belgium | 51.66 | 2.46 | 51.24 | 48.24 | 55.82 | 49.51 | 51.24 | 53.93 | 55.82 |
| Bulgaria | 37.93 | 3.15 | 37.91 | 30.46 | 43.09 | 36.66 | 37.91 | 40.23 | 43.09 |
| Czech Republic | 42.86 | 2.80 | 42.50 | 39.95 | 51.81 | 41.04 | 42.50 | 43.16 | 51.81 |
| Denmark | 54.58 | 2.78 | 55.40 | 49.58 | 58.53 | 52.84 | 55.40 | 56.80 | 58.53 |
| Germany | 46.39 | 2.58 | 46.31 | 42.82 | 54.66 | 44.53 | 46.31 | 47.69 | 54.66 |
| Estonia | 37.85 | 3.03 | 37.97 | 33.57 | 46.05 | 35.18 | 37.97 | 39.53 | 46.05 |
| Ireland | 38.38 | 7.68 | 35.89 | 30.88 | 65.65 | 33.38 | 35.89 | 40.83 | 65.65 |
| Greece | 49.11 | 4.81 | 46.59 | 43.71 | 62.13 | 45.80 | 46.59 | 52.46 | 62.13 |
| Spain | 41.80 | 3.17 | 41.15 | 38.27 | 47.95 | 38.69 | 41.15 | 44.47 | 47.95 |
| France | 54.02 | 2.12 | 52.99 | 51.13 | 57.32 | 52.34 | 52.99 | 56.44 | 57.32 |
| Croatia | 46.76 | 1.28 | 47.06 | 44.72 | 48.83 | 45.40 | 47.06 | 47.67 | 48.83 |
| Italy | 48.85 | 1.96 | 48.31 | 45.50 | 51.80 | 47.24 | 48.31 | 50.78 | 51.80 |
| Cyprus | 38.36 | 4.20 | 38.63 | 30.82 | 48.68 | 34.45 | 38.63 | 41.44 | 48.68 |
| Latvia | 37.10 | 2.96 | 37.01 | 33.53 | 44.80 | 35.15 | 37.01 | 37.48 | 44.80 |
| Lithuania | 37.89 | 4.35 | 36.12 | 33.58 | 50.27 | 34.82 | 36.12 | 40.84 | 50.27 |
| Luxembourg | 41.84 | 2.35 | 41.63 | 37.61 | 46.03 | 40.20 | 41.63 | 44.01 | 46.03 |
| Hungary | 49.89 | 1.71 | 49.64 | 47.21 | 55.38 | 48.78 | 49.64 | 50.72 | 55.38 |
| Malta | 41.89 | 1.20 | 41.81 | 39.14 | 45.19 | 41.40 | 41.81 | 42.33 | 45.19 |
| Netherlands | 45.24 | 2.74 | 44.74 | 41.77 | 53.70 | 43.47 | 44.74 | 46.92 | 53.70 |
| Austria | 51.75 | 1.68 | 51.12 | 49.12 | 55.45 | 50.81 | 51.12 | 52.57 | 55.45 |
| Poland | 44.55 | 2.20 | 44.54 | 41.48 | 51.01 | 43.14 | 44.54 | 45.29 | 51.01 |
| Portugal | 46.07 | 3.21 | 45.32 | 42.45 | 51.82 | 43.15 | 45.32 | 48.53 | 51.82 |
| Romania | 36.13 | 2.45 | 35.52 | 32.95 | 40.95 | 34.34 | 35.52 | 38.34 | 40.95 |
| Slovenia | 47.17 | 3.89 | 45.83 | 42.19 | 60.27 | 44.91 | 45.83 | 48.56 | 60.27 |
| Slovakia | 43.29 | 4.77 | 41.97 | 36.13 | 53.09 | 39.91 | 41.97 | 45.63 | 53.09 |
| Finland | 52.82 | 4.54 | 52.36 | 46.80 | 61.05 | 48.52 | 52.36 | 56.20 | 61.05 |
| Sweden | 53.86 | 3.75 | 52.78 | 49.65 | 63.51 | 51.35 | 52.78 | 54.37 | 63.51 |
| United Kingdom | 42.68 | 3.56 | 42.75 | 37.82 | 49.60 | 40.02 | 42.75 | 44.96 | 49.60 |
| EU-28 | 45.01 | 6.58 | 44.86 | 30.46 | 65.65 | 40.21 | 44.86 | 49.91 | 65.65 |

Source: Ameco, 2016.

**Table 6 Descriptive statistics for the dataset over 1995-2015**

| Statistics | G (mrd. RON) | GGDP (% GDP) | P (mrd.inhabitants) | GP (RON per person) | GDP (mrd RON) | GDPP (RON per person) |
|---|---|---|---|---|---|---|
| **average** | 117.93 | 36.13 | 0.02 | 5354.29 | 320.96 | 14579.92 |
| **median** | 96.10 | 35.52 | 0.02 | 4507.39 | 290.49 | 13625.39 |
| **st.dev.** | 92.12 | 2.45 | 0.00 | 4060.82 | 247.14 | 10882.47 |
| **min** | 2.61 | 32.95 | 0.02 | 131.37 | 7.66 | 385.33 |
| **max** | 253.23 | 40.95 | 0.02 | 11164.83 | 712.83 | 31428.68 |

Source: Ameco