

RE-EXAMINATION OF WAGNER’S LAW FOR OECD COUNTRIES

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Abstract

This paper investigates the relationship between government spending and economic growth. Economic theory generally expects a negative relationship between these variables for rich countries with large public sectors. However, empirical studies often cannot find a robust negative relationship and have provided mixed empirical evidence. In the case of the relationship between public expenditure and economic growth it appears that specification of econometric methods, data selection and time span could affect the findings and lead to contradictory conclusions. This paper utilizes a panel of cross-sectional and time series data for 16 OECD countries over the 1995-2010 periods to reexamine the relationship between government spending and economic growth by conducting econometric panel study. We investigate the unit root properties and cointegration, long-run economic relationship, between government expenditure and economic growth to test the validity of Wagner’s Law. Our findings indicate that government spending exerts a positive and significant influence on economic growth and provide evidence for the validity of Wagner’s law.

KEY WORDS: Government expenditure, Economic growth; Wagner’s law; Panel unit root, Panel cointegration, OECD countries.

JEL CODE: C23, E62, H10, H50, O23.

1. Introduction

Economic theory does not give a clear prediction and empirical investigations provide conflicting findings about the relationship between government expenditures and economic growth. The role of the government size on economic growth is obviously an important research area.

From an income accounting perspective, it is possible to claim that higher government expenditure might impede investment and private consumption, and so has negative impact on economic growth rate. However, it is generally accepted that even a big portion of government consumption expenditure, such as education and health care, in fact contribute to economic growth especially in the long run. On the other hand if government expenditure is in expense of private consumption, it is hard to claim that government expenditure is detrimental for investment. Some functions of government, such as judicial system, resolve social and economic problems and help economic growth. So income accounting perspective has several points under discussion.

Modern economics is based on the ideas of Adam Smith who stresses the virtue of free market. According to this tradition free market is the best solution for many economic problems and best way to prosperity and economic growth. This idea has been supported by several economists including some Nobel Prize winners. According to them a large public sector leads to inefficient market system, bureaucracy and corruption. Overspending of government also leads to crowding out effect which reduces capital accumulation of the economy in the long-run. This results stem from the ideas that government is inefficient, unproductive and regulatory process is costly. Also, if government constitutes a big portion of the economy this will have adverse economic impacts, such as fiscal deficit and higher interest rates, and dampen economic stimulus. This economic tradition is the foremost supporter of deregulation, privatization and market economy.

The model developed by Arrow and Kurz [1] is an important contribution to the literature on the relationship between fiscal policy and the economic growth. The model is based on neoclassical economic tradition so according to this model government expenditure can only affect transitional growth rate, however steady-state growth rate is

determined by other factors. Model claims that both private consumption and public capital stock provide utility for consumers. On the other hand, capital stock is beneficial for private production as well. Later several papers have elaborated the impact of government expenditures on economic growth in the basic neoclassical growth model framework [among others, 2, 3].

On the other hand, traditional Keynesian macroeconomics approaches government expenditure much different from neoclassical tradition. According to them government spending first increases aggregate demand and then will have much broader impact on the economy with the help of multiplier. So government expenditure contributes economic growth and decreases unemployment rate. Also government has several functions those contribute economic growth. Government solves conflicts between parties and establishes a peaceful economic and social environment which is important for healthy growth of an economy. So Keynesian tradition is prone to assign a critical role to the government in the economic development and smooth functioning of the economy. Public sector is also important for provision of goods and services, externalities and can help to reach optimal investment level and creates synergy between sectors of the economy. Government functions can be complementary of private sector and also establish market creating institutions.

Structuralist approach [among others, 4, 5] stresses on structural properties of countries those differ in developed and less developed ones. Economic development and growth rates are largely based on these characteristics of the economies. Free market believers typically think that structural properties change due to internal dynamics of the society and economy. However, others believe that government action is necessary to change these characteristics and so to enhance economic growth. According to Structuralist School under some conditions, higher government spending could contribute economic growth [6].

Endogenous growth models link public expenditure to long-term economic growth. However, there no generally accepted endogenous growth model that explains this relationship and different models come up with different set of variables to explain economic growth. Some models claim that private and social returns of investment diverge [7, 8]. According to this type of model social returns to scale could be constant and even increasing due to spillovers and externalities. Some endogenous models take into account government size while investigating government spending policies and economic growth relationship. So these models could be seen as helpful guidelines for empirical research on the determinants of economic growth and have motivated several studies.

Some growth models link economic development and growth to some exogenous factors such as technological progress [8] and population growth [9] and assume constant or increasing returns [10, 11]. To explain economic growth [12] uses a model that does not incorporate externalities. This model assumes that decisions of free market are Pareto optimal and return to private capital is constant.

To summarize it can be argued that there has been an ongoing theoretical debate on the relationship of government sector and economic growth. Well known Wagner's Law claims that government spending enhances economic growth. This Law implies that government services such as judiciary, education, health and infrastructure contribute long term economic growth. On the other hand government spending is income elastic which indicate that government sector enlarges in parallel with economic development. Wagner's Law has been on the center of several economic researches that investigate determinants of economic growth. Empirical investigations which have been conducted to test validity of Wagner's Law usually provide contradictory findings. This paper claims to test this Law by using long span panel data of 16 OECD countries.

The remainder of this paper is organized as follows: Section 2 summarizes the prior empirical results on this topic. Section 3 introduces panel data analysis. Section 4 describes data and the econometric methods used in the paper and discusses the empirical results. Section 5 gives our concluding remarks.

2. Literature Review

The relationship between government activity and economic growth has been elaborated in the literature extensively however, the empirical findings remain controversial. Barro [13] uses an endogenous growth model which assumes a positive relationship between the share of government spending in GDP and economic growth to investigate this relationship. His one-sector endogenous growth model analysis the affect of infrastructural expenditure on economic growth and assumes constant returns to capital. Model claims that government expenditure is productive and complementary to private sector and if public services are incorporated to the model as inputs, a positive relationship between government spending and economic growth arises. Faig [14] employs human capital-driven growth model of Lucas [10] to reveal the relationship between government sector and economic growth. His findings imply that temporary government spending has temporary effect on growth; however permanent shocks have no effect. His results are compatible with those of Hall [15] and Barro [16]. Barro [17] reexamines this relationship by using a large cross-section of data and finds that large government sector enhances economic growth. This result has been shared by several researchers including Engen and Skinner [18], Grier [19]. However, empirical findings those provided by others [e.g. 20] indicate that there is no relationship between government sector and economic growth. On the contrary Landau [21, 22] asserts that there is a negative relationship between government size and

growth of per capita income.

A number of studies have investigated the relationship between particular components of government expenditure and economic growth but most of them are not based on robust theoretical framework [23]. Later researches aroused from theoretical models have been conducted as well [24]. These empirical works are mainly interested in productivity of US government expenditures and obtain results those are far from consensus. Grossman [25] claims that government can contribute economic growth by providing several services such as national defense, judiciary and establishing necessary framework for a healthy economic system. Also government can increase productivity and so contribute economic growth by banning harmful practices those may have detrimental effects on the social system and the economy. Taylor [26] stresses on the complementary characteristic of government sector. Government spending can stimulate private sector and enhance economic growth. Rodrik [27] asserts that a sizeable government sector can be a kind of insurance against the potential risks of excess open economy. Shleifer and Vishny [28] do not share this view and claim that larger government is detrimental for economic growth because government sector is inefficient, has crowding out affect and so lowers the productivity.

Several researchers implicitly assume that all government investment is productive. However, others classify government expenditure as productive and unproductive and find a negative relationship between government consumption and economic growth [e.g. 29]. A major finding of these studies is that output growth is negatively correlated with the share of government consumption in GDP. Devarajan and Vinaya [30] claim that there is a negative and insignificant relationship between productive expenditure and growth. Lin [31] investigates the impact of nonproductive spending and obtains different results for developing and developed countries. Nonproductive spending of government enhances economic growth in developing countries, in contrast to developed ones. Relative size of the government is another concern put forward by researchers. Slemrod [32] claims that above a certain threshold government expenditure will detriment economic growth. Barro [17] also classifies government expenditure as productive and unproductive. According to him unproductive governmental spending has detrimental effect on economic growth. On the other hand affect of productive government expenditure on growth largely depends on the expenditure ratio and government policy. So positive affect of government spending and complementary role of government for the market economy only can be observed under some circumstances. Albeit there is no consensus on this topic, it can be claimed that generally literature suggests a positive relationship between government infrastructure investment and growth and negative relationship between government consumption and growth.

Ram [33] and Grossman [25] do not disaggregate the government spending and provide evidence for positive relationship between this variable and economic growth. Hansson and Henrekson [34] use disaggregated data as well. The empirical findings of this research show that government transfers and consumption have negative effect on growth, however educational spending enhances private productivity growth. On the other hand many researchers believe that type of government spending could affect the finding about this relationship so expenditures should be disaggregated according to some criteria to analyze the affect of each different spending class. Diamond [23] investigates affect of social and infrastructure expenditure on economic growth and concludes that both of them have positive contribution in the short-run. However, capital expenditure is detrimental to economic growth. Ghali [35] tests government impact on economic growth and cannot obtain any consistent evidence.

To reveal the relationship between government expenditure and growth, different kinds of data have been utilized. Most of the empirical researches employ cross-section analysis. This analysis use time series data for a number of countries. Generally these works can find positive relationship between government spending and growth, however there are some controversial findings as well. Kormendi and Meguire [36] investigate the role of government consumption expenditures by using data of 47 countries those cover roughly 20 year periods. They are unable to find any meaningful relationship between variables investigated. Grier and Tullock [37] reexamine this relationship with the help of very big set of data that includes roughly 5-year interval data of 115 countries. In contrast to Kormendi and Meguire [36], for most of the OECD countries their results indicate negative relationship between economic growth and the growth of the government share of GDP. Cross sectional analysis of Landau [21] that use time series data of 104 countries demonstrates consistent evidence for significant negative relationship between growth rate and government consumption expenditures. This result is supported by study of Barth and Bradley [38] that utilizes data of 16 OECD countries for 1971- 1983 periods. Gwartney et al. [39] find that OECD countries with larger government have slower growth rate in comparison to other OECD countries. Multivariate cointegration analysis of Ghali [40] provides evidence for positive relationship between government size and economic growth for OECD countries.

Some economic and financial variables tend to move together and this property of variables affects the result of econometric analysis. Cointegration analysis can be used to reveal long run relationship between government expenditure and economic growth. Ansari et al. [41] employ Granger and Holmes-Hutton tests and cannot find any evidence for long-run relationship between government expenditure and national income of Ghana, Kenya and South Africa. Courakis et al. [42] obtain some evidence for long run relationship between these variables for Greece and

Portugal. Chletsos and Kollias [43] support the finding of Courakis et al. [42] for only military expenditures in Greece.

Some studies [e.g., 33] assume an inverted-U relationship between government expenditure and economic growth. For this group of research government size is matter. Non-linearity has been taken into account by several researcher as well [among others, 2, 44]. According to these studies the sign of the affect of government size on economic growth could change in associated with government size. Generally for larger government size, affect of government spending on economic growth tend to turn negative. This reversal sign can be explained by some problems such as bureaucracy, inefficiency, crowding out effect that arises as a consequence of very large government sector.

Famous Wagners’ Law [45] states that relative importance of public sector increases when per capita income rises depending on technological, institutional and political changes. It also asserts that government size tends to get larger with the level of income. This implies that government income elasticity is greater than one. Musgrave [46] developed a testable hypothesis for Wagner’s hypothesis of “expanding state activity and his formulation indicate positive correlation between the shares of public expenditure in the economy and income per capita”. A number of studies have been conducted to test this hypothesis in terms of Musgraves formulation [among others, 47, 48]. Empiric investigations of Wagner’s Law have utilized from different statistical methods, used different measures of government expenditures and obtained different findings. Henrekson [49] cannot find any evidence for Wagner’s Law using the Swedish data, however in contrast to this study Akitoby et al. [50] provide evidence by employing co-integration method to a sample of 51 developing countries. Abu-Bader and Abu-Quar [51], Halicioglu [52] and Dritsakis [53] provide evidence for Wagner’s Law by employing Granger causality test. In general for developed countries there are more evidences in favor of Wagner’s Law in comparison to developing ones.

Different studies could reach different and sometimes controversial conclusions with respect to relationship between government spending and economic growth. This may be attributed to several factors such as sample selection and measurement of government spending [54]. Also specification of econometric models could cause obtaining different evidences.

3. Panel Data Methodology

Selection of data type is an important aspect of empirical economic investigation and specification of econometric models is largely depending on data type. Many studies those test the relationship between government expenditure and economic growth prefer to use country-specific or cross-sectional data. This type of data ignores the affect of time which may make the analysis biased or sample specific. Cross sectional studies that employ long span data might suffer from several intrinsic problems as well. Some of them can be listed as simultaneity problem [54], endogenous selection of tax policy, inefficiency due to discretion of information on within-country variation. On the other hand time-series econometrics take into account the affect of time, but if the data is constitute a small number of countries, findings might be of limited use. Henrekson [49] asserts that earlier findings of time-series studies may be spurious because they did not pretest the stationarity properties of the data. To overcome the problems mentioned above researchers began to use panel data and classify panels based on regions or income levels. Panel data analysis can increase the power of the test and more robust findings can be obtained.

Panel data can be defined as a combination of cross-section and time series data. So with the help of this data a cross-sectional unit can be surveyed over time which means that both space and time dimensions can be observed. Panel data have several advantages over cross-section or time series data. Panel data can take heterogeneity explicitly into account and give “more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency”. Also pane data is “better suited to study the dynamics of change” [55]. So by using panel data techniques econometric analysis can be enriched.

Functional representation of panel data analysis can be represented as in equation (1):

$$\begin{aligned}
 Y_{it} &= \alpha + \beta_{it} X_{it} + \mu_i + \gamma_t + e_{it} \\
 i &= 1, 2, \dots, N \\
 t &= 1, 2, \dots, T
 \end{aligned}
 \tag{1}$$

Recent studies have popularized panel cointegration based analysis of relationship between government spending and GDP growth. Alike other cointegration methods in order to conduct panel cointegration analysis variables of interest have to contain a unit root. Econometric modeling requires knowledge on the stationary properties of variables. It is a standard approach to apply unit root test in order to reveal integration properties of series. Most studies employ five famous univariate unit root test, namely ADF [56], PP [57], KPSS [58], DFGLS [59] and NP [60], to test unit root. However, it is widely accepted that univariate unit root tests, especially traditional ADF-PP-KPSS tests, have low power. This problem becomes more severe for small samples. One method to overcome this problem is to employ panel data unit root tests. This approach pools the information from both time-series and cross-sectional dimensions which makes the test more powerful. There are several panel data unit root

tests, among others Levin et al. [61] test, feasible generalized least squares (FGLS) test [62] and the t-bar test [63], those aim to utilize extra power this technique. These panel unit root tests have been applied to a range of macroeconomic variables [64, 65].

If it is confirmed that the variables of interest have unit root the second step will be to examine whether these series are cointegrated. To distinguish long-run affect from the short-run, which can be revealed by panel cointegration analysis, is especially important for policy formulation. Cointegration between two or more series implies that these series move not apart from each other in the long-run and so short-term deviations from this relation will disappear ultimately. However, non-stationary series which are not cointegrated could move apart from each other even in the long-run. In this paper, we re-examine the relationships between government expenditure and economic growth by undertaking panel unit root and panel cointegration methods.

4. Data and Empirical Findings

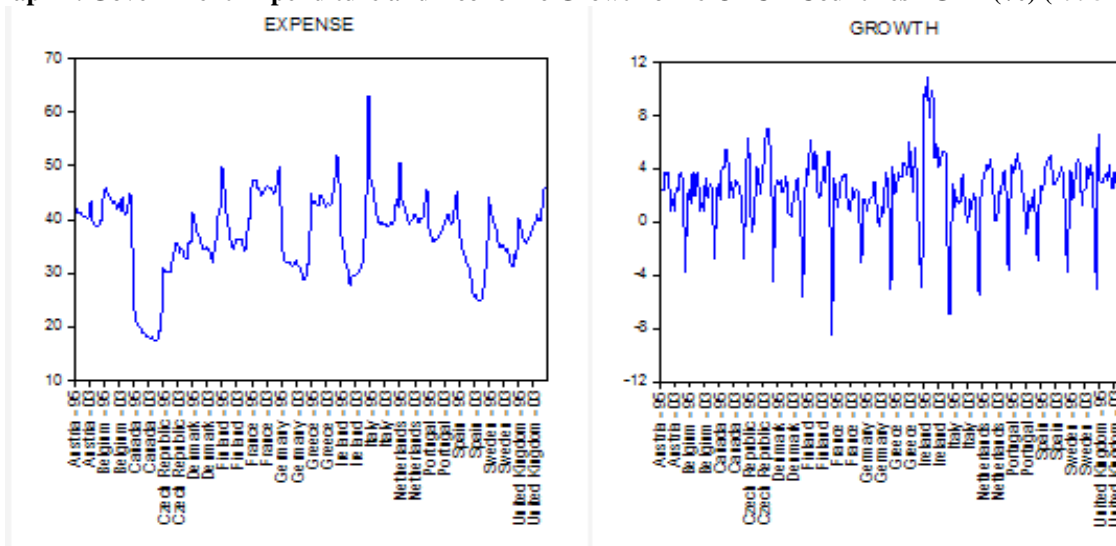
4.1. Data

Data selection is important to obtain robust evidence on validity of Wagner’s Law. Indeed, there are several differences between rich and poor countries those may affect the results of analysis. Tax rates and tax regimes, which are important determinants of economic growth, are different in developed and developing countries. Also composition of government spending of rich countries differs from developing ones. This difference is more prominent for schooling and infrastructure which have positive effects on economic growth. So Slemrod [32] claims that it is better to restrict the empirical analysis with rich countries. Grier and Tullock [37] show that OECD countries and others have different set of coefficients which imply that to pool these two class of countries might result biased findings. We use panel data of 16 OECD countries, namely Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Holland, Portugal, Spain, Sweden, and U.K. for 1995-2010 periods. Both our annual GNP and government expenditure data are from World Bank data base. Using a panel of 16 OECD countries over the period 1995-2010, we investigate the non-stationarity and cointegration properties between government expenditure and economic growth.

4.2. Relationship between Expenditure and Growth

Graph one shows annual GNP growth and share of government expenditure in GNP of 16 OECD countries investigated. This simple relationship reveals a similar pattern for these two series which lead us to search the topic with the help of advanced econometric methods.

Graph 1. Government Expenditure and Economic Growth of 16 OECD Countries– GDP (%) (1995 - 2010)



4.3. Panel unit-root tests

Before implementing the panel cointegration tests, panel unit-root tests are conducted to investigate whether the variables of interest have unit root. Six versions of panel unit root tests; LLC [66, 67], IPS [63], ADF [56], PP [57], Breitung and Meyer [68], and Hadri [69]; with the same null hypothesis are employed. Table 2 reports the findings of unit root tests for government spending. LLC, IPS, ADF, PP and Breitung panel unit root tests reveal that the variable of interest have unit root, however, Hadri test suggests otherwise. Our findings show that government expenditure has also unit root.

Table 1. Panel Unit Root Test Results for Government Expenditure

Test	Test Stat	Prob
Levin, Lin & Chu t*	0.74253	0.7711
Breitung t-stat	5.33358	1.0000
Im, Pesaran and Shin W-stat	2.61588	0.9956
ADF - Fisher Chi-square	24.0761	0.8416
PP - Fisher Chi-square	34.0309	0.3701
Hadri Z-stat	9.11732	0.0000
Heteroscedastic Consistent Z-stat	7.51644	0.0000

4.4. Panel Cointegration Tests

Panel unit root tests can find evidence for unit root in the series investigated. To test potential cointegration between series we first employ Pedroni [70] panel cointegration test. Pedroni offers 7 test statistics, namely panel v-stat, panel rho-stat, panel PP-stat, panel ADF-stat, group rho-stat, group PP-stat, group ADF-stat. Hypothesis of Pedroni test are given below:

H_0 : No cointegration

H_1 : Cointegration

The results for government expenditures are reported in Table 3. Five test stat out of seven imply that cointegration exist between the variables investigated which provides an evidence for validity of Wagner's Law.

Table 2. Pedroni Cointegration Test Results

	Test Stat	Prob
Panel v-Stat	2.350134	0.0952
Panel rho- Stat	-2.959327	0.0002
Panel PP- Stat	-4.795423	0.0000
Panel ADF- Stat	-4.419682	0.0000
Group rho- Stat	-1.439610	0.0750
Group PP- Stat	-5.244019	0.0000
Group ADF- Stat	-5.457937	0.0000

To tackle sensitivity problem, this may arise as a result of country selection or econometric specification cointegration, re-examined by employing Johansen-Fisher panel cointegration test [71]. The results are reported in Table 3. Johansen-Fisher panel cointegration test confirms previous finding and supports the validity of Wagner's Law. Both cointegration tests show that government expenditure and economic growth are expected to move together in the long run.

Table 3. Johansen-Fisher Cointegration Test Results

Hypothesized No. of CE(s)	Fisher Stat (trace test)	Prob Value	Fisher Stat (max-eigen test)	Prob Value
None	116.5	0.0000	79.75	0.0000
At most 1	101.2	0.0000	101.2	0.0000

4.5. Fixed Affect Panel Data Estimation

The next step of panel data estimation is to investigate whether cross-section and period affects can be

explained by fixed affect or random affect model. Fixed effect model assumes that slope coefficient is fixed however intercepts can differ from country to country or/and over time. According to this model there are differences between countries. If constant changes only over time but not cross-sectionally this model will be named as one way fixed affect model, otherwise model will be named as two way fixed affect model. Generally one way fixed affect model is preferred by researchers [72]. Specifications of these models are given below:

$$Y_{it} = (a_{it} + \mu_i) + \beta_{lit} X_{lit} + \dots + \beta_{kit} X_{kit} + e_{it} \tag{2}$$

$$Y_{it} = (a_{it} + \mu_i + \lambda_t) + \beta_{lit} X_{lit} + \dots + \beta_{kit} X_{kit} + e_{it} \tag{3}$$

Random effect model is an alternative to fixed effect model. Random affect model can be described as a model that has a random constant term [73]. ‘Under the random effects model, the intercepts for each cross-sectional unit are assumed to arise from a common intercept α (which is the same for all cross-sectional units and over time), plus a random variable that varies cross-sectionally but is constant over time’ [74]. Specification of both one and two way random affect models are presented below:

$$Y_{it} = a_{it} + \beta_{lit} + X_{lit} + \dots + \beta_{kit} X_{kit} + (\mu_i + v_{it}) \tag{4}$$

$$Y_{it} = a_{it} + \beta_{lit} + X_{lit} + \dots + \beta_{kit} X_{kit} + (\mu_i + v_{it} + \lambda_t) \tag{5}$$

We think that to employ fixed affect model for OECD countries is sensible. Our fixed effect panel model allows for different intercepts across countries investigated, however assumes that effects do not change over time. Results of fixed effect model are reported in table 4. According to this table we can assert that government expenditure affects economic growth.

Table 4. Fixed Affect Panel Data Estimation

	Coefficient	SE	T-Stat	Prob
C	7.979502	1.211576	6.586049	0.0000
EXPENSE	-0.150340	0.032407	-4.639152	0.0000
R2: 0.191851 DW: 1.576128 F Stat (Prob): 7.569555 (0.000)				

4.6. Likelihood Ratio Panel Heteroskedasticity and Wooldridge Tests

In order to have more robust findings we investigate whether there is heteroskedasticity or autocorrelation problem. To test for heteroskedasticity and autocorrelation at fixed effect model LR panel heteroskedasticity test [73] and Wooldridge test for autocorrelation in panel data [75] are used respectively. Hypothesis for these tests are below:

H₀: Heteroskedasticity and autocorrelation problems exist

H₁: Heteroskedasticity and autocorrelation problems don't exist

The results shown in table five indicate that null hypothesis can be rejected. These findings imply that no heteroskedasticity or autocorrelation problem exist in the model.

Table 5. LR Heteroskedasticity and Wooldridge Autocorrelation Test Results

Test	Test Stat	Critical Value
LR Heteroskedasticity Test	28.14	37.65
Wooldridge Autocorrelation Test	1.08	4.33

5. Conclusion

The role of government for economic development and growth has been investigated by numerous researchers and Wagner’s law has been examined by employing several econometric tests in the past few decades. In the case of the relationship between public expenditure and economic growth it appears that specification of econometric methods, data selection and time span could affect the findings and lead to contradictory conclusions. So it can be claimed that this body of evidence are far from consensus.

By addressing the within-country variation by means of panel regressions and limiting the analysis with developed countries, it is possible to obtain more robust findings. To this aim, we utilize econometric panel study on a sample of 16 OECD countries covering the 1995-2010 periods.

First stationary properties of the series are analyzed with the help of 6 different panel unit root test and for both of the series 5 test out of six conclude that series have unit root. Then to test cointegration relationship between variables two well-known panel cointegration tests are applied. Both of these tests reveal that the variables of interest are cointegrated. Our analysis also confirms that fixed affects model is sensible for our analysis. We also apply LR panel heteroskedasticity test [73] and Wooldridge test for autocorrelation in panel data [75] to test for heteroskedasticity and autocorrelation. Results show that no heteroskedasticity and/or autocorrelation problem exist.

Our results indicate a robust positive relationship between government expenditure and economic growth in 16 OECD countries and provide evidence for validity of Wagner’s Law. However, while interpreting our result and

suggesting any economic policy other factors have to be taken into account. Especially for the last two decades government debt burden has become a major threat for some developed countries. High debt ratios of the governments make the economies more fragile and countries become prone to financial crisis. So our results shouldn't be taken as a simple 'the bigger is the better' principle. All aspects of government expenditure need to be elaborated in depth.

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