A Synthesis of Empirical Research on the Validity of Wagner's Law

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Abstract

In this paper we provide a synthesis of empirical research in the validity of Wagner's law of the existing literature for the period 1969-2014. Wagner's law attracted the interest of many authors and is still being discussed by policy makers and economists in relation to government spending expansion since it was applied by Adolph Wagner in the 1880s. There are two different hypotheses about the expansion of state activity. Firstly, the size of government activity is tested in endogenous growth models, while the second suggest that the economic activity is exogenous to the economic growth (Keynesian view). Additionally, we will present the previous empirical work in this topic. Since the translation of Wagner's "law" in 1950's, a large number of authors tested various specifications of the law. These studies used both time series and panel data sets and empirically examined the law for a single country and for a group of countries (multi-country studies). Furthermore, there are studies using data on government expenditure at the provincial or state level. Existing studies in this topic vary in the country selection. They used data for developed, developing countries or group of both, while most of them examined developed or industrial countries. Finally, there are studies examined the Wagner's against Keynesian hypothesis. All these studies found different empirical results: support, no support or mixed results. Conflicting findings in this field are not surprising because of the diverse theoretical predictions and also because countries may be at different stages of economic development; thus, the debate about the relationship between government spending and economic growth remains an unresolved issue.

Keywords: Wagner's' Law, Causality Tests, Greece, Long Run Time Series Analysis

JEL Codes: A10, E6, H3, H4, I3, N1

Introduction

The relationship between government spending and national income is very important for many economic and policy issues. Nowadays European Countries are in recession and government authorities have to stimulate their economies through extra fiscal measures. The government

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spending and national output relationship is also crucial for the sustainability of public deficits, thus the detection of this relationship will provide a theoretical and empirical framework which can be used in order for governments to succeed in the budgetary objectives. As we mentioned, the relationship between government spending and economic growth is one of the most debated issues among economists during the last decades (Bird, 1971; Musgrave, 1969;Courakis et al.,1993; Gandhi, 1971; Oxley, 1994; Mann, 1980; Lin, 1995; Paparas et al., 2015a; Paparas et al., 2015b; Paparas and Richter, 2018; Richter and Paparas, 2013b). It is an old issue of classical economics and many economists (Landau 1983, Barro and Sala-I-Martin, 2004; Folster and Henrekson, 2001) claimed that the growth of government spending has a significant negative impact on economic growth of a country and the state activities are required to be kept on the least possible.

Many studies have investigated the relationship between government spending and economic growth across countries (Kolluri and Wahab, 2007; Shelton, 2007; Karagianni et al., 1998). A strand of literature examined the determinants of the size of government by focusing on alternative explanations such as per capita income (Borcherding, 1985) or focusing on the relative price of government provided goods and services (Baumol, 1967), on demographic factors (Heller and Diamond 1990), or the size (Alesina and Wacziarg,1998) or finally the degree of openness of the economy. Another branch investigated the relationship between expenditure and economic growth over time (some studies focused on the description of long-run tendencies). Finally other studies (Bird, 1971; Georgakopoulos and Loizides, 1994) attempted to estimate the elasticity of government expenditure with respect to output and tried to find evidence of the empirical test called “Wagner’s law”, the hypothesis that government spending increases more than proportionally with higher economic activity.

One reason of having this study is the extensive debate among economists involving the impact of government spending and taxation on economic growth across different countries. Focusing on the relationship between government spending and economic growth we will examine studies that investigated the validity of Wagner’s law. If the law is valid, it will allow the government authorities to reduce the government spending. Therefore, the budget deficits will be reduced and the expanding role of the private sector in the economy will be promoted. On the other hand, if government spending has a significant impact on growth, government authorities and policy makers have to recognize the crucial role of spending on economic growth.

There have been several studies, including some meta-analyses, of the macroeconomic effects of various government spending categories, including government consumption, military, education, infrastructure and total government expenditure (see, e.g.,Alptekin and Levine, 2012;Awaworyi Churchill et al., 2017; Bergh and Henrekson, 2011;Nijkamp and Poot, 2004); but unpredictably, much less research has been done on the validity of Wagner’s Law. To the best of our knowledge, this paper is the first to provide a detailed empirical synthesis of the validity of Wagner’s law.

Poot (2000) made a synthesis of the 1983-98 published literature on the empirical evidence regarding the interaction between government policies and growth. He suggested that a better link with current theories will be obtained when parameter calibration methods for micro-foundations based models replace parameter estimation of regression models with ad hoc specifications. Better data are needed at the regional macro and meso levels to complement the currently available pooled cross-section time-series country data. The potential endogeneity of government fiscal variables can be resolved through the selection of appropriate instrumental variables, such as those that arise in cases of "natural experiments".

Conflicting findings in this field are not surprising because of the diverse theoretical predictions and also because countries may be at different stages of economic development; thus, the proportion of GDP spent on government spending may vary over time and between countries. In addition, model specification as well as estimation methods differ between studies. Thus, the debate about the relationship between government spending and economic growth remains an unresolved issue.

Versions of Wagner's law

According to Dutt and Ghosh (1997), Wagner did not present any mathematical form in order to examine his hypothesis and he also was not explicit in the formulation of his hypothesis. However, there are several versions that tested the Wagner's hypothesis and the most important of them are the followings: Peacock and Wiseman(1961), Gupta (1967), Goffman (1968) , Goffman and Mahar (1971), Pryor (1969), Musgrave (1969), Mann (1980) and finally Florio and Colautti (2005). These different interpretations include different measures of spending or national income and include different functional form of the relationship between state activity and income. Finally, they have different limits of the state activity, or they do not have any limits at all.

The first version was constructed by Peacock and Wiseman (1961), while subsequent authors made changes in their original form. None of the seven versions have included the regulatory activity in their analysis. Only Florio and Colautti (2005) recognized and attempted to analyse the limits of fiscal expansion. All versions, except Gupta (1967) and Florio and Colautti (2005), tested the linear relationship between spending and national income in levels or logs. Gupta (1967) presented a non-linear model because he believed that this provides enhanced explanations of the Wagner's hypothesis and it is easier to understand the relationship between spending and income over time across different countries.

Many authors however, recognise that the traditional formulation of the law is quite simplistic. Economic development is a very complex process and cannot be represented only from a single index; many factors (economic and non-economic) can affect the expansion of public activities. Some of these factors, such as technological advances, are qualitative in nature and therefore cannot be easily quantified. On the other hand some of them can be quantitatively introduced to the model by quantifiable variables or by dummies. Two very good examples that can be possible variables of long-run evolution of government activity are given by Georgakopoulos et al. (1992), such as population size and the political attitudes of the party in power.

A Synthesis of the empirical literature

Since the translation of Wagner's "law" in 1950's, a large number of authors tested various specifications of the law. These studies used both time series and cross-sectional data sets and empirically examined the law for a single country and for a group of countries (multi-country studies). Finally, there are studies using data on government expenditure at the provincial or state level. Existing studies in this topic vary in the country selection. They used data for developed, developing countries or group of both, while most of them examined developed or industrial countries. However, during the last 5 years there are an increased number of studies examining the case of developing countries from Africa and South Asia. Table 1 includes 113 studies that examined the Wagner's law containing information about: Name of author, year of publication, tested period, type of analysis,

type of methodology and main conclusion for the validity of the law. In the next section we will analyse the different methodologies, analyses and results.

Table 1: Survey in previous studies examined Wagner's Law

No	Author	Country	Time period	Type of Analysis	Methodology	Main results
1	Lall (1969)	46 developing countries	1962-1964	Panel data	Ordinary Least Squares	No support
2	Bird (1971)	Canada	1933-1965	Time series	Ordinary Least Squares	Support
3	Gandhi (1971)	25 African countries	1960-1965	Panel data	Ordinary Least Squares	No support
4	Goffman and Mahar (1971)	6 Caribbean countries	1940-1965	Time series	Ordinary Least Squares	No support
5	Thorn (1972)	52 countries	1952-1962	Panel data	Ordinary Least Squares	Support
6	Michas (1974)	Canada	1950-1961	Panel data	Ordinary Least Squares	Support
7	Wagner and Weber (1977)	34 countries	1950-1972	Time series	Ordinary Least Squares	No support
8	Man (1980)	Mexico	1913-1958	Time series	Ordinary Least Squares	Mixed results
9	Ghamdi (1983)	Saudi Arabia	1960-1981	Time series	Ordinary Least Squares	Support
10	Singth and Sahni (1984)	India	1950-1981	Time series	Ordinary Least Squares	No support
11	AbIzabeh and Gray (1985)	55 countries	1963-1976	Panel data	Ordinary Least Squares	Mixed results
12	Vatter and Walker (1986)	U.S.A.	1929-1979	Time series	Ordinary Least Squares	Support
13	Ram (1986b)	63 countries	1950-1980	Panel data	Ordinary Least Squares, Granger causality	Support
14	Afxentiou (1986)	Cyprus	1960-1982	Time series	Ordinary Least Squares	Mixed results
15	Ram (1987)	115 countries	1950-1980	Panel data	Ordinary Least Squares	Mixed results
16	Abizadeh and Yousefi (1988)	U.S.A	1950-1984	Time series	Ordinary Least Squares	Support
17	Kolluri et al. (1989)	6 countries	1960-1985	Time series	Ordinary Least Squares	Support
18	Nagarajan and Spears (1990)	Mexico	1950-1980	Time series	Ordinary Least Squares	Support
19	Khan (1990)	Pakistan	1959-1984	Time series	Ordinary Least Squares	Support
20	Gyles (1991)	U.K.	1946-1985	Time series	Ordinary Least Squares	Support
21	Georgakopoulos et al. (1992)	U.K.	1954-1983	Time series	Ordinary Least Squares	No support
22	Ram (1992)	OECD countries	1950-1985	Time series	Ordinary Least Squares	Support
23	Yousefi and Abizadeh (1992)	U.S.A. (30 states)	1950-1985	Time series	Ordinary Least Squares	Support
24	Bairam (1992)	OECD countries	1950-1985	Time series	Ordinary Least Squares	Mixed results
25	Henrekson (1993)	Sweden	1861-1990	Time series	Cointegration, Granger Causality	No support
26	Courakis et al. (1993)	Greece and Portugal	1958-1985	Time series	Ordinary Least Squares	No support
27	Murthy (1993)	Mexico	1950-1980	Time series	Cointegration, Granger Causality	Support
28	Murthy (1994)	Mexico	1950-1988	Time series	Cointegration, Granger Causality	Support
29	Ashworth (1994)	Mexico	1950-1988	Time series	Cointegration, Granger Causality	No support
30	Hayo (1994)	Mexico	1950-1980	Time series	Cointegration, Granger Causality	No support
31	Georgakopoulos and Loizides (1994)	Greece	1953-1991	Time series	Ordinary Least Squares	No support
32	Oxley (1994)	Britain	1870-1913	Time series	Cointegration, Granger Causality	Support
33	Koop and Poirier (1995)	86 countries	1960-1981	Panel data	Cointegration, Granger Causality	Mixed results

34	Hondroyiannis and Papapetrou (1995)	Greece	1951-1992	Time series	Cointegration, Granger Causality	No support
35	Nomura (1995)	Japan	1960-1991	Time series	Ordinary Least Squares	Support
36	Lin (1995)	Mexico	1950-1980,1950-1990	Time series	Cointegration, Granger Causality	Support
37	Dao (1995)	55 countries	1980-1991	Panel data	Ordinary Least Squares	Mixed results
38	Bairam (1995)	U.S.A.	1972-1991	Time series	Ordinary Least Squares	Mixed results
39	Payne and Ewing (1996)	22 countries	1948-1994	Time series	Cointegration, Granger Causality	Mixed results
40	Bohl (1996)	G7 countries	1850-1995	Time series	Cointegration, Granger Causality	Mixed results
41	Ferris and West (1996)	U.S.A.	1959-1989	Time series	Ordinary Least Squares	No support
42	Afxentiou and Serletis (1996)	6 European countries	1961-1991	Time series	Ordinary Least Squares, Granger causality	No support
43	Ahsan et al. (1996)	Canada	1952-1988	Time series	Cointegration, Granger Causality	Support
44	Abdel-Rahman and Barry (1997)	KSA countries	1970-1991	Time series	Cointegration, Granger Causality	Mixed results
45	Chletsos and Kollias (1997)	Greece	1958-1993	Time series	Cointegration, Granger Causality	Mixed results
46	Ansari et al. (1997)	3 African countries	1963-1990	Time series	Cointegration, Granger Causality	Mixed results
47	Sinha (1998)	Malaysia	1950-1992	Time series	Cointegration, Granger Causality	Mixed results
48	Abizadeh and Yousefi (1998)	South Korea	1960-1990	Time series	Ordinary Least Squares	Support
49	Karaggianni et al. (1998)	European Union countries	1949-1998	Time series	Cointegration, Granger Causality	Mixed results
50	Thornton (1999)	6 countries	1850-1913	Time series	Cointegration, Granger Causality	Support
51	Alleyne (1999)	4 Caribbean countries	1950-1997	Time series	Cointegration, Granger Causality	No support
52	Biswal et al. (1999)	Canada	1950-1995	Time series	Cointegration, Granger Causality	Mixed results
53	Asseery et al. (1999)	Iraq	1950-1980	Time series	Cointegration, Granger Causality	Mixed results
54	Demirbas (1999)	Turkey	1950-1990	Time series	Cointegration, Granger Causality	No support
55	Agorastos et al. (1998)	Greece	1980-1995	Panel data	Cointegration	Support
56	Kolluri et al. (2000)	G7 countries	1960-1993	Time series	Cointegration, Granger Causality	Support
57	Islam (2001)	U.S.A.	1929-1996	Time series	Cointegration, Granger Causality	Support
58	Al-Faris (2002)	Gulf cooperation council	1970-1999	Time series	Cointegration, Granger Causality	Support
59	Albatel (2002)	South Arabia	1964-1995	Time series	Cointegration, Granger Causality	Support
60	Chang (2002)	6 countries	1951-1996	Time series	Cointegration, Granger Causality	Mixed results
61	Dar and Amirkhalkali (2002)	OECD countries	1971-1999	Panel data	Generalized Least Squares	Mixed results
62	Chow et al. (2002)	U.K.	1948-1997	Time series	Cointegration, Granger Causality	Support
63	Legrenzi and Milas (2002)	Italy	1959-1996	Time series	Cointegration, Granger Causality	No support
64	Burney (2002)	Kuwait	1969-1994	Time series	Cointegration, Granger Causality	No support
65	Peters (2002)	4 countries	1948-1995	Time series	Cointegration	Mixed results
66	Bagdigen and Cetintas (2003)	Turkey	1965-2000	Time series	Cointegration, Granger Causality	No support
67	Halicioglu (2003)	Turkey	1960-2000	Time series	Cointegration, Granger Causality	No support
68	Florio and Colautti (2005)	5 countries	1870-2000	Time series	Ordinary Least Squares	No support
69	Al-Obaid (2004)	Saudi Arabia	1970-2001	Time series	Cointegration, Granger Causality	Support

70	Chang et al. (2004)	10 countries	1951-1996	Time series	Cointegration, Granger Causality	Mixed results
71	Dritsakis and Adamopoulos (2004)	Greece	1960-2001	Time series	Cointegration, Granger Causality	Support
72	Wahab (2004)	OECD countries	1950-2000	Panel data	Cointegration, Granger Causality	Mixed results
73	Iyare and Lorde (2004)	9 countries	1950-2000	Time series	Cointegration, Granger Causality	Mixed results
74	Dilrukshini (2004)	Sri Lanca	1952-2002	Time series	Cointegration, Granger Causality	No support
75	Al Hasoon (2005)	Gulf cooperation council	1975-2002	Time series	Cointegration, Granger Causality	Mixed results
76	Liu et al. (2005)	China	1979-2002	Time series	Cointegration, Granger Causality	No support
77	Ahmad and Ahmed (2005)	D-8 Countries	1973-2002	Time series	Cointegration, Granger Causality	Mixed results
78	Yuk (2005)	U.K.	1830-1993	Time series	Cointegration, Granger Causality	Mixed results
79	Loizides and Vamvoukas (2005)	Greece, U.K. and Ireland	1960-1995	Time series	Cointegration, Granger Causality	Mixed results
80	Dogan and Tang (2006)	Five South East Asian Countries	1960-2002	Time series	Cointegration, Granger Causality	No support
81	Ju Huang (2006)	China and Taiwan	1979-2002	Time series	Cointegration, Granger Causality	No support
82	Akitoby et al. (2006)	51 countries	1970-2002	Time series	Ordinary Least Squares, Cointegration	Mixed results
83	Sideris (2007)	Greece	1833-1938	Time series	Cointegration, Granger Causality	Support
84	Guerrero and Parker (2007)	U.S.A.	1792-2004	Time series	Cointegration, Granger Causality	Support
85	Shelton (2007)	100 countries	1970-2000	Panel data	Ordinary Least Squares	Mixed results
86	Rehman et al. (2007)	Pakistan	1972-2004	Time series	Cointegration	Support
87	Kolluri and Wahab (2007)	OECD and EU countries	1950-2000	Panel data	Ordinary Least Squares	Mixed results
88	Arpaia and Turrini (2008)	European and Monetary Union countries	1970-2003	Panel data	Cointegration	Support
89	Liu et al. (2008)	U.S.A.	1947-2002	Time series	Ordinary Least Squares, Granger causality	No support
90	Narayan et al. (2008)	China	1952-2003	Panel data	Cointegration, Granger Causality	Mixed results
91	Lamartina and Zaghini (2008)	23 OECD countries	1970-2004	Panel data	Cointegration	Support
92	Ghartey (2008)	Jamaica	1960-2005	Time series	Cointegration, Granger Causality	Support
93	Narayan et al. (2008)	Fiji Islands	1970-2002	Time series	OLS, Cointegration, Granger causality	Support
94	Samudran et al. (2009)	Malaysia	1970-2004	Time series	Cointegration	Support
95	Kumar et al. (2009)	New Zealand	1960-2007	Time series	Ordinary Least Squares, Cointegration	Support
96	Abul Kalam and Aziz (2009)	Bagladesh	1976-2009	Time series	Cointegration, Granger Causality	Support
97	Cavusoglou (2005)	Turkey	1923-2003, 1950-2003	Time series	Cointegration	No support
98	Babatube (2008)	Nigeria	1970-2006	Time series	Cointegration, Granger Causality	No support
99	Karaggianni and Pempetzoglou (2009)	European Union countries	1949-1998	Time series	Granger Causality	Mixed results
100	Yay and Tastan (2009)	Turkey	1950-2004	Time series	Cointegration, Granger Causality	Support
101	Tang (2010)	Malaysia	1960-2005	Time series	Cointegration, Granger Causality	Support
102	Katrakilidis and Tsaliki (2009)	Greece	1958-2004	Time series	Cointegration	Support
103	Dolenc (2009)	Slovenia	1992-2007	Time series	Ordinary Least Squares	Mixed results
104	Maggazino (2010b)	Italy	1960-2004	Time series	Cointegration, Granger Causality	Support

105	Maggazino (2010a)	European Union countries	1970-2009	Panel data	Cointegration, Granger Causality	Mixed results
106	Zheng et al. (2010)	China	1952-2007	Time series	Ordinary Least Squares	No support
107	Verma and Arora (2010)	India	1950-2008	Time series	Cointegration	Support
108	Afzal and Abbas (2010)	Pakistan	1960-2007	Time series	Cointegration, Granger Causality	No support
109	Iniguez-Montiel (2010)	Mexico	1950-1999	Time series	Cointegration, Granger Causality	Support
110	Abdullah and Maamor (2010)	Malaysia	1970-2007	Time series	Cointegration	Mixed results
111	Ighorado and Oriakhi (2010)	Nigeria	1961-2007	Time series	Cointegration, Granger Causality	No support
112	Pahlavani et al. (2011)	Iran	1960-2008	Time series	Cointegration, Granger Causality	Support
113	Oteng-Abayie (2011)	5 Sub-Saharan countries	1986-2004	Panel data	Cointegration	No support
114	Priesmeier and Koester (2012)	Germany	1960-2007	Time series	Cointegration, ECM	Support
115	Kesavarajah (2012)	Sri Lanka	1960-2010	Time series	Cointegration, Granger Causality	No support
116	Ageli (2013)	Saudi Arabia	1970-2012	Time series	Cointegration, ECM	Support
117	Mutuku and Kimani(2012)	Kenya	1960-2009	Time series	Cointegration, Granger Causality	Support
118	Menyah and Wolde-Rufael (2012)	South Africa	1950-2007	Time series	OLS	Support
119	*Richter and Paparas (2012)*	United Kingdom	1850-2010	Time series	Cointegration, Granger Causality	Support
120	Njimanted (2012)	Cameroon	1980-2012	Time series	Cointegration	No support
121	Permana and Wika (2013)	Indonesia	1999-2011	Time series	ARDL, GARCH	Support
122	Antoniou et al. (2013)	Greece	1833-1938	Time series	ARDL	Support
123	Alimi (2012)	Nigeria	1970-2012	Time series	Cointegration, ECM	Support
124	Bashirli and Sabiroglu (2013)	Azerbaijan	2001-2010	Time series	Bounds testing, ARDL	Support
125	Richter and Paparas (2013a)	Greece	1883-2010	Time series	Cointegration, Granger Causality	Support
126	Grenade and Wright (2014)	Selected Caribbean countries	1980-2011	Panel data	OLS, Granger causality tests	No support

The majority of studies examined the validity of Wagner's law published during the last 20 years. Interest for the Wagner hypothesis attracted the attention of many economists after the translation of the original work of Wagner by Cooke (1958), however the interest had declined at the end of 1970s. Although, the increased public spending in most countries, new development of econometric techniques, and the last translation of Wagner's work by Biehl (1998) attracted again the interest of many policy makers and economists.

Type of Analysis

There are two types of analysis used to examine Wagner's law validity, time series and panel data analysis. Studies using time series analysis examine the effect of the national income growth on the expansion of government expenditures over time for a particular country. The panel data analysis investigates the relationship between national income and government expenditures across different countries. Bird (1971) implied that studies using panel data in order to examine the validity of

Wagner's law are irrelevant, since a postulated change in the public sector happens over time. Henrekson (1993) used long-term data for the Swedish economy and claimed that the growth of public sector is a process occurring over time in a single country.

On the other hand, Michas (1975) argued that panel data analysis is more relevant because there is an examination of a number of countries and the law can be generalized. Gupta (1967) commented on the Peacock-Wiseman displacement effect hypothesis that they tested only the case of the United Kingdom, however, before making any generalizations they should also test the case of other countries. Wahab (2004) claimed that by including panel data analysis in his study he maximized sample size and increased the power of empirical tests. Ram (1987) suggested that most authors examining developing countries prefer panel data analysis since long-time series for these countries are unavailable. However, studies using panel data analysis in order to test developing countries and find evidence of positive relationship between national income and spending, does not necessarily mean that this country will have increased growth over time.

During the last decade many databases were created by the International Monetary Fund (IMF), European commission, OECD, International Financial Statistics (IFS), Penn World Tables (PWT). Slemrond (1995) stated that "the recent availability of a great quantity of comparable cross-country data, due to the work of Robert Summers and Allan Heston, stimulated revival of empirical studies on issues such as the determinants of growth." (Slemrod 1995, pp. 395). According to our review of the literature in this topic, the majority of previous studies have applied time series analysis. We can see in Table 2 that 106 out of 126 studies used time series analysis and accounted for almost 84.1% of the total studies. The studies that deployed panel data analysis are accounted for only 15.9 %. Finally, there are 3 studies using both of the analyses in order to examine the validity of Wagner's law (2.4%).

Table 2: Type of analysis used from previous studies

Type of analysis	Number of studies
Panel data	20
Time series	106
Total number of studies	126

Time series analysis

In this paper we identified that 106 out of the 126 empirical studies in the literature applied time series analysis in order to examine the validity of Wagner's law. A large proportion of these studies have tested the law for a single country, while only a few have examined a group of countries. In addition, while some of the studies using time series data examined developing countries, most have focused on developed and industrialized countries.

Panel data analysis

This type of analysis is applied to test a group of countries or to examine states or regions. Noticeably, this analysis covers a much wider range of countries in contrast to time series analysis. While time series analysis is mostly used in developing countries, this type of analysis is used mostly in groups of developing countries. In the introduction of this section we mention that the reason why this occurs is the unavailability of long data series or developing countries. There are several studies used panel data analysis in order to examine the case of group of countries or the states of a country.

Type of analysis and Empirical results

Among the 106 studies applied time series data, the majority of the studies (47%) found support of the validity of Wagner's law. The 30% of time series studies found that the law is invalid, while the mixed results accounted for about 23% and was the less frequent result. Among the studies applied Panel data analysis (20), the 50% of them had mixed results (across different countries or across different versions), 30% found support of the law and 20% found that the law is invalid. (Table 3).

Table 3: Type of analysis and empirical results

Row Labels	Panel data	Time series	Grand Total
Mixed results	10	25	35
No support	4	31	35
Support	6	50	56
Grand Total	**20**	**106**	**126**

States

In our revision of the existing literature that examined Wagner's law, three studies (Table 4) focused on the states or regions of a country by using panel data analysis and one using time series analysis. Yousefi and Abizadeh (1992) and Agorastos et al. (1998) supported Wagner's hypothesis, while Narayan et al. (2008) found mixed results. Narayan et al. (2008) presented also the advantages of a study that focuses on states.

Table 4: Studies that examined the Wagner's Law by focusing on states or regions

No	Author	Country	Time period	Type of Analysis	Main results
1	Yousefi and Abizadeh (1992)	U.S.A.	1950-1985	Time series	Support
2	Agorastos et al. (1998)	Greece	1980-1995	Panel data	Support
3	Narayan et al. (2008)	China	1952-2003	Panel data	Mixed results

Time span

The majority of previous studies used post World-War II data and tested periods less than 50 years. However there are several studies (Table 5) that examine long data sets for single countries or group of countries. One of the most important assumptions of original Wagner's hypothesis is that the tested country has to be in early stages of development, urbanisation and modernization. Hence, Wagner's law might be more applicable to newly industrialized and developing countries or developed countries by using data for the period between late 19th century and World War II. During this period we expect to find support of the law in most of the countries, since they transformed their economies from rural agricultural to urban industrial with increased demand for public services (infrastructure). However, focusing on empirical results of studies that used long series we realise that results are mixed and do not follow any common pattern.

Furthermore, one might expect that any examination of the validity of Wagner's hypothesis in a developed country for the period after the World War II will lead to results indicate no support of the law. This is because most of the developed countries would have less demand for public services, since there is a weak relationship between government spending and national income in high levels of

development and industrialisation. However, many studies on countries such as the U.K (Chow et al. 2002, U.S.A (Islam 2001) and other developed European Union countries (Maggazino 2010a) show supportive evidence of the validity of the law for the period after World War II.

Table 5: Studies examined Wagner's Law by using long data series

No	Author	Country	Time period	Type of Analysis	Main results
1	Henrekson (1993)	Sweden	1861-1990	Time series	No support
2	Oxley (1994)	Britain	1870-1913	Time series	Support
3	Bohl(1996)	G7 countries	1850-1995	Time series	Mixed results
4	Thornton (1999)	6 countries	1850-1913	Time series	Support
5	Florio and Colautti (2005)	5 countries	1870-2000	Time series	No support
6	Yuk(2005)	U.K.	1830-1993	Time series	Mixed results
7	Sideris (2007)	Greece	1833-1938	Time series	Support
8	Guerrero and Parker (2007)	U.S.A.	1792-2004	Time series	Support
9	Cavusoglou(2005)	Turkey	1923-2003, 1950-2003	Time series	No support
10	Richter and Paparas (2012)	U.K.	1850-2010	Time series	Support
11	Antoniou et al. (2012)	Greece	1833-1938	Time series	Support
12	Richter and Paparas (2013a)	Greece	1883-2010	Time series	Support

Studies examined the validity of the law by using long data sets used only time series analysis, the majority of them (58%) found support of the law , 25% found that the law is invalid and finally 17% of these studies had mixed results. We discussed in the previous section why the use of long data sets examining the law is more appropriate (Table 6).

Table 6

Row Labels	Mixed results	No support	Support	Grand Total
Time series	2	3	7	12
Grand Total	**2**	**3**	**7**	**12**

Methods

Among a large number of studies (Table 7) that examined Wagner's law for various countries, there have been used many methods of analysis. The most important of them are the following: ordinary least squares for stochastic modelling, cointegration approach for examining if there is any long run relationship between spending and national income and finally Granger causality tests for identifying the direction of the causality. The majority of the studies used recent econometric techniques such as cointegration analysis and Granger causality tests, while studies before 1985 mostly used Ordinary least squares method.

Table 7: Methods used to examine Wagner's Law

Method	Studies

Cointegration	18
Cointegration, Granger Causality	63
Generalized Least Squares	1
Granger Causality	1
OLS, Cointegration, Granger causality	1
Ordinary Least Squares	36
Ordinary Least Squares, Cointegration	2
Ordinary Least Squares, Granger causality	4
Total	**126**

OLS

Studies applied OLS mainly ignored the problems of spurious regression and their empirical results are based on non-stationary time series. On the other side, cointegration analysis overcomes this problem by examining the long run relationship between the tested variables and estimating the short run dynamics by an error correction model. When they find evidence of long run relationship they use Granger causality test to identify the direction of causality. Henrekson (1993) implied that studies used time series analysis and supported the validity of Wagner's law are likely to suffer from spurious regression, since they used OLS on non-stationary series. Courakis et al. (1993) made an assumption that the tested series are stationary and then applied the OLS, however their findings might be inaccurate.

Cointegration techniques (Johansen, Engle-Granger, Bound test)

The majority of the studies during the last decades used one of the cointegration approaches in order to examine the long run relationship between economic growth and government spending.In the past, some authors focused in the positive relationship between government spending and national income rather than on the direction of the causality. Peacock and Scott (2000) criticized previous studies testing Wagner's hypothesis empirically, state the consistency of the cointegration approach with Wagner's view. According to Peacock and Scott (2000) "Wagner does not present an articulated model of the growth process in which cause and effect are clearly delineated". pp.3.

Cavusoglou suggested that "However, the conventional cointegration techniques, such as Engle-Granger (1987) and Johansen (1988 and 1992) approaches, require the underlying time series data to be integrated of order one. The bounds testing approach outperforms the conventional techniques when there is the uncertainty of mixed order of integration resulting from the lack of power of unit root tests". pp.75.

Granger causality test

Finally, there are studies that used Granger causality tests in the short run dynamics error correction model and try to identify the direction of the causality between government spending and national income. In order to apply this test they have to establish an existence of a cointegrating vector. We have to mention that most recent studies apply Granger causality tests and the majority of them support or not support the law, there are only very few studies applied Granger tests and found mixed results.

Methodology and Empirical results

In table 8 we can see the relationship between the methodology applied to examine the validity of the law and the empirical results. Most of the studies before 1990s used OLS, while after 1990 the majority of the studies applied cointegration techniques and granger causality tests.

Table 8: Methodology and empirical results

Row Labels	Mixed results	No support	Support	Grand Total
Cointegration	2	3	13	18
Cointegration, Granger Causality	20	18	25	63
Generalized Least Squares	1			1
Granger Causality	1			1
OLS, Cointegration, Granger causality			1	1
Ordinary Least Squares	10	11	15	36
Ordinary Least Squares, Cointegration	1		1	2
Ordinary Least Squares, Granger causality		3	1	4
Grand Total	**35**	**35**	**56**	**126**

Methodology and Type of analysis

In table 9 we can see that the majority of studies used times series data, applied cointegration and granger causality analysis and accounted for about 69%. On the other side, 45% of studies applied panel data analysis included the OLS.

Table 9: Methodology and type of analysis

Row Labels	Panel data	Time series	Grand Total
Cointegration	4	14	18
Cointegration, Granger Causality	4	59	63
Generalized Least Squares	1		1
Granger Causality		1	1
OLS, Cointegration, Granger causality		1	1
Ordinary Least Squares	9	27	36
Ordinary Least Squares, Cointegration		2	2
Ordinary Least Squares, Granger causality	2	2	4
Grand Total	**20**	**106**	**126**

Results

There is a large volume of literature examined the validity of Wagner's law but there is no clear pattern on the empirical results (Table 10). There is a group of studies[3] that found supportive evidence of the validity of the law and accounted for about 44.4%. Their results suggest that there is a long run relationship between national income and public spending, furthermore there is causality runs from

[3] For instance: Gyles (1991), Oxley (1994) , Kolluri et al. (2000), Islam(2001) and Dritsakis and Adamopoulos (2004).

income to growth. There is another group of empirical studies[4] found evidence that do not support Wagner's hypothesis, and they accounted for 27.8%.

Table 10: Results of previous studies

Results	Number of studies
Mixed results	35
No support	35
Support	56
Total	**126**

The basic implications of the absence of a long-run relationship between government activity and economic development in a country are firstly the possible weak association between public activity and economic growth. Maybe because of the crucial role of other factors, which according to Legrenzi and Milas (2002) "the role of omitted variables in identifying a long-run equilibrium relationship ... "pp.435. Another implication may be the application of inappropriate measures of government spending or economic growth.

Mixed results

There is another strand of the literature found mixed results (Table 11) in the relationship between spending and national income and accounted for 27.8% of all studies. These studies used data from different countries and found positive relationship for some of them and different results for other ones[5]. Or they used different versions of the law for a specific country but some versions support the law and other has contradictory results[6].

Table 11: Studies with mixed results about the validity of Wagner's Law

1	**Man (1980)**	**Mexico**	**1913-1958**	**Mixed results**	**4 of 6 versions supportive**
2	Abizabeh and Gray (1985)	55 countries	1963-1976	Mixed results	Mixed results across group of countries
3	Afxentiou (1986)	Cyprus	1960-1982	Mixed results	4 of 6 versions supportive
4	Ram (1987)	115 countries	1950-1980	Mixed results	Mixed results across methodologies
5	Bairam (1992)	OECD countries	1950-1985	Mixed results	Mixed results across countries
6	Koop and Poirier(1995)	86 countries	1960-1981	Mixed results	Mixed results across countries
7	Dao (1995)	55 countries	1980-1991	Mixed results	Mixed results across different type of public spending
8	Bairam (1995)	U.S.A.	1972-1991	Mixed results	Mixed results across different type of public spending
9	Payne and Ewing (1996)	22 countries	1948-1994	Mixed results	Mixed results across countries
10	Bohl(1996)	G7 countries	1850-1995	Mixed results	Mixed results across countries
11	Abdel-Rahman and Barry (1997)	KSA countries	1970-1991	Mixed results	Mixed results across countries
12	Chletsos and Kollias (1997)	Greece	1958-1993	Mixed results	Mixed results across different type of public spending
13	Ansari et al. (1997)	3 African countries	1963-1990	Mixed results	Mixed results across countries
14	Sinha(1998)	Malaysia	1950-1992	Mixed results	Cointegration supportive, Granger against

[4] Henrekson (1993), Courakis et al. (1993), Hondroyiiannis and Papapetrou (1995), Ferris and West (1996), Legrenzi and Milas (2002)and Burney (2002).
[5] Ram (1987), Bohl (1996), Ansari (1997), Karagianni (1998), Chang (2002) and Chang (2004).
[6] Man (1980), Chletsos (1997), Biswal (1999) and Asseery (1999).

15	Karaggianni et al. (1998)	European Union countries	1949-1998	Mixed results	Mixed results across countries
16	Biswal et al. (1999)	Canada	1950-1995	Mixed results	Mixed results across different type of public spending
17	Asseery et al. (1999)	Iraq	1950-1980	Mixed results	Constant prices supportive, real against
18	Chang (2002)	6 countries	1951-1996	Mixed results	Mixed results across countries
19	Dar and Amirkhalkali(2002)	OECD countries	1971-1999	Mixed results	Mixed results across countries
20	Peters (2002)	4 countries	1948-1995	Mixed results	Engle mixed results, Johansen supportive
21	Chang et al. (2004)	10 countries	1951-1996	Mixed results	Mixed results across countries
22	Wahab (2004)	OECD countries	1950-2000	Mixed results	Mixed results across group of countries
23	Iyare and Lorde (2004)	9 countries	1950-2000	Mixed results	Mixed results across countries and across versions
24	Ahmad and Ahmed (2005)	D-8 Countries	1973-2002	Mixed results	Mixed results across methodologies
25	Yuk(2005)	U.K.	1830-1993	Mixed results	Mixed results across different periods
26	Loizides and Vamvoukas(2005)	Greece, U.K. and Ireland	1960-1995	Mixed results	Mixed results across countries
27	Al Hasoon(2005)	Gulf cooperation council	1975-2002	Mixed results	Mixed results across countries and across versions
28	Akitoby et al.(2006)	51 countries	1970-2002	Mixed results	Mixed results across countries
29	Shelton(2007)	100 countries	1970-2000	Mixed results	Mixed results across different type of public spending
30	Kolluri and Wahab(2007)	OECD and EU countries	1950-2000	Mixed results	Mixed results across group of countries
31	Narayan et al. (2008)	China	1952-2003	Mixed results	Mixed results across states
32	Karaggianni and Pempetzoglou (2009)	European Union countries	1949-1998	Mixed results	Mixed results across countries
33	Dolenc (2009)	Slovenia	1992-2007	Mixed results	5 of 6 versions supportive
34	Maggazino(2010b)	Italy	1960-2004	Mixed results	3 of 5 versions supportive
35	Abdullah and Maamor (2010)	Malaysia	1970-2007	Mixed results	4 of 5 versions supportive

Keynes vs. Wagner

Finally, there are a number of studies (Table 12) that tested the Wagner's law against the Keynesian hypothesis. The Keynesian theoretical framework of economic growth suggests a long-run relationship between national income and government expenditures. However, this causal relationship runs from expenditures to income which is in contrast with Wagner's law. There are some studies such as Liu et al. (2008) Katrakilidis and Tsaliki (2009) Tang (2010) Samudran et al. (2009) that found evidence of bi-directional causality between national income and government spending , hence support for Wagner's and Keynesian hypothesis. There are also studies such as Afxentiou and Serletis (1996) and Demirbas(1999) that did not find any causal relationship between these variables and suggest that both hypotheses are invalid. Finally, is very important to mention here that if the Wagner's law is not valid for a country, does not necessarily mean that also the Keynesian hypothesis is invalid.

Table 12: Studies examined Keynesian hypothesis against Wagner's Law

No	Author	Country	Main results Wagner	Main results Keynes
1	Afxentiou and Serletis (1996)	6 European countries	No support	No support
2	Ansari et al. (1997)	3 African countries	Mixed results	No support
3	Demirbas(1999)	Turkey	No support	No support

4	Biswal et al. (1999)	Canada	Mixed results	Support
5	Al-Faris (2002)	Gulf cooperation council	Support	No support
6	Albatel (2002)	South Arabia	Support	Support
7	Bagdigen and Cetintas(2003)	Turkey	No support	No support
8	Dilrukshini(2004)	Sri Lanca	No support	No support
9	Dritsakis and Adamopoulos (2004)	Greece	Support	Support
10	Ju Huang (2006)	China and Taiwan	No support	No support
11	Liu et al. (2008)	U.S.A.	No support	Support
12	Katrakilidis and Tsaliki (2009)	Greece	Support	Support
13	Tang (2010)	Malaysia	Support	Support
14	Samudran et al. (2009)	Malaysia	Support	Support
15	Maggazino(2010b)	Italy	Support	No support
16	Maggazino(2010a)	European Union countries	Mixed results	No support
17	Iniguez-Montiel (2010)	Mexico	Support	Support
18	Pahlavani et al. (2011)	Iran	Support	No support

Discussion

During the last decades a large number of authors tested various specifications of Wagner's law. These studies used both time series and cross-sectional data sets and empirically examined the law for a single country and for a group of countries (multi-country studies). Moreover, there are studies using data on government expenditure at the provincial or state level. Existing studies in this topic vary in the country selection. They used data for developed, developing countries or group of both, while most of them examined developed or industrial countries. However, during the last 5 years there are an increased number of studies examining the case of developing countries from Africa and South Asia. Another strand of literature examined the Wagner's against Keynesian hypothesis. The empirical results across all these studies vary; some of them found support of the law, a number of studies found that the law is invalid, while a number of them found mixed results across different versions of the law or across different countries.

In this paper we try to provide a synthesis of previous empirical work in Wagner's law. We provide analysis of the year of publication, tested period, type of analysis, type of methodology and main conclusion for the validity of the law. Our findings are:

- Wagner's hypothesis has been the focus of many economists during the last century. However, the worldwide concern on the increased public spending in many countries and the developments on econometric techniques during the last 20 years attracted the interest of many policy makers and economists.
- The majority of previous studies have applied time series analysis; 106 out of 126 studies used time series analysis, while studies deployed panel data analysis are only 20. Among the studies which used time series analysis, the majority found support of the law. The majority of studies that deployed panel data analysis found mixed results.

- There are several studies that used long data and used only time series analysis. Most of them (58%) found support of the law.
- Among a large number of studies that examined Wagner's law for various countries, multiple methods of analysis have been used. The most important are the following: ordinary least squares for stochastic modelling, cointegration approach for examining if there is any long run relationship between spending and national income and finally Granger causality tests for identifying the direction of the causality. The majority of the studies used recent econometric techniques, such as cointegration analysis and Granger causality tests, while most studies before 1985 used Ordinary least squares method.
- The majority of studies that used times series data, applied cointegration and Granger causality analysis. On the other hand, most studies which implemented panel data analysis applied OLS.
- A large number of studies examined the validity of Wagner's law, but there is no clear pattern on the empirical results.
- Several studies tested Wagner's law against the Keynesian hypothesis. Some studies found support of both hypotheses, while others found that both are invalid.
- Studies that applied OLS ignored the problems of spurious regression and their empirical results are based on non-stationary time series and their findings might be inaccurate. On the other hand, cointegration analysis overcomes this problem by examining the long run relationship between the tested variables and estimating the short run dynamics by an error correction model. When they find evidence of long run relationship they use Granger causality test to identify the direction of causality. However, they do not take account any structural change in tested series and assume that there is no structural break.

Conclusion

As we have mentioned above, there are several studies that have an empirical support of both classical hypotheses: Wagner's law and Keynesian hypothesis, provides a further direction for analysing policy issues, and exposes a fundamental understanding to the government or policy makers about inter-linkages between public expenditures and economic growth. The indication of this inter-dependency between these variables reproduce the effectiveness of government expenditure as fiscal instrument in stimulating economic growth, and the contribution of economic growth in government budget formulation. These results are by no means surprising. After all, all tests include a measure of GDP and government expenditure. As government expenditure is part of the GDP, we are actually estimating a sort of identity making it difficult to identify any causal relationship. Therefore, it is necessary to re-think the concept of using government expenditure. We suggest to include for future research welfare expenditure by the government. Although, it is true that welfare expenditure as part of government expenditure is also included in the overall GDP calculation, it does not necessarily move in line with GDP. For example, welfare expenditure could well fall or remain constant if GDP increases. The question is whether those data are available which therefore constitutes a new research project.

The first limitation of previous studies in the examination of the validity of Wagner's law is the difficulty of measuring the government activity only with fiscal measures. Wagner in his original study

highlighted the twofold faces the government: the fiscal and the regulatory government. However, the regulatory government is included neither in our thesis nor in any other study in the past. The reason is that there is no measure which can be included into empirical modelling and take into account accurately the regulations of the government. Another limitation is that according to Wagner "all earlier attempts to lay down absolute figures of expenditure or to define an upper limit of its proportion to national income, have always miscarried" ((Cooke 1958, pp. 8)). Wagner in his original study recognised that the state expansion has some limits. He mentioned that the proportion between government spending and national income may not be permanently overstepped.

Nijkamp and Poot (2004) claimed that while the previous research on this subject has peaked in the late 1990s, additional publications will unquestionably appear and they are needed. Even among growth regression models, there are still numerous issues that require more attention. A noticeable issue is the endogeneity of government expenditure itself. The size of government may be related to the stage of development, the openness of the economy, the variability of output, social fragmentation, population structure and institutional and cultural aspects of society. If growth regressions continue to have policy variables on the right-hand side, special efforts should be made to find suitable instrumental variables to avoid biased policy variable coefficients.

Econometrically, most studies ignore the spatial configuration of the growth process. Regions or countries are often treated as non-spatial units of observation. While panel data analysis may control for the possibility of cross-sectional heteroscedasticity, time-wise auto regression, simultaneity and endogeneity, the possibility of spatial autocorrelation is rarely acknowledged.

Given that the government spending and social security systems in the EU and the US are quite different, it is relevant for future research to divide the developed-country sample into an EU sample and US sample. So far, only three categories of developed country samples are used in the literature, OECD countries, EU countries and a mixture of developed countries. Additionally, more attention should be paid to examining the issue of a non-linear relationship between government spending and growth, as neglecting a non-linear relationship could lead to model misspecification and biased empirical analysis. We found that a major limitation in the literature is the absence of control for a non-linear relationship between government spending and growth.

In recent years, the emphasis of the research of fiscal policy on growth has moved from the traditional fiscal policy variables to externalities, competition policy, monetary policy, property rights, institutions and law and order. Given the growing popularity of meta-analysis in economics and the growing ease by which new research findings are quickly distributed worldwide, meta-analysis of such topics could be a fruitful endeavour in the future.

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