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Disaggregated Public Spending, GDP and Money Supply: Evidence for Italy

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Abstract

The aim of this article is to analyze the relationship between public spending and GDP controlling for the money supply in Italy for the period 1990-2010 at a disaggregated level, using a time series approach. After a brief introduction, a survey of the economic literature on this issue is shown, before estimating this nexus for ten items of public spending according to the COFOG functional classification. Cointegration tests reveal a long-run relationship between GDP, money supply and eight spending items. Moreover, Granger causality tests results show evidence in favour of Wagner's Law in two cases (Y→G), while a bi-directional flow has been found in only one case. The Keynesian hypothesis (G→Y) is supported by five series of spending. Some notes on the policy implications of this analysis conclude the paper.

Keywords: Public Spending; GDP; Money Supply; Wagner's Law; Time Series; Unit Root; Cointegration; Causality; Fiscal Policy.
JEL Classification Codes: C32; E60; H50; H60; N44.

1. Introduction

In this paper we analyze the relationship between some items of public expenditure and GDP, controlling for the money supply, according to the COFOG[1] international classification in the case of Italy.

A point of debate among the economists is whether the public sector should or should not intervene to stabilize the short-term fluctuations of economic activity. If Classical economists have opposed such a kind of public action, the Keynesians have invoked fiscal policies to support the economy during recessions.

Wagner's Law (Wagner, 1883, 1912) suggests that the public expenditure share of GDP (G/Y) tends to increase in the process of economic development. The reasons are varied: a) public functions substitute for private activities, b) development results in an expansion of expenditure on culture and welfare, therefore public intervention might be necessary to manage natural monopolies. In sum, the expansion of public spending can be seen as a by-product of economic development, and not vice versa (Bird, 1971).

As a result, the two alternative positions call for opposite directions of causality running from public expenditure to income for the Keynesians, and from income to public expenditure for Wagner.

[1] The COFOG classification is defined by the major international institutions dealing with national accounts (OECD, IMF, Eurostat), and it is articulated in three levels of analysis: divisions, groups and classes.

Over the past four decades, several studies on this issue focused on many countries and time periods, using the concepts of cointegration and Granger causality. Since the pioneering research by Gupta (1967), empirical findings are mixed and, for some countries, even controversial (Tarschys, 1975; Peacock and Scott, 2000). The results differ either on the direction of causality or on the short-term and long-term effects.

Few studies have been conducted for Italy either on this specific topic (Chletsos and Kollias, 1997), or on Wagner's Law in general (Bella and Quintieri, 1989; Thornton, 1999; Kolluri *et al.*, 2000; Florio and Colautti, 2001; Arpaia and Turrini, 2008; Magazzino, 2009a, 2009b, 2010a, 2010b, 2011). The aim of this paper is to analyze the relationship between disaggregated public spending and aggregate income in Italy, both in the short and in the long run. Time series methodologies have been applied in order to investigate stationarity properties, cointegration and causality.

Since Italy holds either a very high public debt to GDP ratio (B/Y) or a high G/Y, G reduction may offer an important contribute to the recovery of public finances. However, the size reduction of public sector should focus on the expenditure items that have less impact on GDP growth, if any (Forte and Magazzino, 2011).

Government spending is an important component in influencing the growth of the Italian economy. It must be handled systematically and wisely so that the expenditure which has been made is effective. The Italian budget is in deficit. If the size of the deficit is large and cannot be closed again in an average period, then it leads to more problems.

The rest of the paper is organized as follows. Section 2 provides a survey of the economic literature on this issue. Section 3 overviews the applied empirical methodology and offers a brief discussion of the data used. Section 4 discusses the empirical results. Section 5 presents some policy implications and concludes.

2. Wagner's Model and the Economic Literature

We owe to Adolf H. Wagner the first theory on the public expenditure increase dependent upon the structural evolution of society (Wagner, 1883, 1912). He made research on the existence of a desirable limit to the size of the public sector, concluding that such a limit was in fact not possible. In his opinion, the time path of public spending is essentially determined by the increase of national income. An increase of this variable generates a more than proportional expansion of the public sector. Hence, he derived the "law of increasing state activity" (Wagner, 1883, 1912), arguing that its financial pressure would increase in time.

The empirical evidence concerning the relationship between national income and expenditure is based on the assessment of the elasticity of expenditure to income. Only if such elasticity is significant and >1 and the coefficient sign is positive, we may conclude that the link between the two variables exists and it is consistent with Wagner's hypothesis (Hadjimatheou, 1976; Jackson, 1980; Fossati, 1981; Diba, 1982).

Murthy (1994) suggests a broader interpretation of the law allowing for the addition of further explanatory variables related to economic development and government expenditure (e.g. the degree of urbanization, budget deficits, etc.). This alternative would reduce the omitted variable bias in the specification. Magazzino (2010b) discussed alternative functional forms of Wagner's Law.

The directions of Granger causality between public spending and aggregate income can be categorized into four types, each of which has important implications for economic policy (Peacock and Scott, 2000):

- *Neutrality hypothesis:* the above economic variables are not correlated as it has been stated by Demirbas (1999), Bağdigen and Cetintaş (2003), Huang (2006), Sinha (2007), Chimobi (2009), and Afzal and Abbas (2010).
- *Wagner's hypothesis:* the unidirectional causality running from GDP to public spending. This hypothesis found empirical support in Ahsan et al. (1996), Ansary et al. (1997), Chletsos and Kollias (1997), Abizadeh and Yousefi (1998), Asseery et al. (1999), Thornton (1999),

Islam (2001), Tang (2001), Albatel (2002), Tan (2003), Iyare and Lorde (2004), Sideris (2007), Samudram et al. (2008), Kalam and Aziz (2009), Kumar (2009), Kumar et al. (2009), and Abdullah and Maamor (2010).

- *Keynesian hypothesis:* the unidirectional causality running from public spending to GDP. This hypothesis is in line with empirical findings in Iyare and Lorde (2004), Dogan and Tang (2006) Babatunde (2007), and Govindaraju et al. (2010).
- *Feedback hypothesis:* there exists a bi-directional causality flow between GDP and public spending. The feedback hypothesis has been proposed by Thornton (1999), Chow et al. (2002), Abu-Bader and Abu-Qarn (2003), Dritsakis and Adamopoulos (2003), Iyare and Lorde (2004), Halicioğlu (2005), Narayan et al. (2008), Ziramba (2008), Ghorbani and Zarea (2009), and Yay and Tastan (2009).

Table 1: A comparison of studies about causality and cointegration analysis between public expenditure and GDP

Authors	Countries	Study period	Causality	Cointegration relationship
Abdullah, Maamor (2010)	Malaysia	1970-2007	Y → G	Yes
Abizaeh, Yousefi (1998)	Soth Korea	1961-1992	Y → G	-
Abu-Bader, Abu-Qarn (2003)	Egypt, Israel, Syria	1963-1998	Israel, Syria: Y ↔ G	Yes, for Israel and Syria
Afzal, Abbas (2010)	Pakistan	1960-2007	Neutral	No
Ahsan* et al. *(1996)	Canada	1952-1988	Y → G	Yes
Akitoby* et al. *(2006)	51 developing countries	1970–2002	-	Yes, for 21 countries
Albatel (2002)	Saudi Arabia	1964-1998	Y → G	Yes
Ansari* et al. *(1997)	Ghana, Kenya, South Africa	1957-1990	Ghana: Y → G	No
Asseery* et al. *(1999)	Iraq	1950-1980	Y → G	Yes
Babatunde (2007)	Nigeria	1970-2006	G → Y	No
Bağdigen, Cetintaş (2003)	Turkey	1965-2000	Neutral	No
Burney (2002)	Kuwait	1969-1995	-	Yes
Chimobi (2009)	Nigeria	1970-2005	Neutral	No
Chletsos, Kollias (1997)	Greece	1958-1993	Y → G	Yes
Chow* et al. *(2002)	UK	1948-1997	Y ↔ G	Yes
Cotsomitis* et al. *(1996)	China	1952-1992	-	Yes
Demirbas (1999)	Turkey	1950-1990	Neutral	Yes
Dogan, Tang (2006)	5 South-East Asian countries	1960-2002	Indonesia, Malaysia, Singapore, Thailand: Neutral Philippines: G → Y	Only for Indonesia
Dritsakis, Adamopoulos (2003)	Greece	1960-2001	Y ↔ G	Yes
Ghorbani, Zarea (2009)	Iran	1960-2000	Y ↔ G	No
Govindaraju* et al. *(2010)	Malaysia	1970-2006	G → Y	Yes
Halicioğlu (2005)	Turkey	1960-2000	Y ↔ G	Yes
Huang (2006)	China and Taiwan	1979-2002	Neutral	No
Islam (2001)	USA	1929-1996	Y → G	Yes
Iyare, Lord (2004)	9 Caribbean countries	1950-2000	Jamaica: Neutral Antigua, Barbados, Belize, Grenada, St. Kitts and Nevis, St. Lucia, Trinidad and Tobago: Y → G Guyana: G → Y	Yes, for 3 countries
Kalam, Aziz (2009)	Bangladesh	1976-2007	Y → G	Yes
Karagianni* et al. *(2002)	EU-15	1949-1998	Greece: Neutral	Yes, for 13 countries
Kumar (2009)	China, Hong Kong, Japan, Taiwan, South Korea	1960-2007	Y → G	Yes
Kumar* et al. *(2009)	New Zealand	1960-2007	Y → G	No
Lamartina, Zaghini (2008)	23 OECD countries	1970-2006	Y → G	Yes
Magazzino (2010b)	EU-27	1970-2009	Neutral only for 5 out of 11 countries	Yes, for 7 out of 11 countries
Narayan* et al. *(2008)	Chinese provinces	1952-1989	Y ↔ G	Yes
Rehman* et al. *(2007)	Pakistan	1972-2004	-	Yes
Samudram* et al. *(2008)	Malaysia	1970-2004	Y → G	Yes
Sideris (2007)	Greece	1832-1938	Y → G	Yes
Sinha (2007)	Thailand	1950-2003	Neutral	Yes
Tan (2003)	Malaysia	1991Q1-2002Q3	Y → G	Yes
Tang (2001)	Malaysia	1960-1998	Y → G	No
Thornton (1999)	Denmark, Germany, Italy, Norway, Sweden, UK	1850-1913	Denmark, Germany, Norway, Sweden: Y → G Italy, UK: Y ↔ G	Yes, for 5 countries
Verma, Arora (2010)	India	1950-2008	-	Yes
Yay, Tastan (2009)	Turkey	1950-2004	Y ↔ G	Yes
Ziramba (2008)	South Africa	1960-2006	Y ↔ G	Yes

Sources: our elaborations.

Table 1 above presents a concise overview on cointegration and causality between public expenditure and national income discussed in several studies on Wagner's Law.

3. Methodology and Data

According to Engle and Granger (1987), a linear combination of two or more non-stationary series (with the same order of integration) may be stationary. A time series that requires the first differencing filter to remove the stochastic trend is called a time series that is integrated of order 1 (*I(1)*). If such a stationary linear combination exists, the series are considered to be cointegrated and therefore long-run equilibrium relationships exist. Incorporating these cointegrated properties, an Error-Correction Model (ECM) could be constructed to test for Granger causation of the series in at least one direction. In this study, the ECM is specifically adopted to examine the Granger causality between public expenditure's items and real GDP.

So, in order to investigate the stationarity properties of the series, the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979, 1981), Phillips-Perron (PP, 1988), Dickey-Fuller GLS (DF-GLS) (Elliott, Rothenberg and Stock, 1996), and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS, 1992) tests have been applied.

Then we examine the unit root (or stationarity) properties of the variables, accounting for structural breaks. The present paper employs the Clemente, Montañés and Reyes (CMR, 1998) test, a procedure allowing for a gradual shift in the mean to test more than one break point.

When both series integrated are of the same order, we can proceed to test for the presence of cointegration. The Johansen maximum likelihood procedure (Johansen, 1988; Johansen and Juselius, 1990) is used for this purpose. Any long-run cointegrating relationship found between the series will contribute an additional error-correction term to the ECM.

Granger causality implies causality in the prediction (forecast) sense rather than in a structural sense. It starts with the premise that 'the future cannot cause the past'; if event A occurs after event B, then A cannot cause B (Granger, 1969). Therefore, in order to test whether energy Granger-causes GDP the following bivariate equation is estimated:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + \sum_{j=1}^{n} \lambda_i \Delta e_{t-i} + \upsilon_t \quad (1)$$

where e_t=ln(E_t); y_t = ln(Y_t); E_t is the real spending; Y_t the real GDP; and Δ is the first difference operator.

The presence of Granger-causality depends on the significance of the Δe_{t-j} terms in eq. (1); energy causes GDP if the current value of Δy is predicted better by including the past values of Δe than by not doing so.

The short-run causality is based on a standard *F*-test statistics to test jointly the significance of the coefficients of the explanatory variable in their first differences. The long-run causality is based on a standard t-test. Negative and statistically significant values of the coefficients of the error correction terms indicate the existence of long-run causality.

Different items of public spending have been selected focusing on their functional nature and according to the "Classification Of Function of Government" (COFOG), in order to reveal any empirical evidence in favor of a model *à la* Wagner. Moreover, in order to take into account the question of omitted variables, we testing for the validity of Wagner's hypothesis in a multivariate context. It is noted that this use of money supply as an omitted variable is prompted by the money-income causality literature, which shows money stock to be intimately connected with national income (Chow *et al.*, 2002). Afzal and Abbas (2010) proposed to "augment" the Wagner's Law with fiscal deficit and population growth; Burney (2002) with revenue and the degree of openness of the economy; Rehman *et al.* (2007) with financial development and openness to trade; Shelton (2007) with population, openness, ethnic fractionalization and demographic factors.

The ten items of spending selected by the COFOG classification involve spending for general public services, for defence, for public order and safety, for economic affairs, for environmental protection, for housing and community amenities, for health, for recreation, culture and religion, for education, and for social protection. In order to convert nominal variables into real variables we used the GDP deflator and the public consumption deflator for GDP and public expenditures respectively, both derived from the ISTAT[1] in the period 1990-2010. Our empirical analysis is constrained by the availability of data of disaggregated public spending.

In Table 2 the variables of the model are summed up. All series contain yearly data in real terms.

Table 2: List of the variables (mld EIT)

Variable	Explanation
RGDP	Gross Domestic Product at constant factor cost
RGPS	Real spending for general public services
RD	Real spending for defence
RPOS	Real spending for public order and safety
REA	Real spending for economic affairs
REP	Real spending for environmental protection
RHCA	Real spending for housing and community amenities
RH	Real spending for health
RRCR	Real spending for recreation, culture and religion
RE	Real spending for education
RSP	Real spending for social protection
M1	Money supply

Source: ISTAT (2011).

4. Econometric Results

In this section we present and discuss an analysis of the relationship between disaggregated public spending and real GDP, applied to the Italian case.

First of all, we obtained the log-transformations of the series. As a preliminary analysis, some descriptive statistics are shown in the following Table 3. Inter-Quartile Range shows the absence of outliers in our samples. Then, we applied time series techniques on stationarity and unit root processes.

Table 3: Exploratory data analysis

Variable	Mean	Median	Standard Deviation	Skewness	Kurtosis	Range
RGDP	13.9573	13.9722	0.0795	-0.2129	1.5984	0.2363
RGPS	10.3578	10.3246	0.1078	0.1891	1.3056	0.2844
RD	9.6106	9.6240	0.1358	-0.1257	1.8703	0.4521
RPOS	10.0191	10.0259	0.0324	-0.9936	3.3358	0.1174
REA	9.6481	9.6285	0.0544	1.1384	2.8198	0.1638
REP	7.8236	7.7623	0.2704	0.3053	1.5569	0.7531
RHCA	8.4906	8.5280	0.0818	-0.3467	1.6742	0.2461
RH	11.1541	11.1130	0.1341	0.2792	1.6385	0.3915
RRCR	8.4926	8.4737	0.0564	1.0512	3.0469	0.1937
RE	10.8437	10.83218	0.0331	0.9190	2.6888	0.1128
RSP	9.1684	9.1341	0.1057	0.2792	1.4502	0.2927
M1	5.7069	5.6994	0.4954	0.3305	2.1149	1.6101

Source: ISTAT (2011).

Correlation coefficients, summarized in Table 4, indicate a strong positive correlation ($r \geq 0.9$) between real GDP and real spending for general public services, environmental protection, housing and

[1] See: http://www.istat.it/dati/db_siti/.

community amenities. These findings underline that higher values of real GDP are associated with higher values of various items of public spending. Moreover, we find a strong positive correlation among some different categories of public spending (*RGPS* and *REP*, *RGPS* and *RSP*, *REP* and *RSP*, *RH* and *REP*, *RH* and *RSP*).

Table 4: Correlation matrix

	RGDP	RGPS	RD	RPOS	REA	REP	RHCA	RH	RRCR	RE	RSP	M1
RGDP	1											
RGPS	.928	1										
RD	.401	.642	1									
RPOS	.489	.361	-.229	1								
REA	.598	.636	.769	.114	1							
REP	.900	.947	.714	.301	.814	1						
RHCA	.926	.826	.326	.541	.579	.842	1					
RH	.810	.894	.822	.069	.831	.934	.745	1				
RRCR	.680	.630	.508	.371	.870	.774	.715	.725	1			
RE	-.733	-.590	.049	-.788	-.273	-.574	-.763	-.360	-.471	1		
RSP	.865	.935	.741	.217	.771	.967	.798	.944	.730	-.499	1	
M1	.945	.877	.461	.510	.786	.931	.879	.819	.819	-.682	.850	1

Notes: Bonferroni adjustment applied.
Source: our calculations on ISTAT (2011) data.

Table 5 contains the results of common unit root tests, for our variables.

Table 5: Results for stationarity tests

Variable	Stationarity tests				
	Deterministic component	ADF	ERS	PP	KPSS
RGDP	Intercept	NS: -1.647	NS: -2.085	NS: -1.574	NS: 1.020
ΔRGDP	Intercept	DS: -2.774	DS: -2.251	DS: -3.084	DS: 0.323
RGPS	Intercept	NS: -0.653	NS: -0.686	NS: -0.719	NS: 0.981
ΔRGPS	Intercept	DS: -2.545	DS: -3.036	DS: -2.651	NS: 0.112
RD	Intercept, trend	NS: -1.876	NS: -1.815	NS: -1.104	NS: 0.231
ΔRD	Intercept	DS: -2.680	NS: -1.811	NS: -2.100	DS: 0.335
RPOS	Intercept	LS: -3.228	NS: -1.048	NS: -2.429	LS: 0.394
ΔRPOS	Intercept	DS: -4.460	DS: -2.621	DS: -4.066	DS: 0.235
REA	Intercept	NS: 0.501	NS: 0.066	NS: 0.439	NS: 0.691
ΔREA	Intercept	DS: -4.568	NS: -2.267	DS: -4.626	DS: 0.113
REP	Intercept, trend	NS: -1.978	NS: -2.447	NS: -1.903	TS: 0.145
ΔREP	Intercept	DS: -5.120	DS: -2.659	DS: -5.085	DS: 0.162
RHCA	Intercept	NS: -0.849	NS: -0.368	NS: -0.836	NS: 0.989
ΔRHCA	Interceot	DS: -4.310	DS: -2.397	DS: -4.309	DS: 0.083
RH	Intercept, trend	NS: -3.057	NS: -1.785	NS: -1.575	NS: 0.211
ΔRH	Intercept	NS: -2.493	DS: -2.471	NS: -2.546	DS: 0.258
RRCR	Intercept	NS: -0.514	NS: 0.085	NS: -0.379	NS: 0.760
ΔRRCR	Intercept	DS: -5.036	DS: -2.864	DS: -5.016	DS: 0.148
RE	Intercept	NS: -2.003	NS: -1.530	NS: -1.915	NS: 0.687
ΔRE	Intercept	DS: -5.755	DS: -4.301	DS: -5.876	DS: 0.112
RSP	Intercept, trend	NS: -1.784	NS: -1.980	DS: -1.879	NS: 0.155
ΔRSP	Intercept	DS: -3.611	DS: -2.167	DS: -3.617	DS: 0.159
M1	Intercept	NS: 0.138	NS: -0.480	NS: 0.190	NS: 0.578
ΔM1	Intercept	DS: -4.204	DS: -4.205	DS: -3.375	DS: 0.109

Notes: NS: Non Stationary; TS: Trend Stationary; DS: Difference Stationary.
Source: our calculations on ISTAT (2011) data.

The second column presents the results for Augmented Dickey and Fuller (1979) test; the third one for Elliott, Rothenberg and Stock (1992) test; the fourth column contains the results for Phillips and Perron (1988) test; at last, the fifth column shows the results for Kwiatkowski, Phillips, Schmidt and Shin (1992) test. Here, the results indicate that all series are clearly integrated of order 1, or a *I(1)* process. Yet, the spending for public order and safety could be considered as level-stationary, while the parametric tests suggest that the spending for health is *I(2)*.

Table 6: Results for additive outlier unit root tests

Variable	SB	k	t-stat	5% Critical Value
RGDP	1997	0	-2.693	-3.560
RGPS	2000	0	-3.107	-3.560
RD	2004	1	-2.982	-3.560
RPOS	1997	0	-3.065	-3.560
REA	2004	3	-3.016	-3.560
REP	2000	0	-2.472	-3.560
RHCA	1998	1	-3.729	-3.560
RH	2003	1	-3.261	-3.560
RRCR	2004	0	-3.993	-3.560
RE	1997	0	-4.555	-3.560
RSP	2002	1	-3.677	-3.560
M1	2003	0	-2.183	-3.560
ΔRGDP		0	-5.303	-3.560
ΔRGPS		0	-8.212	-3.560
ΔRD		0	-5.320	-3.560
ΔRPOS		0	-5.940	-3.560
ΔREA		4	-3.587	-3.560
ΔREP		3	-3.585	-3.560
ΔRH		0	-3.707	-3.560
ΔM1		0	-4.647	-3.560

Source: our calculations on ISTAT (2011) data.

From the Table 6 above, we note that focusing on the results by the Clemente *at al.* test, despite the structural breaks, we are unable to reject the null hypothesis of a unit root in 7 series. Yet, if we perform the test at the first differences, our series become stationary: so, we can conclude that GDP, M1 and 6 different items of public spending are *I(1)* processes, while *RHCA*, *RRCR*, *R*E and *RSP* are level-stationary with a break. As regards these breaks, they roughly correspond to the Italian efforts to join the EMU and the implementation of the "Stability and Growth Pact" (1997-2000), or to the effects of the euro adoption (2002-2004).

The lag-order selection has been chosen according to the Final Prediction Error (FPE), Akaike's Information Criterion (AIC), Schwarz's Bayesian Information Criterion (SBIC), and the Hannan and Quinn Information Criterion (HQIC).

The cointegration approach is consistent with Wagner's view that there is a long-run relationship between government spending and output, without necessarily implying causality (Akitoby *et al.*, 2006).

Cointegration tests have been subsequently applied, in order to find the long-run relationship between each item of public spending and real GDP. As is shown in Table 7, Johansen and Juselius cointegration method suggests that there is one cointegrating relationship in six cases (for *RD*, *RPOS*, *REA*, *RH*, *RE* and *RSP*). In fact, the trace statistic and the maximum-eigenvalue statistic reject r=0 in favour of r=1 at the 5% critical value. As in the lag-length selection problem, choosing the number of cointegrating equations that minimizes either the SBIC or the HQIC provides a consistent estimator of the number of cointegrating equations. Yet, all these criteria suggest a rank=1 for these six series. For *RGPS* and *RRCR* we found the existence of two long-run relationships. While for the remaining two items of spending (*REP* and *RHCA*) we find the absence of cointegration (rank=0).

Table 7: Results for cointegration tests

Johansen and Juselius procedure				
Variable	**Trace statistic**	**Maximum-eigenvalue statistic**	**SBIC HQIC AIC**	**Rank**
RGPS	6.6205 (12.25)	6.6205 (12.52)	-12.9102 -13.8813 -13.9884	r=2
RD	18.3013 (25.32)	10.4853 (18.96)	-9.9763 -10.9474 -11.0546	r=1
RPOS	17.0379 (25.32)	10.0103 (18.96)	-11.8338 -12.6283 -12.7160	r=1
REA	20.4031 (25.32)	12.0217 (18.96)	-12.4603 -13.2548 -13.3425	r=1
REP	39.7472 (42.44)	23.0160 (25.54)	-8.6080 -9.1377 -9.1961	r=0
RHCA	25.8244 (34.91)	13.0366 (22.00)	-10.3657 -10.7629 -10.8068	r=0
RH	20.8620 (25.32)	13.3385 (18.96)	-11.0239 -11.8184 -11.9061	r=1
RRCR	2.3732 (12.25)	2.3732 (12.52)	-11.7395 -12.7106 -12.8178	r=2
RE	15.3862 (25.32)	10.5569 (18.96)	-12.9402 -13.7347 -13.8224	r=1
RSP	15.5558 (25.32)	11.4766 (18.96)	-10.9098 -11.7044 -11.7921	r=1

Notes: 5% Critical Values in parenthesis.
Source: our calculations on ISTAT (2011) data.

Granger causality tests suggest a bi-directional flow between real GDP and public spending for housing and community amenities (*RHCA*); the Keynesian hypothesis is supported for *RGPS*, *RD*, *REP*, *RRCR* and *RSP*; Wagner's Law is confirmed in two cases (*REA* and *RE*). Finally, for the remaining two items of spending (*RPOS* and *RH*) no form of Granger causality has been found (see Table 8).

Table 8: Results for short-run causality tests.

Dependent variable	**Independent variables**			**Causal inference**
	G	**RGDP**	**M1**	
RGPS	-	4.172 (0.243)	15.292 (0.002) ***	
RGDP	6.436 (0.092) *	-	8.430 (0.038) **	M1→RGPS, RGPS→RGDP, M1↔RGDP
M1	3.778 (0.286)	24.057 (0.000)	-	
RD	-	3.548 (0.315)	88.332 (0.000) ***	
RGDP	11.461 (0.009) ***	-	13.703 (0.003) ***	M1↔RD, RD→RGDP, M1↔RGDP
M1	9.167 (0.027) **	26.383 (0.000) ***	-	
RPOS	-	2.331 (0.507)	2.465 (0.482)	
RGDP	2.537 (0.469)	-	3.394 (0.335)	RPOS→M1, RGDP→M1
M1	52.783 (0.000) ***	29.700 (0.000) ***	-	
REA	-	24.533 (0.000) ***	8.925 (0.030) **	
RGDP	3.500 (0.321)	-	4.704 (0.195)	M1↔REA, RGDP→REA, RGDP→M1
M1	42.800 (0.000) ***	8.397 (0.038) **	-	

Table 8: Results for short-run causality tests. (continued)

Dependent variable	Independent variables			Causal inference
	G	RGDP	M1	
REP	-	3.971 (0.137)	2.664 (0.264)	
RGDP	5.585 (0.061) *	-	2.548 (0.280)	REP→M1, REP→RGDP, RGDP→M1
M1	6.604 (0.037) **	42.787 (0.000) ***	-	
RHCA	-	12.984 (0.005) ***	10.557 (0.014) **	
RGDP	35.437 (0.000) ***	-	17.222 (0.001) ***	M1→RHCA, RHCA↔RGDP, M1→RGDP
M1	4.608 (0.203)	29.095 (0.000) ***	-	
RH	-	1.631 (0.442)	0.944 (0.624)	
RGDP	1.565 (0.457)	-	0.084 (0.959)	RGDP→M1
M1	1.886 (0.390)	22.223 (0.000) ***	-	
RRCR	-	1.222 (0.748)	12.004 (0.007) ***	
RGDP	28.889 (0.000) ***	-	11.273 (0.010) **	M1↔RRCR, RRCR→RGDP, M1↔RGDP
M1	61.058 (0.000) ***	127.010 (0.000) ***	-	
RE	-	9.726 (0.021) **	14.378 (0.002) ***	
RGDP	2.283 (0.516)	-	0.359 (0.949)	RE↔M1, RGDP→RE, RGDP→M1
M1	26.482 (0.000)	70.738 (0.000)	-	
RSP	-	1.231 (0.746)	2.907 (0.406)	
RGDP	13.710 (0.003) ***	-	4.860 (0.182)	RSP→RGDP, RGDP→M1
M1	4.948 (0.176)	16.689 (0.001)	-	

Notes: χ^2 values; numbers in parentheses are P-values. ***, ** and * denote significance at 1%, 5% and 10% level, respectively.

Source: our calculations on ISTAT (2011) data.

For all our equations, a Lagrange-multiplier (LM) test for autocorrelation in the residuals of Vector Error-Correction Model (VECM) clarifies that, at the 5% significance level, we cannot reject the null hypothesis, i.e. that there is no serial correlation in the residuals for the orders 1,…,5 tested. Checking the eigenvalue stability condition in the VECM, the eigenvalues of the companion matrix lie inside the unit circle, and the real roots are far from 1. As regard the Wald lag-exclusion statistics, we strongly reject the hypothesis that the coefficients either on the first lag or on the second lag of the endogenous variables are zero in all two equations jointly. The Jarque and Bera normality test results present statistics for each equation and for all equations jointly against the null hypothesis of normality. The results suggest normality for our models. Finally, the ARCH test shows the absence of these effects for the estimated models.

5. Conclusions

The purpose of this paper is to contribute to the literature on the relationship between GDP and public spending at a disaggregated level, using recent econometric techniques. Wagner's Law is empirically tested employing time series data for Italy. To this extent, we have studied the relationship between real GDP, money supply and ten different items of real public spending (according to the COFOG functional classification), using annual data for the period 1990-2010. The time series properties of the data have been assessed using several unit root tests (ADF, DF-GLS, PP and KPSS). Furthermore, in order to evaluate the presence of eventual aberrant observation(s), the Clemente *et al.* test has been conducted. Empirical results indicate that all series are clearly a *I(1)* process. Cointegration analysis has revealed that only two out of ten spending series (for environmental protection and for housing and community amenities) don't share a common trend – and a long-run relationship – with real aggregate income. Granger causality tests results show evidence in favour of Wagner's Law (Y→G) in two cases: spending for economic affairs and for education. A bi-directional causality flow has been found only for spending for housing and community amenities. On the contrary, the causality flow predicted by the Keynesian hypothesis (G→Y) is supported by the data in five cases: spending for general public services, defence, environmental protection, creation, culture and religion, and social protection. Finally, for the remaining two items of spending (spending for public order and safety and for health)

the neutrality hypothesis holds. Therefore, we find no clear evidence of government spending causing national income in the analyzed time period, as well as for the reverse causation.

Moreover, since a long-term relationship between the level of output and government spending has been found for several items, short-run cuts in spending, or surges in government outlays, will eventually be erased as the government spending/GDP ratio returns to its long-term average. Special care will need to be taken to ensure that spending cuts achieved over the short-run are accompanied by longer-term structural reforms to ensure these savings are durable (Akitoby *et al.*, 2006). As suggested by Shelton (2007), the increasing share of the population over 65 is strongly supporting the growth of government spending (and thus the positive correlation with per capita GDP) in many advanced economies since greying population calls for increased social security expenditures.

The implications of our analysis are straightforward: since no item of public spending Granger-causes GDP, expenditure cuts shouldn't negatively impact on economic growth. Therefore, reallocating resources among different items of public spending might result in increased economic growth, if R&D sector is promoted (Musu, 2007). Though, if the structural knots of the Italian economy are not removed, even the public promotion of the R&D sector may come out ineffective (Romagnoli, 2011). Moreover, expenditure cuts would contribute to reduce public debt, consolidating Italian public finances (Forte and Magazzino, 2011).

However, while traditional channels for the expanding role of government may be less effective, other factors may have contributed to the upholding of Wagner's law in the most recent period of relatively subdued growth in per capita GDP: from the supply-side, the increased ability of governments in collecting taxes and thus the relatively ease in financing growing expenditures; from the demand-side, the most advanced economies have witnessed an increasing demand of social security services due to fast-ageing population (Lamartina and Zaghini, 2008).

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References

1] Abizadeh, S., Yousefi, M., (1988), An empirical reexamination of Wagner's law, *Economic Letters*, 26, 169-173.

2] Abdullah, H., Maamor, S., (2010), Relationship between National Product and Malaysian Government Development Expenditure: Wagner's Law Validity Application, *International Journal of Business and Management*, 5, 1, January, 88-97.

3] Abu-Bader, S., Abu-Qarn, A.S., (2003), Government Expenditures, Military Spending and Economic Growth: Causality Evidence from Egypt, Israel and Syria, *Journal of Policy Modeling*, 25(6-7), 567-583.

4] Afzal, M., Abbas, Q., (2010), Wagner's law in Pakistan: Another look, *Journal of Economics and International Finance*, 2(1), January, 12-19.

5] Ahsan, M., Kwan, A.C.C., Sahni, B. S., (1996), Cointegration and Wagner's hypothesis: time series evidence for Canada, *Applied Economics*, 28, 1055-1058.

6] Akitoby, B., Clement, B., Gupta S., Inchauste, G., (2006), Public spending, voracity, and Wagner's law in developing countries, *European Journal of Political Economy*, 22, 4, December, 908-924.

7] Albatel, A.H., (2002), Wagner's Law and the Expanding Public Sector in Saudi Arabia, *Administrative Sciences*, 14(2), 139-156.

8] Ansari, M.I., Gordon, D.V., Akuamoah, C., (1997), Keynes versus Wagner: public expenditure and national income in three African countries, *Applied Economics*, 29, 543-550.

9] Asseery, A.A., Law D., Perdikis, N., (1999), Wagner's Law and public expenditure in Iraq: a test using disaggregated data, *Applied Economics*, 6, 39-44.
10] Arpaia, A., Turrini, A., (2008), Government expenditure and economic growth in the EU: long-run tendencies and short-term adjustment, *Economic Papers*, 300, February.
11] Babatunde, M.A., (2007), A Bound Testing Analysis of Wagner's Law in Nigeria: 1970-2006, Proceedings at Africa Metrics Conference.
12] Bağdigen, M., Cetintaş H., (2003), Causality Between Public Expenditure and Economic Growth: The Turkish Case, *Journal of Economic and Social Research*, 6 (1), 53-72.
13] Bella, M., Quintieri, B., (1989), Crescita in disequilibrio ed espansione del settore pubblico, *Rivista Internazionale di Scienze Sociali*, 2, 179-200.
14] Bird, R.M., (1971), Wagner's Law: a Pooled Time Series and Cross Section Comparison, *National Tax Journal*, 38, 209-218.
15] Burney, N.A., (2002), Wagner's hypothesis: evidence from Kuwait using cointegration tests, *Applied Economics*, 34, 49-57.
16] Chimobi, O.P., (2009), Government Expenditure and National Income: A Causality Test for Nigeria, *European Journal of Economic and Political Studies*.
17] Chletsos, M., Kollias, C., (1997), Testing Wagner's law using disaggregated data in the case of Greece: 1958-93, *Applied Economics*, 29, 371-377.
18] Chow, Y.-F., Cotsomitis, J.A., Kwan, A.C.C., (2002), Multivariate cointegration and causality tests of Wagner's hypothesis: evidence from the UK, *Applied Economics*, 34, 1671-1677.
19] Cotsomitis, J.A., Harnhirun, S., Kwan, A.C.C., (1996), Co-integration Analysis and the Long-Run Validity of Wagner's Hypothesis: Evidence from the People's Republic of China, *Journal of Economic Development*, 21, 2, December.
20] Demirbas, S., (1999), Cointegration Analysis-Causality Testing and Wagner's Law: The Case of Turkey, 1950-1990, *Discussion Papers in Economics*, Department of Economics, University of Leicester, 99/3, May.
21] Diba, B., (1982), A Note on Public Sector Growth: a Real Perspective, *Public Finance*, 37, 114-119.
22] Dogan, E., Tang, T.C., (2006), Government Expenditure and National Income: causality Test For Five South East Asian Countries, *International Business & Economics Research Journal*, 5, 10, October, 49-58.
23] Dritsakis, N., Adamopoulos, A., (2004), A Causal Relationship between Government Spending and Economic Development: An Empirical Examination of the Greek Economy, *Applied Economics*, 36, 457-464.
24] Faini, R., Annez, P., Taylor, L., (1986), Defense Spending, Economic Structure and Growth: Evidence Among Countries and Over Time, *Economic Development and Cultural Change*, 487-498.
25] Florio, M., Colautti S., (2001), A logistic growth law for government expenditures: an explanatory analysis, *Dipartimento di Economia Politica e Aziendale – Working Paper*, Università degli Studi di Milano, 13, June.
26] Forte, F., Magazzino, C., (2011), Optimal size of government and economic growth in EU countries, *Journal of analytical and institutional economics*, XXVIII, 3, 295-321.
27] Fossati, A., (1981), La spesa pubblica in Italia dal 1951 al 1980, *Rivista di Diritto Finanziario e Scienza delle Finanze*, 3, XL, 322-375.
28] Giarda, P.D., (1988), Una interpretazione della crescita della spesa pubblica in Italia: 1952-1987, *Rivista Bancaria*, XLIV, 11-12, November-December.
29] Ghorbani, M., Zarea, A.F., (2009), Investigating Wagner's law in Iran's economy, *Journal of Economics and International Finance*, 1(5), October, 115-121.
30] Gupta, S., (1967), Public Expenditure and Economic Growth: A Time Series Analysis, *Public Finance*, 22, 423-461.

31] Hadjimatheou, G., (1976), On the Empirical Evidence on Government Expenditure Development, *Public Finance*, 31, 144-148.
32] Halicioğlu, F., (2005), Testing Wagner's Law for Turkey, 1960-2003, *Public Economics*.
33] Hondroyiannis, G., Papapetrou, E., (1995), An Examination of Wagner's law for Greece: A Cointegration Analysis, *Public Finance*, 50, 1, 67-79.
34] Huang, C.-J., (2006), Government Expenditures in China and Taiwan: Do They Follow Wagner's Law?, *Journal of Economic Development*, 31, 2, December, 139-148.
35] Islam, A.M., (2001), Wagner's Law Revisited: Cointegration and Exogeneity Tests for the USA, *Applied Economics Letters*, 8, 509-515.
36] ISTAT, (2011), Spesa delle Amministrazioni pubbliche per funzione, Roma: ISTAT.
37] Iyare, S.O., Lorde, T., (2004), Co-integration, causality and Wagner's law: tests for selected Caribbean countries, *Applied Economics Letters*, 11, 815-825.
38] Kalam, A.M., Aziz, N., (2009), Growth of Government Expenditure in Bangladesh: An Empirical Inquiry into the Validity of Wagner's Law, *Global Economy Journal*, 9, 2, 5.
39] Karagianni, S., Pempetzoglou, M., Strikou, S., (2002), Testing Wagner's Law For The European Union Economies, *The Journal of Applied Business Research*, 18, 4, 107-114.
40] Kolluri, B.R., Panik, M.J., Wahab, M.S., (2000), Government expenditure and economic growth: evidence from G7 countries, *Applied Economics*, 32, 1059-1068.
41] Kumar, S. (2009), Further Evidence on Public Spending and Economic Growth in East Asian Countries, *MPRA Paper*, October, 19298.
42] Kumar, S., Webber, D.J., Fargher, S., (2009), Wagner's Law Revisited: Cointegration and Causality tests for New Zealand, *University of the West of England Discussion Papers*, 0917.
43] Lamartina, S., Zaghini, A., (2008), Increasing Public Expenditures: Wagner's Law in OECD Countries, *Center for Financial Studies Working Papers*, 13.
44] Lim, D., (1983), Instability of Government Revenue and Expenditure in Less Developed Countries, *World Development*, 11(5), 447-450.
45] Magazzino, C., (2009a), "Legge di Wagner" e spesa pubblica disaggregata: un approccio VAR, *Economia Pubblica*, 5-6, October-December, 133-156.
46] Magazzino, C., (2009b), Spesa pubblica disaggregata e "Legge di Wagner", *Economia, Impresa e Mercati finanziari*, 3, September-Decemeber, 7-31.
47] Magazzino, C., (2010a), "Wagner's Law" in Italy: Empirical Evidence from 1960 to 2008, *Global & Local Economic Review*, 2, January-June, 91-116.
48] Magazzino, C., (2010b), Wagner's Law and Augmented Wagner's Law in EU-27, *C.R.E.I. Working Papers*, 05/2010.
49] Magazzino, C., (2011), The Nexus between Public Expenditure and Inflation in the Mediterranean Countries, Theoretical and Practical Research in Economic and Finance, II, 1(3), pp. 94-107.
50] Murthy, V., (1994), Wagner's *Law*, Spurious in Mexico or Misspecification: a reply, *Public Finance*, 49, 2, 295-303.
51] Narayan, P.K., Nielsen, I., Smyth, R., (2008), Panel Data, cointegration, causality and Wagner's law: Empirical evidence from Chinese provinces, *China Economic Review*, 19, 2, June, 297-307.
52] Peacock, A.T., Scott, A., (2000), The Curious Attraction of Wagner's Law, *Public Choice*, 102(1-2), 1-17.
53] Rehman, H.U., Ahmed, I., Awan, M.S., (2007), Testing Wagner's Law for Pakistan: 1972-2004, *Pakistan Economic and Social Review*, 45, 2, Winter, 155-166.
54] Romagnoli, G.C., (2011), La stabilità finanziaria dell'Italia: i rischi da evitare, in Auteri, M. (ed.), *La manovra finanziaria 2011-2013*, Roma: Aracne.
55] Samudram, M., Nair, M., Vaithilingam, S., (2008), Keynes and Wagner on government expenditures and economic development: the case of a developing economy, *Empirical Economics*, 36, 697-712.

56] Shelton, C.A., (2007), The size and composition of government expenditure, *Journal of Public Economics*, 91, 2230-2260.
57] Sideris, D., (2007), Wagner's Law in 19th Century Greece: A Cointegration and Causality Analysis, *Bank of Greece Working Papers*, 64, December.
58] Sinha, D., (2007), Does the Wagner's Law Holds for Thailand? A Time Series Study, *MPRA Paper*, 2560.
59] Tan, E.C., (2003), Does Wagner's Law or the Keynesian Paradigm Hold in the Case of Malaysia?, *Thammasat Review*, 8, 1, December, 62-75.
60] Tang, T.C., (2001), Testing the relationship between Government Expenditure and National Income in Malaysia, *Analysis*, 8 (1&2), 37-51.
61] Tarschys, D., (1975), The growth of public expenditure – nine modes of explanation, *Scandinavian Political Studies*, 10, 9-32.
62] Thornton, J., (1999), Cointegration, Causality and Wagner's Law in 19th Century Europe, *Applied Economic Letters*, 6, 7, July, 413-416.
63] Verma, S., Arora, R., (2010), Does the Indian Economy Support Wagner's Law? An Econometric Analysis, *Eurasian Journal of Business and Economics*, 3 (5), 77-91.
64] Wagner, A.H., (1883), *Finanzwissenschaft*, Leipzig.
65] Wagner, A.H., (1912), *Les fondements de l'economie politique*, Paris: Girard & Brière.
66] Yay, T., Tastan, H., (2009), Growth of public Expenditures in Turkey during the 1950-2004 Period: An Econometric Analysis, *Romanian Journal of Economic Forecasting*, 4, 101-118.
67] Ziramba, E., (2009), Wagner's Law: An Econometric Test for south Africa, 1960-2006, *South Africa Journal of Economics*, 76, 4, 596-606.