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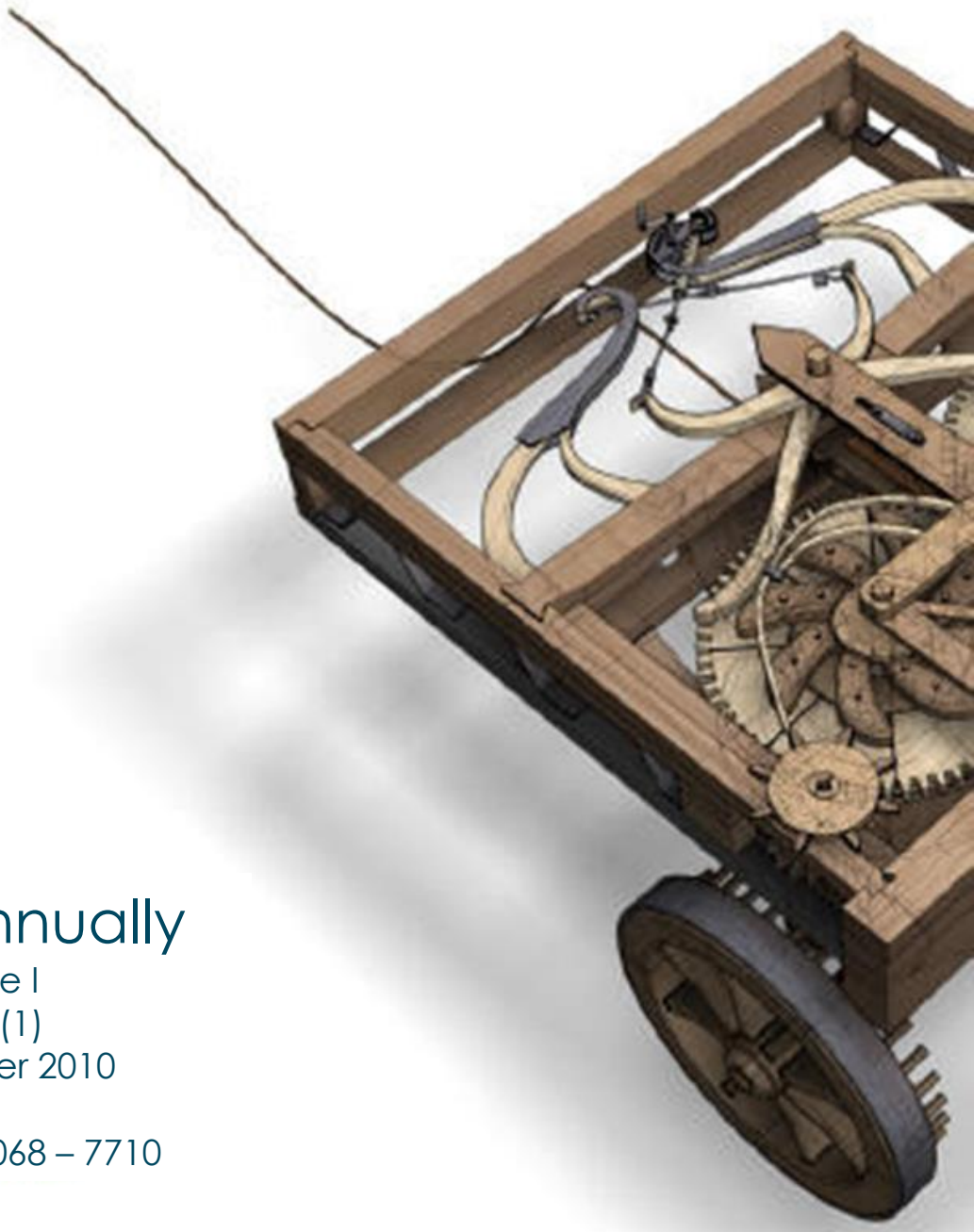

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Theoretical and Practical Research in Economic Fields

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THE NEXUS BETWEEN PUBLIC EXPENDITURE AND INFLATION IN THE MEDITERRANEAN COUNTRIES

Cosimo MAGAZZINO
Roma Tre University, **Italy**
cmagazzino@uniroma3.it

Abstract:
The aim of this article is to assess the empirical evidence of the nexus between public expenditure and inflation for the Mediterranean countries during the period 1970-2009, using a time-series approach. After a brief introduction, a concise survey of the economic literature on this issue is shown, before discussing the data and introducing some econometric techniques. Stationarity tests reveal, generally, that public expenditure/GDP ratio is a I(1) process, while prices index is a I(2) process. Moreover, a long-run relationship between the share of public expenditure and inflation is found for Cyprus, France, Greece and Portugal. Furthermore, Granger causality tests results show a short-run evidence of a directional flow from inflation to expenditure for Cyprus, France and Spain; and of a bidirectional flow for Italy, Malta and Portugal. Some notes on the policy implications of our empirical results conclude the paper.

Keywords: public expenditure; inflation; Mediterranean countries; time series; unit root; cointegration; causality.

JEL Classification: C32; E31; E62; H50.

1. Introduction

The optimal size of public sector is one of the most appealing topics in fiscal policy and public finance studies. Several theories have been advanced to explain this problem in different countries. Among them, one can find Wagner's Law (1912) of increasing state activities, Peacock, and Wiseman hypothesis (1961), critical-limit hypothesis (Clark 1945, 1964), Leviathan hypothesis (Brennan, and Buchanan 1980), differential productivity hypothesis (Baumol 1967), and the relative price hypothesis (Balassa 1964, Samuelson 1964). So, economic literature identified several determinants of public expenditure growth: inflation (Clark 1933, 1937, 1945, 1964), total revenue (De Viti De Marco 1893, 1898, 1934, Dalena, and Magazzino 2010), debt service or burden ratio (Ricardo 1817, Barro 1974, 1989, Reinhart, and Rogoff 2010), GDP growth rate (Barro 1989, 1990, Scully 1994, Armey 1995, Forte, and Magazzino 2010, Magazzino 2008, 2009b, 2009c, 2010a, 2010b), strategic transfers from federal government to the state governments, population growth, urbanization effect (Wagner 1912), and taxation. Over the past three decades, some studies – using the concepts of cointegration and Granger causality – focused on several countries and time periods. Yet, empirical findings are mixed and, for some countries, controversial. The results differ even on the direction of causality and the short-term versus long-term effects on economic policies. Depending upon what kind of causal relationship exists, its policy implications may be significant.

The aim of our study is to analyze the nexus between public expenditure and prices for the Mediterranean countries in the period 1970-2009. The data used in this work were taken from the IMF *Government Finance Statistics* database. In addition, Italy has a high public debt to GDP ratio and a high share of public expenditure; so, the reduction in public expenditure could represent a valid way for the consolidation of public finances. However, reducing the size of public sector should focus on the expenditure items that have less impact on GDP.

The outline of this paper is as follows. Section 2 provides a survey of economic literature on this issue. Section 3 provides an overview of the applied empirical methodology and a brief discussion of the data used. Section 4 discusses the empirical results. Finally, Section 5 presents our concluding remarks and some policy implications.

2. Literature Survey

Already Ricardo (1824) stressed the importance of separation of the central bank from political institutions, and the prohibition of monetary financing by the excesses of government spending (deficit monetization), only to clearly enunciate the key principles of the theory of today' central bank independence from political power.

Clark (1933, 1937, 1945, 1964) warned the most economically advanced countries of the danger of letting go beyond the relationship between public expenditure and national income as the threshold value of 25%. Clark lies down that when government tax proceeds reach this critical ratio, a progressive tax system generates increasing proportions of additional income from taxpayers, whose productivity falls. In fact, high levels of taxation would have reduced incentives to work and saving. Moreover, people become less resistant to the inflationary

methods of government financing. According to the analysis of Clark, the higher taxes would have decreased the profits of enterprises, which, passing it on to prices, have increased the prices of final goods. So, the overall effect is a fall of the aggregate supply (due to the falls of private incentives) and an expansion of the aggregate demand (due to the inflationary financing techniques) and, hence, inflation results.

Through an analysis of time series on prices, taxes and public spending of a large group of countries for the inter-War period, Clark came precisely the threshold of 25% as a ratio of public expenditure on national income. If it is true that inflation is a "social evil", it is true that inflation reduces the costs of the public sector, since certain groups in society cannot defend. Moreover, the fiscal drag – the crop that inflation gives policy-makers in countries with progressive tax systems of type – is disappearing in many states, since the awareness of citizens in this respect has increased in recent years. Yet, recent decades have, however, proved that many countries have crossed the 25% limit without much inflationary tendencies (Jain 1989).

Already Bernstein (1936) had investigated the possibility of using the public know which specific anti-recession tool, highlighting the effects of inflation. According to the scholar, in the first three decades of the twentieth century great attention was given to possible use of public expenditure in order to minimize cyclical fluctuations on employment and production (emphasized by the report of the "Royal Commission on the Poor Laws"), while others economists – as Keynes, Martin, Foster, Catchings, and Pigou – had suggested the use of public spending as an instrument of economic policy, whereas periods of depression as a stage characterized by a low cost. Bernstein came to the conclusion that if these conditions were not favorable, considerable increases in public spending during periods of economic depression would lead to increased prices and production.

Bullock (1934), about the crisis of the thirties, put it on the rise-to the effects of economic policy choices of the Administration status, stressing the inadequacy and the lateness of the spending policies enacted in the years 1933-1934, also in view of the level of prices and sharp decline in tax revenue. Basically, if the start conditions of monetary stability are preserved, then the government will have ample room in the policies of deficit.

Pechman, and Mayer (1952) discussed the limits to the inflation taxation outlined by Clark, concluding that in the period between the two world wars, the empirical evidence supports the thesis Clark in only two cases (Britain, and Norway). Similarly, the price indices calculated for the period 1945-1948 grew annually in 53 of the 71 countries considered here: Clark arguments do not prove that prices grew faster where the tax burden exceeded the limit set by him.

Eltis (1983), analyzing the causes of the difficulties of the British economy in the seventies, found a double bond between inflation and public spending on the one hand, inflation was seen as the effect of deficit policies, useful - through increases supply of money - to finance the excess expenditure. Secondly it was originated by the wage increases put forward by workers to protect their purchasing power. Furthermore, Eltis found a strong empirical evidence to support the view that robust budget deficits create inflationary pressures.

Tanzi, Blejer, and Teijeiro (1987) moved from the consideration that the different parts of the public budget respond differently to inflationary pressures. However, scientists spotted in public debt service a strong link between public spending and the price trend.

Buiter (1987) studied the consequences for inflation of public expenditure cuts, emphasizing the important distinction between cuts in public consumption expenditure (which will tend to reduce the deficit) and cuts in public sector capital formation (which may have the perverse effect of increasing the deficit). This will happen if the expenditure effect is swamped by the direct and indirect effects of a reduced public sector capital stock on government revenues. If the public sector deficit increased, the cuts in public sector capital formation will raise the demand for seigniorage revenue.

Özatay (1997) studying the Turkish experience in the period 1997-1995 emphasizes the importance of coordination of fiscal and monetary policies in achieving price stability. Results indicate that, despite the rapidly changing financial environment, there are stationary long-run money-income relationships. Moreover, the growth rates of various monetary aggregates have predictive power for future movements in the Consumer Price Index. However, as the Turkish case clarifies, in an economy with persistent budget deficits these properties are not sufficient to conduct successful monetary policies. By a credible policy, it is possible to substantially reduce the inflation rate from 85% to 10% in a 4-year period. Yet, this necessitates that the Public Sector Borrowing Requirement should not exceed 1.5% of GNP.

Ruge-Murcia (1999) developed a dynamic, rational expectations model of inflation where the money supply is endogenously determined by the government's use of newly created money to finance its current spending and by the effect of past rates of inflation on the real value of taxes. In an empirical application to Brazil (1980-1989, monthly data), estimates indicate that there are steady-state inflation and money growth rates associated with each of the two possible government spending regimes. The low regime would be characterized

in equilibrium by rates of inflation and money growth of 8.22% and 7.29% per month, respectively, and a share of GDP devoted to government outlays of 22.73%. The high spending regime would be associated with an expenditure level amounting to 33.43% of GDP, a monthly rate of inflation of 19.12%, and a monthly money growth rate of 19.25%.

Aizenman, and Hausmann (2000) investigated budgetary rules for an economy characterized by inflation and volatile relative prices. In the absence of shocks, the design of the budget is that the Treasury allocates funds once in every budgetary cycle. In the presence of volatile shocks, one would observe occasional budgetary revisions, the outcome of which is that the actual expenditure differs from the projected one. They use a panel data for Argentina, Brazil, Chile, Columbia, Costa Rica, Caribbean, Salvador, Guatemala, Honduras, Mexico, Peru, and Venezuela, for 1970-1994. The correlation between the budget error and the inflation variable turned out to be high, and highly significant. Similar results are found for the case where inflation is decomposed into the expected and the unexpected components, confirming that both the expected and the unexpected inflation increase the budget error.

Alavirad (2003) studied the effect of inflation on government revenue and expenditure for Islamic Republic of Iran. His major finding is that the government budget deficit increases in the inflationary condition. In addition, the deficit increases money supply, and this tends to increase inflation in Iran.

Ezirim, and Muoghalu (2006), starting from Clark's hypothesis, found that when the size of the public sector (measured by the share of expenditure on GDP) exceed a certain threshold, incentives to produce are discouraged (because of high tax burden). The reduction in aggregate supply, in addition, is even more pronounced in the case of budget balance (viewed as a fiscal constraint). The net result of such a bad adjustment between demand and supply is an inflationary spiral.

Kia (2006), studying Iranian economy for the period 1970-2002, focused on internal and external factors, which influence the inflation rate in developing countries. According to the estimation results, over the long run, a higher exchange rate leads to a higher price in Iran. So, a policy regime that leads to a stronger currency can help to lower inflation. However, a higher money supply when it is anticipated does not lead to a higher price level, but an unanticipated shock in the money supply results in a permanent rise in the price level. So, an unanticipated reduction in the money supply should be a powerful tool to reduce inflation in Iran. It is also found that the fiscal policy is very effective in Iran to fight inflation as the increase in the real government expenditures as well as deficits cause inflation, but if the changes are unanticipated they cause the opposite effect. While a high debt per GDP is deflationary.

Ezirim, Muoghalu, and Elike (2008) studied the relationship between growth rate of public spending and inflation rate for the United States of America in the period 1970-2002 found that the two variables move in the same direction. According to their analysis, inflation affects spending decisions of the U.S. federal government, but is in turn influenced both the short and long term. The dual causality was confirmed, however, the conclusions were reached and Ezirim, and Ofurum (2003). The conclusion drawn by these scholars is that, in order to bend inflation, governments should appropriately reduce the levels of expenditures; on the other hand, to reduce the growth in the size of the public, policy-makers should diminish price dynamics. A further consequence would be that fiscal policy would be a valuable tool for controlling inflation, by virtue of their ability to act directly on public spending (content).

Pekarski (2010) analyzed budget deficits and inflation in high inflation economies. The main finding is that recurrent outbursts of extreme inflation in these economies can be explicitly explained by the hysteresis effect associated with the action of two mechanisms: the arithmetic of the wrong side of the ITLC and the Patinkin effect. Another finding is that changes in different items of the budget balance sheet may have very different effects on inflation (apart from their different effects on the real economy). Varvarigos (2010) constructed a stochastic, dynamic general equilibrium model of endogenously sustained growth of an economy whose government finances volatile public spending via seigniorage. The resulting volatility in money supply, combined with the effects of money on human capital formation, yielded some interesting and important results concerning macroeconomic performance. The model predicts a negative correlation between long-run output growth and policy volatility. In addition, given that both the mean and the variance of the inflation rate are elevated by volatility in public spending, the model provides a possible account for the strong positive correlation between inflation and its variability, as well as their negative correlation with output growth.

3. Data and methodology

For the purpose of this paper, the variables analyzed have been expressed in a logarithmic form. The data that have been used are annual and cover the time period 1970-2009, for Mediterranean countries.

The data used in this work were taken from the IMF *Government and Finance Statistics* database, which provide current and internationally comparable data on the finances and fiscal policies of Fund member governments[57]. Most of time series have unit root as many studies indicated, including Nelson, and Plosser (1982), and as proved by Stock, and Watson (1988), and Campbell, and Perron (1991) among others, that most of the time series are non-stationary. The presence of a unit root in any time series means that the mean and variance are not independent of time. Conventional regression techniques based on non-stationary time series produce spurious regression and statistics may simply indicate only correlated trends rather than a true relationship (Granger, and Newbold 1974). Spurious regression can be detected in regression model by low Durbin-Watson statistics and relatively moderate R^2.

One of the most widely used unit root tests is the ADF (Dickey, and Fuller 1979, 1981). Alternatively, Phillips (1987), and Phillips, and Perron (1988) proposed a non-parametric method to correct a wide variety of serial correlation and heteroskedasticity (PP). Perron (1989, 1990) demonstrates that if a time series exhibits stationary fluctuations around a trend or a level containing a structural break, then unit root tests will erroneously conclude that there is a unit root. PP and ADF tests have the same asymptotic distributions.

Elliott, Rothenberg, and Stock (ERS, 1996) proposed a modified Dickey-Fuller *t*-test (known as the DF-GLS test). Essentially, this test is an Augmented Dickey-Fuller test, except that the time series are transformed via a generalized least squares (GLS) regression before performing the test. The Augmented Dickey-Fuller test involves fitting a regression of the form:

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta t + \xi_1 \Delta y_{t-1} + \xi_2 \Delta y_{t-2} + \ldots + \xi_k \Delta y_{t-k} + \varepsilon_t \quad (1)$$

and then testing the null hypothesis H_0: $\beta=0$. The DF-GLS test is performed analogously but on GLS-detrended data. The null hypothesis of the test is that y_t is a random walk, possibly with drift.

Finally, the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS 1992) test differs from those unit root tests in common use (such as ADF, PP, and DF-GLS) by having a null hypothesis of stationarity. The test may be conducted under the null of either trend stationarity (the default) or level stationarity. Inference from this test is complementary to that derived from those based on the Dickey-Fuller distribution.

Then we examine the unit root (or stationarity) properties of the variables, accounting for structural breaks. The present paper employs Zivot, and Andrews (ZA, 1992) test to address this issue. The Zivot, and Andrews test is performed by running the following regression:

$$x_t = \mu + \beta t + \alpha x_{t-1} + \sum_{i=1}^{k} \delta_i \Delta x_{t-i} + \varepsilon_t \quad (2)$$

for $t=1,\ldots,T$, where x_t is a potentially non-stationary time-series, and the terms Δx_{t-i}, $i=1,\ldots,k$ are included to purge any serial correlation among the residuals. Furthermore, Clemente, Montañés, and Reyes (CMR 1998) have developed a procedure allowing for a gradual shift in the mean to test more than one break point.

The non-stationary series with the same order of integration may be cointegrated if there exists some linear combination that can be tested for stationarity. The Johansen and Juselius procedure (Johansen 1988, Johansen, and Juselius 1990) is preferable to test for cointegration for more than two series.

Moreover, Johansen, and Juselius procedure is considered better than Engle-Granger even in two time series case and has better small sample properties since it allows feedback effects among the variables under investigation where it is assumed, in the Engle, and Granger procedure, that there are no feedback effects between the variables. The procedure is based on likelihood ratio (LR) test to determine the number of cointegration vectors in the regression. Johansen technique enables to test for the existence of non-unique cointegration relationships. Three tests statistics are suggested to determine the number of cointegration vectors: the first is the Johansen's "trace" statistic method, the second is his "maximum eigenvalue" statistic method, and the third method chooses *r* to minimize an information criterion. Having established the long-run equilibrium relationship between government expenditure and revenues, the short-run adjustments are estimated using the Error Correction Model (ECM). This model is based on the two following equations:

$$\Delta X_t = \alpha_0 + \alpha_1 e_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta X_{t-i} + \sum_{i=1}^{n} \alpha_j \Delta Y_{t-i} + \varepsilon_t, \quad (3)$$

$$\Delta Y_t = \beta_0 + \beta_1 u_{t-1} + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{n} \beta_j \Delta X_{t-i} + \eta_t \quad (4)$$

[57] See: http://www.esds.ac.uk/international/support/user_guides/imf/gfs.asp.

where e_{t-1} and u_{t-1} represent the error-correction terms which are the lagged residuals from the cointegration relations. The error correction terms will capture the speed of the short-run adjustments toward the long-run equilibrium. Furthermore, the error correction model equations (3) and (4) allow testing for short-run as well the long-run causality between government expenditure and aggregate income.

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.

4. Econometric results

We present and discuss an empirical analysis of the nexus between public expenditure and inflation, applied to the Mediterranean countries. In Table 1 variables of the model are summed up. All series contain yearly data in real terms.

Table 1. List of the variables.

Variable	Explanation
TEGG	Total Expenditure of General Government, % of GDP
NCPI	National Consumer Price Index, 2000=100

Source: IMF.

In Figure 1 the first differences of NCPI (*ΔNCPI*) for the Mediterranean countries from 1970 to 2009 are shown

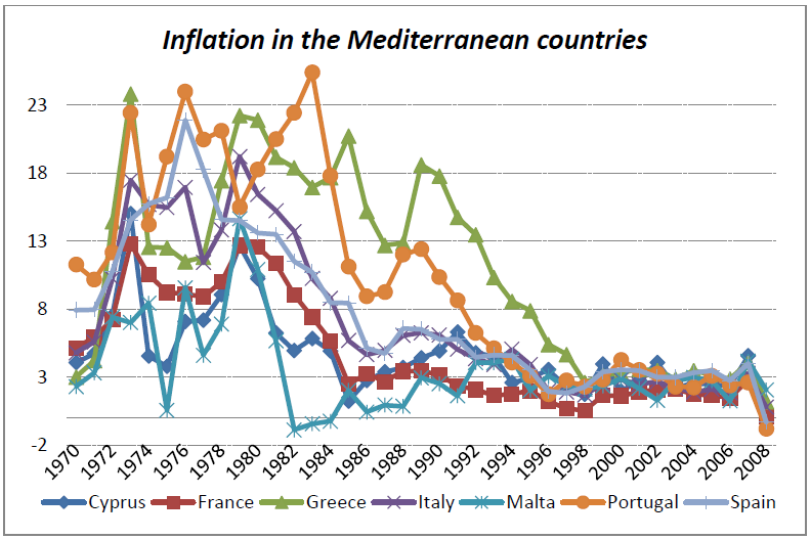

Figure 1. Inflation in the Mediterranean countries (1970-2009).

Source: our elaborations on IMF data.

As a preliminary analysis, some descriptive statistics are shown in the following Table 2.

Table 2. Exploratory data analysis (mld EUR, 1970-2009).

Variable	Mean	Median	Standard Deviation	Skewness	Kurtosis	Range
TEGG	45.2512	44.8566	5.5844	-0.2273	2.5783	26.6596
NCPI	66.1517	71.2841	38.5341	-0.1515	1.7357	130.3617

Source: our calculations on IMF data.

Correlation coefficients summarized in Table 3 indicate a low positive correlation between real total public expenditure and price index. These findings indicate that higher values of real public expenditure are associated with higher values of NCPI (except in Italy and Spain).

Table 3. Correlation analysis between public expenditure and price index.

Country	Correlation coefficient between TEGG and NCPI	Correlation coefficient between ΔTEGG and ΔNCPI
Cyprus	0.9095	-0.0617
France	0.8344	0.3088
Greece	0.6284	-0.1408
Italy	0.1241	0.3503
Malta	0.5106	-0.0642
Portugal	0.9422	-0.1384
Spain	-0.1412	-0.3202

Notes: Bonferroni adjustment applied.
Source: our calculations on IMF data.

First of all, we obtained log-transformations of the time-series. The Inter-Quartile Range analysis shows the absence of outliers in our samples. Then, we applied time-series techniques on stationarity and unit root processes, in order to check some stationarity properties. Table 4 contains the results of common unit root tests for our variables.

Table 4. Results for stationarity tests.

Country	Variable	Stationarity tests				
		Deterministic component	ADF	ERS	PP	KPSS
Cyprus	***TEGG***	intercept, trend	NS: -2.357	NS: -2.336	NS: -2.357	TS: 0.113
	NCPI	intercept, trend	NS: -2.887	NS: -1.217	NS: -2.871	NS: 0.357
	ΔTEGG	intercept	DS: -3.418	DS: -2.298	DS: -3.418	DS: 0.067
	ΔNCPI	intercept	DS: -4.694	NS: -1.929	DS: -4.647	NS: 0.534
France	***TEGG***	intercept, trend	NS: -3.369	NS: -2.465	NS: -2.421	NS: 0.188
	NCPI	intercept, trend	NS: -2.128	NS: -1.083	NS: -1.388	NS: 2.030
	ΔTEGG	intercept	DS: -3.159	DS: -2.631	DS: -3.159	DS: 0.129
	ΔNCPI	intercept	NS: -1.942	NS: -1.412	DS: -1.923	NS: 0.433
Greece	***TEGG***	intercept	NS: -2.183	NS: -0.247	NS: -2.183	NS: 0.555
	NCPI	intercept, trend	NS: -2.619	NS: -2.268	NS: -2.676	NS: 0.451
	ΔTEGG	intercept	DS: -5.183	NS: -2.059	DS: -5.183	DS: 0.138
	ΔNCPI	intercept	NS: -1.610	NS: -1.092	NS: -1.579	NS: 1.140
Italy	***TEGG***	intercept	LS: -2.855	NS: -0.733	LS: -2.855	LS: 0.269
	NCPI	intercept, trend	NS: -2.153	NS: -1.818	NS: -2.937	NS: 0.208
	ΔTEGG	intercept	DS: -3.708	NS: -1.481	DS: -3.708	DS: 0.352
	ΔNCPI	intercept	NS: -2.622	NS: -1.373	NS: -2.567	NS: 0.676
Malta	***TEGG***	intercept	LS: -2.917	NS: -1.360	LS: -2.917	LS: 0.399
	NCPI	intercept, trend	NS: -2.399	NS: -2.445	NS: -1.549	NS: 0.168
	ΔTEGG	intercept	DS: -4.732	NS: -1.937	DS: -4.732	DS: 0.131
	ΔNCPI	intercept	DS: -3.715	DS: -2.703	DS: -3.725	DS: 0.143
Portugal	***TEGG***	intercept, trend	NS: -3.277	TS: -3.434	NS: -3.086	NS: 0.148
	NCPI	intercept, trend	NS: -2.120	NS: -2.125	NS: -2.972	NS: 0.309
	ΔTEGG	intercept	DS: -4.125	DS: -2.783	DS: -4.098	DS: 0.064
	ΔNCPI	intercept	NS: -1.527	NS: -1.454	NS: -1.640	NS: 0.610
Spain	***TEGG***	intercept	NS: 0.720	NS: -1.389	NS: -1.218	LS: 0.232
	NCPI	intercept, trend	TS: -4.910	NS: -1.573	TS: -4.711	NS: 0.270
	ΔTEGG	intercept	DS: -3.222	DS: -2.321	DS: -3.299	DS: 0.458
	ΔNCPI	intercept	NS: -2.575	NS: -1.209	NS: -2.697	NS: 0.673

Notes: LS: Level Stationary; NS: Non Stationary; TS: Trend Stationary; DS: Difference Stationary.
Source: our calculations on IMF data.

The second column presents results for Augmented Dickey, and Fuller (1979) test; the third one for Elliott, Rothenberg, and Stock (1992) test; the fourth column contains results for Phillips, and Perron (1988) test; at last, in the fifth column there are results for Kwiatkowski, Phillips, Schmidt, and Shin (1992) test. Here, results indicate that public expenditure is clearly a *I(1)* process in five countries (Cyprus, France, Greece, Portugal and Spain); a *I(0)* process for Italy and Malta (where it seems to be level-stationary). While, prices index is a *I(2)* process everywhere, except Malta (*I(1)*).

Table 5. Results for unit root tests with structural breaks.

Country	Variable	TB	k	t-stat	1% Critical Value	5% Critical Value
Cyprus	***TEGG***	2003	0	-4.573	-5.57	-5.08
	ΔTEGG		0	-5.504	-5.57	-5.08
	ΔNCPI		0	-5.408	-5.57	-5.08
	Δ²NCPI		1	-6.428	-4.93	-4.42
France	***TEGG***	1992	1	-3.424	-5.57	-5.08
	ΔTEGG		0	-5.752	-5.57	-5.08
	ΔNCPI		2	-3.918	-5.57	-5.08
	Δ²NCPI		0	-5.573	-4.93	-4.42
Greece	***TEGG***	2006	0	-3.663	-5.57	-5.08
	ΔTEGG		0	-7.309	-5.57	-5.08
	ΔNCPI		0	-4.395	-5.57	-5.08
	Δ²NCPI		0	-5.601	-5.57	-5.08
Italy	***TEGG***	2005	0	-2.508	-5.57	-5.08
	ΔTEGG		0	-6.282	-5.57	-5.08
	ΔNCPI		0	-4.679	-5.57	-5.08
	Δ²NCPI		0	-5.983	-4.93	-4.42
Malta	***TEGG***	2003	0	-5.230	-5.57	-5.08
	ΔTEGG		0	-5.324	-5.57	-5.08
	ΔNCPI		0	-3.880	-4.93	-4.42
	Δ²NCPI		2	-4.892	-4.93	-4.42
Portugal	***TEGG***	1997	1	-4.512	-5.57	-5.08
	ΔTEGG		1	-4.439	-4.93	-4.42
	ΔNCPI		0	-3.055	-5.57	-5.08
	Δ²NCPI		2	-4.835	-4.93	-4.42
Spain	***TEGG***	2007	0	-1.008	-5.57	-5.08
	ΔTEGG		0	-7.911	-5.57	-5.08
	ΔNCPI		1	-2.892	-5.57	-5.08
	Δ²NCPI		0	-6.047	-4.93	-4.42

Source: our calculations on IMF data.

The results of the Zivot, and Andrews's unit root test are summarized in Table 5. An examination of these results for public expenditure series indicate that the null hypothesis of a unit root cannot be rejected in levels (the only exception is Malta, at a 5% significance level). If we take the first differences, we can reject the null hypothesis for all countries. So, we can conclude that public expenditure is clearly a *I(1)* process in six countries (Cyprus, France, Greece, Italy, Portugal and Spain); a *I(0)* process for Malta. Inflation is a *I(1)* process everywhere.

Table 6. Results for additive outlier unit root tests.

Country	Variable	SB	k	t-stat	5% Critical Value
Cyprus	***TEGG***	2000	0	-3.366	-3.560
	ΔTEGG		0	-6.378	-3.560
	ΔNCPI		4	-3.637	-3.560
	Δ²NCPI		1	-8.361	-3.560
France	***TEGG***	1994	1	-3.954	-3.560
	ΔTEGG		0	-3.964	-3.560
	ΔNCPI		5	-3.177	-5.490
	Δ²NCPI		1	-4.237	-3.560
Greece	***TEGG***	2008	0	-4.184	-3.560
	ΔTEGG		0	-6.796	-3.560
	ΔNCPI		5	-2.300	-5.490
	Δ²NCPI		0	-6.516	-5.490
Italy	***TEGG***	1989, 1996	4	-1.310	-5.490
	ΔTEGG		0	-5.559	-5.490
	ΔNCPI		2	-5.962	-5.490
	Δ²NCPI		2	-3.591	-3.560
Malta	***TEGG***	2000	2	-3.472	-3.560
	ΔTEGG		1	-3.891	-3.560
	ΔNCPI		0	-4.627	-5.490
	Δ²NCPI		1	-6.566	-3.560
Portugal	***TEGG***	1987, 1992	0	-2.330	-5.490
	ΔTEGG		1	-5.001	-3.560
	ΔNCPI		5	-3.127	-5.490
	Δ²NCPI		2	-3.892	-3.560
Spain	***TEGG***	1998, 2007	3	-3.646	-5.490
	ΔTEGG		1	-3.754	-3.560
	ΔNCPI		0	-4.205	-3.560
	Δ²NCPI		2	-3.658	-3.560

Source: our calculations on IMF data.

From the Table 6 above, we note that the Clemente *et al.* test results are quite different to those found with the Zivot, and Andrews test. For *TEGG*, despite the structural break, we are unable to reject the null hypothesis of a unit root in five countries (Cyprus, Italy, Malta, Portugal and Spain); as a conclusion, public expenditure seems to be a *I(1)* process in these countries, but a *I(0)* process in France and Greece. Inflation is *I(0)* for Cyprus, Italy and Spain, and *I(1)* otherwise.

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).

Cointegration tests have been subsequently applied, in order to find the long-run relationship between the share of public expenditure on GDP (*TEGG*) and inflation (*ΔNCPI*), since these two economic variables are integrated at the same order (1). As is shown in Table 7, the Johansen, and Juselius cointegration method suggests that there is a cointegrating relationship in four cases (Cyprus, France, Greece and Portugal). In these cases, the trace statistic and the maximum-eigenvalue statistic reject r=0 in favour of r=1 at the 5% critical value. Yet, for Spain we have a contradictory result: in fact, the trace statistic suggests r=0, while the maximum-eigenvalue statistic suggests r=1. 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. As a conclusion, we find rank=0 for Italy, Malta and Spain. While, for the other four countries we find the presence of cointegration (rank=1).

Table 7. Results for cointegration tests between public expenditure and inflation (*TEGG* and *ΔNCPI*)

Johansen and Juselius procedure				
Country	**Trace statistic**	**Maximum-eigenvalue statistic**	**SBIC HQIC AIC**	**Rank**
Cyprus	3.9243 (9.42)	3.9243 (9.24)	16.1207 15.7016 15.7730	r=1
France	5.0004 (9.42)	5.0004 (9.24)	13.8819 13.6278 13.5083	r=1
Greece	2.1861 (9.42)	2.1861 (9.24)	15.6044 15.2839 15.2061	r=1
Italy	16.3700 (25.32)	6.7739 (12.52)	14.5055 14.3073 14.2201	r=0
Malta	11.0718 (25.32)	7.2492 (18.96)	15.7444 15.4300 15.4836	r=0
Portugal	6.2125 (12.25)	6.2125 (12.52)	14.7726 14.4608 14.3100	r=1
Spain	24.8214 (25.32)	18.3598 (18.96)	14.9829 14.6685 14.7221	r=0

Notes: 5% Critical Values in parenthesis.
Source: our calculations on IMF data.

Granger causality tests suggest a bi-directional flow, at 1% significance level, between public expenditure and inflation for Italy, Malta and Portugal in the short-run, and for Greece in the long-run; a unidirectional flow, running from inflation to public expenditure for Portugal (in the long-run, at a 1% level), as well as for Cyprus (1%), France (1%) and Spain (10%) in the short-run; a unidirectional flow, but in the opposite direction (from public expenditure to inflation), for Cyprus (at 1% level) and France (1%) in the long-run (see Table 8).

Table 8. Results for short and long-run causality tests

Country	*Lags*	*Log-likelihood*	*SBIC*	*Causality in the long-run*	*Causality in the short-run*
Cyprus	3	-67.9675	15.8456	G → P	P → G
France	1	-203.0899	14.2196	G → P	P → G
Greece	1	-137.3424	16.0068	G ↔ P	-
Italy	4	-152.0508	14.4817	-	G ↔ P
Malta	4	142.6019	24.3757	-	G ↔ P
Portugal	4	-181.8044	15.3662	P → G	G ↔ P
Spain	4	-181.8044	15.3662	-	P → G

Source: our calculations on IMF data.

For all our equations, a Lagrange-multiplier (LM) test for autocorrelation in the residuals of Vector Error-Correction Model (VECM) clarifies as at the 5% significance level we cannot reject the null hypothesis that there is no serial correlation in the residuals for the orders 1,…,5 tested. Checking the eigenvalue stability condition in a 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. For our models, results suggest normality. Finally, the analysis of ARCH effects shows the absence of

this problem for the estimated models.

5. Conclusions and policy implications

The purpose of this paper is to contribute to the literature on the nexus between public expenditure and inflation, using recent econometric techniques. So, we studied the relationship between public expenditure and inflation for Mediterranean countries, using annual data covering the period 1970-2009. The time-series properties of the data were assessed using several unit root tests (ADF, DF-GLS, PP, and KPSS). Furthermore, in order to evaluate the presence of eventual structural breaks, some tests (ZA and CMR) have been conducted. Empirical findings indicate that public expenditure is clearly a *I(1)* process in five countries (Cyprus, France, Greece, Portugal and Spain); and a *I(0)* process for Italy and Malta. While, prices index is a *I(2)* process everywhere, except Malta.

Cointegration analysis reveals that there is a long-run relationship between public expenditure/GDP ratio and inflation in four cases (Cyprus, France, Greece and Portugal). Granger causality tests suggest a bi-directional flow between public expenditure and inflation for Italy, Malta and Portugal in the short-run, and for Greece in the long-run; a unidirectional flow, running from inflation to public expenditure for Portugal (in the long-run), as well as for Cyprus, France and Spain in the short-run; a unidirectional flow, but in the opposite direction, for Cyprus and France in the long-run.

Yet, we find some evidence of government spending causing prices dynamics. In other words, the original Clark's proposition of an excessive government spending as a cause of pressure on prices in the economy is well supported by the data for the Mediterranean countries. Certainly, this result is subject to the time period examined and statistical methods used; nevertheless, our empirical findings show some evidence in favour of the opposite direction of causality flow. In fact the inflation Granger causes public expenditure growth in three cases.

As a main policy implication, the countries where a bi-directional causality flow has been found can comfortably regulate the levels of inflation in the economy controlling the share of its public expenditure. Furthermore, restrictive monetary policies can contain the size of Government.

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