Public expenditure and revenue in Italy, 1862-1993

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PUBLIC EXPENDITURE AND REVENUE IN ITALY, 1862-1993

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ABSTRACT: *This study examines the long-run equilibrium relationship between government expenditure and revenue in Italy from 1862 to 1993, using cointegration techniques and the direction of causality relationship in the long and short runs between the variables through integrating the Error Correction Model (ECM) into the traditional Granger causality test. A Granger non-causality test (due to Toda and Yamamoto) is also performed. Unit root tests have been applied in order to investigate the stationarity properties of the series. Moreover, three more homogeneous sub-period (1862-1913; 1914-1946; 1947-1993) have been analyzed. The nexus between public expenditure and revenue has been discussed also by Impulse Response Functions (IRFs) and Forecast Error Variance Decompositions (FEVDs). Empirical findings show how, for each sub-period, the policy adopted reflect the prevailing paradigm of public finance (neutral or orthodox finance, Keynesian finance and discretionary or compensatory finance, respectively).*

SUMMARY: *1. Introduction; 2. The nexus between public expenditure and revenue; 3. Econometric methodology and data; 4. Discussion of empirical results; 5. Concluding remarks and policy implications; 6. Suggestions for future researches.*

KEYWORDS: *Government expenditure; government revenue; stationarity; cointegration; causality; spend and tax; tax and spend; Italy.*

JEL Codes: *B22; C22; C5; E62; H2.*

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1. – Introduction

The current economic and financial crisis has produced relevant effects on public finances, with growing budget deficits. So, it might be very relevant to investigate the "Tax-and-Spend", "Spend-and-Tax", and "Fiscal Synchronization" hypotheses. In fact, the question whether the revenue determines the public expenditure or the public expenditure determines the revenue is an issue dealt with by the earlier scholars of public finance, that has been neglected in the subsequent times. Therefore, this review of the literature on such that important topic mostly consists in a review of the relationship between public expenditure and public revenue.

This paper examines these hypotheses for Italy in the very long period (1862-1993), using time series methodologies. We analyze three different sub-period (1862-1913; 1914-1946; 1947-1993) and the whole period (1862-1993). The data used are obtained by Mitchell (2007).

The paper is divided into 6 sections. Section 2 provides a survey of the economic literature on the nexus between public expenditure and revenue. Section 3 contains an overview of the applied empirical methodology and a brief discussion of the data used. Section 4 discusses our empirical results. Section 5 presents some concluding remarks and, finally, Section 6 gives suggestions for future researches.

2. – The nexus between public expenditure and revenue

Some economists, including Friedman (1972; 1978), argued that raising taxes will simply lead to more spending. Others, including Buchanan and Wagner (1977), wrote that the high deficits themselves have been responsible for the growth of federal spending, and that if that spending had to be financed completely by direct taxes, people would decrease federal government spending. A third group, led by Barro (1974), clarified that increased taxes and borrowing are results of increased government spending.

A relative small number of econometric studies investigated the nexus between public expenditure and revenue.

A seminal research by Anderson, Wallace and Warner (1986) on U.S. data find evidence in favour of the Barro thesis that expenditures cause revenues. The results disagree sharply with Friedman's hypothesis that increased revenues cause increased expenditures. Neither is the Buchanan and Wagner view that higher taxes lead to less government spending supported by the data. They also find little evidence consistent with the hypothesis that economic instability leads to growth in government expenditures or revenues. While the evidence that inflation causes

growth in real government expenditures is very weak. On the same data, Ram (1988) concludes that taxes Granger cause spending at the federal level, but that the causality is reversed at the state and local level.

Ahiakpor and Amirkhalkhali (1989) evaluate the Canadian evidence. Their statistical analysis appears to support the claim that raising taxes would only partially act to reduce deficits. So, the results are pertinent to the design of a deficits policy. As a conclusion, to attack the problem of persistent deficits, Canada should focus more on spending cuts or fiscal restraint rather than on finding ways of raising additional revenue from taxes.

Later, studying the Canadian data, Payne (1997) find that revenues follow a time path independent of expenditures and GDP. On the other hand, expenditures respond to budgetary disequilibrium in that budget imbalances would be corrected by expenditure changes. Moreover, evidence suggests that expenditures also respond to GDP.

Interestingly, Miller and Russek (1990) find different results to that of in Anderson, Wallace, and Warner (1986), indicating bi-directional causality between taxes and spending (nominal and real) for the federal, and the state and local levels of government. And these results also differ from those reported by Ram (1988).

Huang and Tang (1992) studying the Taiwanese case, find feedback mechanisms between GNP and government expenditure, on the one hand and between government revenue and GNP, on the other hand. But there is only a one-way causality running from government revenue to government expenditure. The two bi-directional causalities seem to fit the expectation of fiscal activism. However, the causal flow from government revenue to expenditure indicates the constraint of the former on the latter.

Baghestani and McNown (1994) find strong support for the existence of a long run relation between revenues and expenditures of the U.S. federal government. However, neither revenues nor expenditures respond to budgetary disequilibria, leading to rejection of both the tax-and-spend and the spend-and-tax models of the budgetary process.

A study on causality link between government expenditure and revenue at federal, state and local levels in Switzerland has been conducted by Manzini and Zarin-Nejadan (1995). The general evidence turns out to be in favor of a causality running from revenue to expenditure. However, the possibility of a feedback cannot be excluded at the state and local levels.

Hondroyiannis and Papapetrou (1996) examine the nexus between public expenditure to GDP and revenue to GDP ratios for Greece over the period 1957-1993, using cointegration techniques. Their results support the hypothesis that there is a long-run relationship between the variables, indicating unidirectional causality from government spending to government revenues, in favour of the spend-tax hypothesis. Therefore, the development of high levels of deficits in Greece over a prolonged period of time is mainly due to spending decisions and

not to the dynamics of government revenues. So, any attempt to reduce public deficit without reducing drastically the levels of spending is doomed to failure.

In relation to the U.K. experience, Hasan and Lincoln (1997) find a controversial empirical evidence. In fact, while the Johansen maximum likelihood procedure indicates that the growth rates of tax revenue and government spending are cointegrated, the sequential testing procedure is indicative of a bi-directional causality between tax revenue and government spending in the quarterly data of the U.K. The results broadly confirm Wildavsky's (1964) incremental budgetary theory and empirically accord well with Owoye (1995).

The rivalling "tax and spend" and "spend and tax" hypotheses for the Austrian case is discussed in Koren and Stiassny (1998), where a trivariate structural VAR model (having expenditures, revenues and aggregate income as variables) of Austria's public sector is shown. The empirical findings indicate that the development of the federal budget was driven dominantly by spending decisions, not by the dynamics of government revenues – so, the "spend and tax" view seems to be confirmed by data.

Park (1998) investigates the Granger causal relationship between government revenues and expenditures in Korea over the period 1964 to 1992. Both parametric and nonparametric test results support the unidirectional causal relationship from government revenues to expenditures.

Li (2001) studying the revenue-expenditure nexus on Chinese data, finds a bi-directional causality pattern. Therefore, the paper concludes that attempts simply to change revenue or expenditure or both without taking into account of the interdependence between the two may be counter-productive, and the effects on aggregate demand of government debt-financing in the presence of inflation may not be as detrimental as some economists would expect.

In the analysis of Chang, Liu and Caudill (2002), the results from Granger causality tests suggest unidirectional causality running from revenues to spending, supporting the "tax-and-spend" hypothesis, for Japan, South Korea, Taiwan, UK and the USA. The opposite relationship, supporting the "spend-and-tax" hypothesis, holds only for Australia and South Africa. In the case of Canada, this study finds a feedback mechanism existing between revenues and spending, supporting the "fiscal synchronization" hypothesis. While, for New Zealand and Thailand, these results support none of the hypotheses.

Alavirad (2003) studies 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.

Studying the most efficient strategy to achieve permanent reductions in fiscal deficits in Spain using VAR techniques and Granger-causality tests, De Castro, González-Páramo and De Cos (2004) find clear evidence of long-run bi-directional causality with public expenditure Granger-causes revenues, and also,

albeit less clearly, in the opposite direction. While in the short run the direction of causality seems to hold mainly from revenue to public expenditure. These results lead them to conclude that a credible fiscal consolidation strategy in Spain should be achieved through downsizing of the public sector and requires public expenditure cuts.

Jevcak (2004) investigates the argument that the expenditure structure of public budget should reflect its revenue structure. It is shown that if the revenue side of the government budget exactly matches the expenditure side that is if industrial public goods are financed by both private production factors with the weights reflecting the contributions of public inputs to the private factor productivity, then public inputs are provided optimally even in the presence of tax competition.

In investigating the causal relation between government revenue and spending, empirical results in Al-Foul and Baghestani (2004) support the "tax-and-spend" hypothesis for Egypt, and the "fiscal synchronization" hypothesis for Jordan. Yet, is essential for both countries to eliminate the budget deficit and therefore ensure the availability of domestic saving for private investment. As a final conclusion, they underline the crucial role of privatization process, since it should lead to higher domestic saving and investment and, at the same time, eliminate the budget deficit by enhancing revenue and curbing spending.

Al-Qudair (2005) examines the long-run equilibrium relationship between government expenditure and revenues in the Kingdom of Saudi Arabia using cointegration technique and Granger causality test. The unit root tests show that the series are non stationary at their levels, whereas they are stationary at their first differences. The cointegration test indicates the existence of long-run equilibrium between government expenditure and revenues. The causality tests indicate that there is a bi-directional causal relationship between government expenditure and revenues in both the long and the short-run.

The nexus between government revenue and government expenditure in nine Asian countries has been studied by Narayan (2005). His empirical results suggest that for three out of the nine countries government revenue and government expenditure are cointegrated; moreover, there is not a strong support for the "tax-and-spend" hypothesis as for the "spend-and-tax one".

Analyzing US data via threshold auto-regression models, Ewing *et al.* (2006) show that revenues and expenditures are cointegrated, and that the adjustment process of the budgetary disequilibrium is asymmetric, while the application of the asymmetric error correction model indicates that revenues and expenditures respond to the long-run requirements of the budgetary balance only when the budget is worsening.

Instead, Nyamongo, Sichei and Schoeman (2007) analyze the relation between these two variables in relation to the South African case, concluding that revenue and expenditure are linked bi-directionally by Granger causality in the long-run, while there is no evidence of Granger causality in the short-run in South Africa.

Another recent paper on this issue is that of Eita and Mbazima (2008) on Namibia. Their results show a unidirectional causality from government revenue to government expenditure. This suggests unsustainable fiscal imbalances (deficit) can be mitigated by policies that stimulate government revenue.

The relationship between public expenditure and revenue has been studied also for some transitional economies by Konukcu-Önal and Tosun (2008). The empirical support for the "tax-and-spend" hypothesis in these economies implies that increasing government revenues may not end up with lower budget deficits due to their stimulating effect on the demand for public goods and services.

Using quarterly US data from 1959:3 to 2007:4, Young (2008) argue that allowing for asymmetric revenue effects results in a compelling case for fiscal illusion: revenue increases inversely Granger-cause expenditure changes. This finding is robust to incorporating additional asymmetries in the error-correction process to long-run budgetary disequilibria.

Studying the Turkish case, Wahid (2008) hypothesizes that increased government spending can cause tax revenue to rise. Its results support the hypothesis that government expenditure causes tax revenues to increase in Turkey.

Wolde-Rufael (2008) investigate the causal relationship between government revenue and government expenditure for 13 African countries within a multivariate framework. The empirical evidence suggests that there was a bi-directional causality running between expenditure and revenue for Mauritius, Swaziland and Zimbabwe; no causality in any direction for Botswana, Burundi and Rwanda; unidirectional causality running from revenue to expenditure for Ethiopia, Ghana, Kenya, Nigeria, Mali and Zambia; and a unidirectional causality running from expenditure to revenue for Burkina Faso only.

Gil-Alana (2009) examines the relationship between the US government expenditures and revenues using a fractional cointegration framework. The results show that both individual series are non-stationary I(1), and he does not find evidence of cointegration of any degree. However, taking into account a structural break at 1973, fractional cointegration is found if the underlying process is autocorrelated, especially in the asymmetric modeling.

Moving from the 2005 reform of the *Stability and Growth Pact*, Lemmer and Stegarescu (2009) provide evidence of a lax implementation of expenditure plans in recent years when revenues were buoyant. Moreover, the influence of revenue windfalls on expenditure overruns is found to be more pronounced in countries that also have not met their medium-term objectives.

Saunoris and Payne (2010) estimate an asymmetric error correction model within a momentum threshold autoregressive framework over the period 1955-2009. Empirical results indicate that government revenues respond to short-run changes in government expenditures as well as asymmetrically to budgetary disequilibrium. Moreover, their empirical findings lend support for the spend-tax hypothesis.

3. – Econometric methodology and data

In this research we use time-series econometric analysis. So, the VAR (*Vector AutoRegressive*) and VEC (*Vector Error Correction*) models were used[3].

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 test is the ADF unit root test (Dickey and Fuller, 1979, 1981). Alternatively, Phillips (1987) and Phillips and Perron (1988) proposed a nonparametric 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 (DF-GLS, 1996) proposed a modified Dickey-Fuller t test (known as the DF-GLS test). Essentially, the test is an augmented Dickey-Fuller test, except that the time series is transformed via a generalized least squares (GLS) regression before performing the test. The augmented Dickey–Fuller test involves fitting a regression of the form

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta t + \xi_1 \Delta y_{t-1} + + \xi_2 \Delta y_{t-2} + \dots + + \xi_k \Delta y_{t-k} + \varepsilon_t \qquad [1]$$

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.

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[3] For a detailed analysis of the time-series modelling used see, among others: LÜTKEPOHL H. (2005), *New Introduction to Multiple Time Series Analysis*, Milan: Springer-Verlag; ENDERS W. (2003), *Applied Econometric Time Series*, Chichester: Wiley; DAGUM E.B. (2002), *Analisi delle serie storiche: modellistica, previsione e scomposizione*, Milan: Springer-Verlag; FRANSES P.H. (2002), *Time series models for business and economic forecasting*, Cambridge: Cambridge University Press; HAMILTON J.D. (1994), *Time Series Analysis*, Princeton: Princeton University Press.

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.

The unit root test and the order of the integration would be performed on both the original series and the differences of the series using the PP test.

The non-stationary series with the same order of integration may be cointegrated if there exist some linear combination of the series 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 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). The error correction model is based on the two following equations:

$\Delta X_t = \alpha_0 + \alpha_1 e_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta X_{t-i} + \sum_{i=1}^{n} \alpha_j \Delta Y_{t-i} + \varepsilon_t$	*[2]*
$\Delta Y_t = \beta_0 + \beta_1 u_{t-1} + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{n} \beta_j \Delta X_{t-i} + \eta_t$	*[3]*

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 (2) and (3) allow to test 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.

For the purpose of this paper, all the variables analyzed have been expressed in a logarithmic scale. The data used are annual and cover the time period 1862-1993, for Italy. Moreover, to eliminate the effect of prices on the number of variables, they were deflated by appropriate deflators. The data has been derived from Mitchell (2007).

In Table 2 variables of the model are summed up. All series contains yearly data for real value of the variables.

Tab. 1 – List of variables.

Variable	Explanation
tcge	Total Central Government Expenditure, thousand million LIT
cgr	Central Government Revenue, thousand million LIT

Sources: Mitchell (2007).

As a preliminary analysis, some descriptive statistics are presented in the following Table 2, while Figure 1 shows the two series investigated.

Tab. 2 – Exploratory data analysis (Italy).

Variable	Mean	Median	Standard Deviation	Skewness	Kurtosis	Range
tcge	12.0712	10.2710	4.7748	0.4807	1.7318	13.5773
cgr	11.2334	9.8919	4.3998	0.6443	1.9516	13.8820

Sources: our calculations on Mitchell (2007) data.

Figure 1 shows clearly the jumps occurred during the two war-periods: both public expenditure and revenue burst in 1916 and 1940, but public expenditure predated revenue (Peacock and Wiseman (1961)).
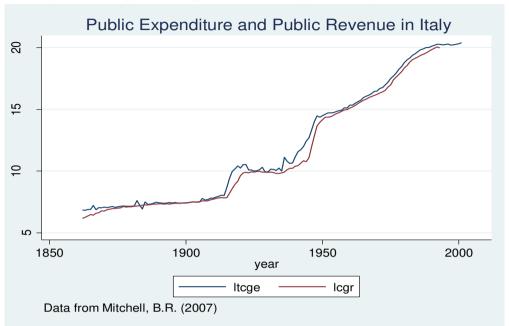
Fig. 1 – Public expenditure and public revenue in Italy (1862-1993).

Sources: our elaborations on Mitchell (2007).

4. – Discussion of empirical results

Firstly, we divided the entire period in three more homogeneous sub-sample. So, we analyzed the years from Italy's unification to World War I; then we studied the inter-wars ages; finally, we investigated the republican era. The last analysis is devoted to the whole period, in order to check some differences not only among these three sub-periods, but also among the whole period and each sub-sample.

Above all, we obtained log-transformations of the time-series. As a preliminary analysis, Inter-quartile Range show 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 3 contains results of common unit root tests, for our variables.

Tab. 3 – Results for stationarity tests (Italy).

Variable	Stationarity tests			
1862-1913				
	ADF	**ERS**	**PP**	**KPSS**
tcge	NS: -1.849	NS: -2.041	TS: -5.831	TS: 0.142
cgr	TS: -4.080	NS: -0.915	TS: -3.860	NS: 0.325
Δtcge	DS: -10.329	DS: -10.742	DS: -12.296	DS: 0.053
Δcgr	DS: -3.761	DS: -2.063	DS: -7.999	DS: 0.482
1914-1946				
	ADF	**ERS**	**PP**	**KPSS**
tcge	NS: -0.552	NS: 2.847	NS: -0.552	NS: 1.20
cgr	NS: -0.084	NS: 1.813	NS: -0.609	NS: 1.28
Δtcge	DS: -4.970	DS: -2.107	DS: -4.946	DS: 0.236
Δcgr	DS: -2.211	DS: -2.126	DS: -3.478	DS: 0.260
1947-1993				
	ADF	**ERS**	**PP**	**KPSS**
tcge	NS: -2.891	TS: -3.100	NS: -1.000	NS: 0.174
cgr	NS: -2.537	NS: -2.914	NS: -2.024	NS: 0.285
Δtcge	DS: -2.915	DS: -2.264	DS: -6.583	DS: 0.358
Δcgr	DS: -7.440	DS: -2.169	DS: -7.308	DS: 0.174

Notes: NS: Non Stationary; TS: Trend Stationary; DS: Difference Stationary.
Source: our calculations on Mitchell (2007) 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 are contradictory only for the period from the Unification to the WWI. In fact, public expenditure seems to be trend-stationary, while for public revenue parametric and non-parametric tests disagree. Since the latter are more robust, we conclude for non-stationary of the series. While, for the others two periods both variables should be considered as clearly non-stationary.

The lag-order selection has been conducted with the following statistics: final prediction error (FPE), Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC). They selected a model with two lags for the years 1914-1946, and with three lags for the others two time period specifications.

Cointegration tests have been subsequently applied, in order to be able to find the long-run relationship between public expenditure and revenue. As is shown in Table 4, Johansen and Juselius cointegration method suggests that there is one cointegrating relationship, for each period. 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 our data.

Tab. 4 – Results for cointegration tests (Italy).

1862-1913		
Johansen and Juselius procedure		
Rank = 1	Rank = 1	Rank = 1
Trace statistic: 0.2494	Maximum-eigenvalue statistic: 0.2494	SBIC: -4.7538
5% Critical Value: 3.76	5% Critical Value: 3.76	HQIC: -5.0653
Log-Likelihood: 141.7655	Log-Likelihood: 141.7655	AIC: -5.2557
1914-1946		
Johansen and Juselius procedure		
Rank = 1	Rank = 1	Rank = 1
Trace statistic: 0.7107	Maximum-eigenvalue statistic: 0.7107	SBIC: 0.1309
5% Critical Value: 3.76	5% Critical Value: 3.76	HQIC: -0.2820
Log-Likelihood: 20.1441	Log-Likelihood: 20.1441	AIC: -0.4763
1947-1993		
Johansen and Juselius procedure		
Rank = 1	Rank = 1	Rank = 1
Trace statistic: 1.0685	Maximum-eigenvalue statistic: 1.0685	SBIC: -4.4157
5% Critical Value: 3.76	5% Critical Value: 3.76	HQIC: -4.6424
Log-Likelihood: 116.4841	Log-Likelihood: 116.4841	AIC: -4.7771

Source: our calculations on Mitchell (2007) data.

The VECM models produce the estimates shown in Table 5 below. It shows that, for the first sub-period, the variation of public expenditure is influenced by its own first lag and by that of revenue; the same we found in the revenue equation. For the years 1914-1946, again in both equation either the lag term of expenditure or that of revenue are significant. Instead, in the post-war period, only the lag of revenue is statistically different to zero, in the equation of revenue.

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 model, results do not suggest non-normality. The analysis of ARCH effects shows the absence of this problem for the estimated models.

Tab. 5 – Results for VECM models estimates for a public expenditure-revenue model (Italy).

	1862-1913				
	Dep. var.: Δtcge			Dep. var.: Δcgr	
	Coefficient	SE		Coefficient	SE
Constant	0.0130	0.0232		0.0314***	0.0064
ECT	-0.4480***	0.1405		0.1852***	0.0389
Δtcge$_{t-1}$	-0.1741	0.1408		-0.0752*	0.0390
Δcgr$_{t-1}$	1.2865***	0.4476		-0.2848**	0.1240
RMSE		0.1267			0.0351
R²		0.4162			0.5856
AIC			-5.0152		
HQIC			-4.8841		
SBIC			-4.6710		
Log-Lik.			134.3792		
FPE			0.0000		
	1914-1946				
	Dep. var.: Δtcge			Dep. var.: Δcgr	
	Coefficient	SE		Coefficient	SE
Constant	0.1721**	0.0741		0.2278***	0.0281
ECT	0.2295**	0.0989		0.3039***	0.0374
Δtcge$_{t-1}$	0.2295**	0.0989		0.3039***	0.0374
Δcgr$_{t-1}$	-0.2523**	0.1087		-0.3341***	0.0412
RMSE		0.3571			0.1352
R²		0.1522			0.6871
AIC			-0.3291		
HQIC			-0.2683		
SBIC			-0.1458		
Log-Lik.			9.2649		
FPE			0.0019		
	1947-1993				
	Dep. var.: Δtcge			Dep. var.: Δcgr	
	Coefficient	SE		Coefficient	SE
Constant	0.1097***	0.0275		0.0908***	0.0197
ECT	-0.2025	0.1513		0.2447**	0.1084
Δtcge$_{t-1}$	0.1254	0.1769		0.1047	0.1268
Δcgr$_{t-1}$	0.0841	0.1644		0.1346	0.1178
RMSE		0.0941			0.0674
R²		0.6787			0.8443
AIC			-4.7771		
HQIC			-4.6424		
SBIC			-4.4157		
Log-Lik.			116.4841		
FPE			0.0000		

Source: our calculations on Mitchell (2007) data.

While, equations *4*, *5* and *6* sum up the only one cointegrating relationship, where the beta is exactly identified, for each sub-period.

1862-1913	
$tcge = -0.9110 \; cgr \; -0.7137$ (0.0575) (0.0000)	*(4)*
1914-1946	
$tcge = -1.0994 \; cgr \; +0.7498$ (0.0000) (0.4670)	*(5)*
1947-1993	
$tcge = -1.0287 \; cgr \; +0.2224$ (0.0000) (0.0000)	*(6)*

As shown in Table 6, Granger causality test suggest a unidirectional flow, from revenue to public expenditure (at 5% level), for years 1862-1913; a unidirectional flow, but in the opposite direction respect to the previous case (at 10% level), for the middle period. While, for the last specification, Granger causality test suggest a bidirectional flow, from public expenditure to revenue (at 5% level), and vice versa (at 5% level). For the whole period, it seems emerge a bidirectional flow, too (in both cases at a significance level of 1%).

Moreover, we use the modified version of the Granger causality test due to Toda and Yamamoto (1995) that does not require pre-testing for cointegration of the data before conducting tests for causality. The procedure uses a modified Wald test (MWald) for restriction on the parameters of a VAR(k), where k is the lag length of the system. To undertake the Toda and Yamamoto (1995) version of the Granger non-causality test, we represent our model in a VAR system. Yet, empirical findings based on the Toda and Yamamoto test are in line with the previous ones, based on the Granger test.

Tab. 6 – Granger causality and Granger non-causality tests (Italy).

	Granger test		**Toda and Yamamoto test**	
	$tcge \rightarrow cgr$	$cgr \rightarrow tcge$	$tcge \rightarrow cgr$	$cgr \rightarrow tcge$
1862-1913	0.73515 (0.692)	7.0309 ** (0.030)	(0.531)	(0.008) ***
1914-1946	3.6357 * (0.057)	1.6489 (0.199)	(0.014) **	(0.113)
1947-1993	8.7378 ** (0.013)	6.3722 ** (0.041)	(0.001) ***	(0.0100) ***
1862-1993	18.906 *** (0.000)	20.386 *** (0.000)	(0.000) ***	(0.000) ***

Source: our calculations on Mitchell (2007) data.

Notes: ***, ** and * denote significant at 1%, 5% and 10% respectively. Optimal lags were selected by the Akaike Information Criteria (AIC) and all residuals were checked for white noise using several misspecification tests.

The results of the variance decomposition analysis based on the above VEC

models provides many useful information on the evolution of the public expenditure-revenue relationship in Italy over time. In general terms, the public expenditure seems to have had an highly dominant position in the Italian public finance system, since in all three homogenous sub-samples the forecast error variance of the expenditure is almost completely attributable to exogenous shocks from the expenditure side, both in the short-run and in the long-run; whereas the forecast error variance of public revenues is mainly determined by exogenous shocks from the revenues side only in the short-term. Note that the first general result is not questioned by the slightly decreasing importance of expenditure innovations in explaining the forecast error variance of the expenditure over time, whereas the second general result is reinforced by the rapidly increasing importance of public expenditure innovations in explaining the forecast error variance of revenues.

Going into much detail (see Table 7), in the first sub-sample (1862-1913) the aforementioned importance of exogenous shocks to public expenditure in determining the variance of both expenditure and revenues is a little less evident compared to the second and the third sub-sample. In fact, in the first year about 95% of the variability of revenues is explained by its own innovations which continue to be more powerful than the expenditure innovations until the fourth year in a decreasing way. Only from the fifth year exogenous shocks from the expenditure side become predominant in explaining the variance of revenues, while in the very long term about 65% of the forecast error variance of expenditure is attributable to the expenditure innovations, and about 35% to its own exogenous shocks. As regard the variance of the expenditure, in the first year the contribution of its own innovations is 100%, whereas in the very long term the two contributions to this variance are about 83% and about 17% respectively for expenditure innovations and revenues innovations.

In the second sub-sample (1914-1946), the role of public expenditure innovations in accounting for the forecast error variance of both public expenditure and revenues seems to be stronger. In the first year about 88% of the forecast error variance of revenues is explained by its own exogenous shocks; but from the third year the innovations in the expenditure side become predominant with an initial 74% share. Afterwards, public expenditure innovations rapidly increase their share in determining the variance of public revenues so that in the very long term about 96% of this variance is attributable to the exogenous shocks in public expenditure and just the remaining 4% to its own innovations. Additionally, public expenditure innovations explain 100% of the variance of the expenditure in the very short term by continuing to determine about 96% of this variance in the very long term. Therefore, in the very long term the contribution to the forecast error variance of public expenditure due to exogenous shocks from the revenue side considerably decrease compared to the first sub-sample.

Tab. 7 – Results for Forecast Error Variance Decomposition (Italy).

	1862-1913			
Step	impulse = tcge response = cgr	impulse = cgr response = cgr	impulse = tcge response = tcge	impulse = cgr response = tcge
0	0	0	0	0
1	0.051089	0.948911	1	0
2	0.207253	0.792747	0.855153	0.144847
3	0.353850	0.646150	0.875158	0.124842
4	0.444946	0.555054	0.857547	0.142453
5	0.513100	0.486900	0.855697	0.144303
6	0.558510	0.441490	0.850943	0.149057
7	0.592431	0.407569	0.846267	0.153733
8	0.617406	0.382594	0.842382	0.157618
9	0.636617	0.363383	0.838353	0.161647
10	0.651647	0.348353	0.834776	0.165224
	1914-1946			
Step	impulse = tcge response = cgr	impulse = cgr response = cgr	impulse = tcge response = tcge	impulse = cgr response = tcge
0	0	0	0	0
1	0.122001	0.877999	1	0
2	0.485038	0.514962	0.996714	0.003286
3	0.738585	0.261415	0.991539	0.008461
4	0.862601	0.137399	0.985902	0.014098
5	0.918926	0.081074	0.980415	0.019585
6	0.944301	0.055699	0.975317	0.024683
7	0.955392	0.044608	0.970682	0.029318
8	0.959655	0.040345	0.966513	0.033487
9	0.960558	0.039442	0.962778	0.037222
10	0.959793	0.040207	0.959436	0.040564
	1947-1993			
Step	impulse = tcge response = cgr	impulse = cgr response = cgr	impulse = tcge response = tcge	impulse = cgr response = tcge
0	0	0	0	0
1	0.421279	0.578721	1	0
2	0.600207	0.399793	0.988160	0.011840
3	0.691512	0.308488	0.974363	0.025637
4	0.744168	0.255832	0.962702	0.037298
5	0.777502	0.222498	0.953535	0.046465
6	0.800085	0.199915	0.946438	0.053562
7	0.816188	0.183812	0.940918	0.059082
8	0.828146	0.171854	0.936569	0.063431
9	0.837323	0.162677	0.933087	0.066913
10	0.844561	0.155439	0.930253	0.069747

Source: our calculations on Mitchell (2007) data.

In the third sub-sample (1947-1993) the weight of exogenous shocks from the expenditure side in determining the forecast error variance of both expenditure and revenues lies rather halfway between the ones characterizing the first and the

second sub-samples. In the first year about 58% of the variance of public revenues is explained by its own innovations, but from the second year about 60% of this variance is determined by expenditure shocks. In the very long term, the two contributions to the revenues variance are about 84% and about 16% respectively for public expenditure innovations and revenues one. Likewise, the first and the second sub-sample public expenditure innovations explain 100% of the forecast error variance of the government expenditure in the first year, whereas in the very long term the two contributions to this variance are about 93% and about 7% for exogenous shocks respectively from the expenditure side and the revenues side.

5. – Concluding remarks and policy implications

As explained in the previous section, the variability of public revenue is due to public expenditure shocks in an increasing way, both in the short period (1914-1946 and 1947-1993) and in the medium one (1862-1913). While the variance of public expenditure is essentially due to its own shocks, in the short as well as in the very long period, with a slow and marginal increase of public revenues innovations.

The results for the post-W. W. II years coincide with the findings of Miller and Russek (1990), Bohn (1991), Owoye (1995), Hasan and Lincoln (1997), Li (2001), Chang *et al.* (2002) for Canada, and Al-Qudair (2005) that government makes simultaneously its revenue and expenditure. Furthermore, this result confirms the finding of Al-Hakami (2002) in a trivariate model when the gross domestic product was added to the model. However, the results are in contrast with Al-Hakami (2002) and Albatel (2002) in the case of the Kingdom of Saudi Arabia in the trivariate model who found that there is a unidirectional causality that runs from government revenues to government expenditure.

Granger causality tests show how the prevailing paradigm of public finance in each period might help to explain both the public expenditure-revenues relationship and the dynamics of these variables. In fact, from 1862 to 1913 there is a unidirectional flow, from revenues to expenditure. It is reasonable since, at that moment, the dominant theory was that of annual balanced budget, as suggested by "neutral (or orthodox) finance" (Messedaglia, 1850; Ricca Salerno, 1879; Pantaleoni, 1891; De Viti De Marco, 1934): the budget deficit was conceived by this school as a phenomenon of "extraordinary" finance. So, these scholars underlined the importance of public revenues together with a limited public expenditure, that would ensure the fulfillment of basic needs, in a general context of "small Government". As a result, during these years, public revenues Granger causes expenditure. In the following interwar period, the context dramatically changed as well

as the predominant paradigm. With the Keynesian finance the assumption of full employment disappeared in favour of under-employment equilibrium. Yet, the deficit spending became the key for the support to aggregate demand (Keynes, 1936). Therefore, public expenditure and fiscal policy became the most important instruments for policy-makers, and economic growth was based on expenditure stimuli. As a result, from 1914 to 1946, public expenditure Granger causes revenues. Finally, during the second post-war age, both public expenditure and revenues increased a lot, with similar rate of growth. Notwithstanding, the burden of expenditures for interest, connected with a high public debt/GDP ratio, raised budget deficit. For this period, one can invoke a third paradigm, the so-called "discretionary (or compensatory) finance", which stated a balanced budget in the long term (Hansen, 1941; Lerner, 1946, 1969; Harris, 1952).

6. – Suggestions for future researches

Further researches could investigate the nexus between public expenditure and revenues at a disaggregated level, showing the empirical evidence between direct and indirect taxation on the one hand, and various other items of expenditure on the other.

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