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ECONOMETRIC EVIDENCE OF TAX SMOOTHING IN ITALY, 1861-1998

Roberto Ricciuti
Dipartimento di Economia Politica
Università degli Studi di Siena
Piazza San Francesco 7, 53100 Siena, Italy
Email: ricciuti@unisi.it

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ABSTRACT

In this paper we provide evidence that over the period 1861-1998 Italian fiscal policy has followed an optimal pattern of deficit/surplus government balances. We find that the tax rate follows a random walk process, the government surplus is stationary, and the budget surplus Granger-causes government expenditure. An impulse response function between government expenditure and government debt also supports our conclusion, with some caution. This result stands in contrast with some recent tests on OECD countries for shorter and more recent periods.

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1. Introduction

Barro (1979) provided a theory in which government debt is used to smooth the tax rate over time and, accordingly, reduce the welfare losses due to changes in the tax rate. The consequence for the budget policy is that a temporary increase in government expenditure should be funded by debt experiencing deficit, while a permanent increase in government expenditure should be financed by an increase in taxes. Therefore, the pattern of the budget deficit should be countercyclical: surplus in good times and deficit in bad times. In the literature on the Italian public finance a very limited number of papers deal with these issues and they mainly cover short periods of time, as many in the international literature. We concentrate on long-run behaviour (1861-1998) because the financing needs of the two wars and of the great depression provide real test cases. In addition, the Italian case is of interest because it shows both historical and contemporary high level of public debt and deficit.

The paper is organised as follows: Section 2 reviews the theory of optimal fiscal policy. In Section 3 previous empirical results are surveyed, while in Section 4 a short overview of the main Italian fiscal aggregates is presented. Section 5 and 6, respectively, present the empirical methodology used here and the results. Conclusions are drawn in the final Section.

2. A model of optimal fiscal policy

If Ricardian equivalence holds, there is no rationale for the government to issue bonds. Starting from the idea that modify the marginal rate of taxation according to the changes in government expenditures would have high distortionary effects and would

increase the dead-weight losses of taxation, Barro (1979) proposed the use of government bond as a way to keep tax rates constant. Then, issuing bonds when the current government expenditure is higher than its normal level, and retiring them when it is lower, would reduce the relevant losses. The simple tax smoothing model considers a closed economy in which a representative agent consumes, works and saves. It is assumed that non zero tax rates impose a dead-weight loss on the representative consumer which represents the distortion of allocative decisions and administrative costs incurred by the tax raising institution. The goal of the government in period t is to find a tax collection sequence $\{T_t\}_{t=0}^{\infty}$, which minimises the present discounted value of the excess burden of taxation. Given the inherited value of debt and an exogenous time path for government expenditure, the government has to minimise its objective function:

$$E_t \sum_{j=0}^{\infty} \beta^j L(T_{t+j}, Y_{t+j}), \tag{1}$$

where Y_t is the tax base which is assumed to be equal to the real national income, T_t is the total real tax revenue at time t, and L is the loss function with $L' > 0$ and $L'' > 0$ in both arguments.

The objective function (1) is minimised with respect to $\{T_t, B_{t+1}\}_{t=0}^{\infty}$ subject to a sequence of budget constraints:

$$B_{t+1} = (1+r)B_t + G_t - T_t, \tag{2}$$

where r is the constant real interest rate,[1] B_t and G_t denote respectively the real value of public debt and the real government expenditure net of interest that follows an exogenous stochastic process, and B_{t-1} is the stock of debt at the beginning of period t. Under the assumptions of perfect foresight and the no-Ponzi game condition, we can impose:

$$\lim_{t\to\infty} \frac{B_t}{(1+r)^t} = 0 . \tag{3}$$

Solving the difference equation (2) using (3) as terminal condition, we obtain the intertemporal government budget constraint:

$$\sum_{j=0}^{\infty} \frac{1}{(1+r)^j} E_t T_{t+j} = B_t + \sum_{j=0}^{\infty} \frac{1}{(1+r)^j} E_t G_{t+j} . \tag{4}$$

Equation (4) states that the expected present value of tax collection equals the sum of the current value of debt plus the expected present value of government expenditure. The Euler equation associated with the problem of minimising (1) subject to (4) is:

$$\frac{L'(T_t)}{E_t \beta L'(T_{t+1})} = 1 + r . \tag{5}$$

In the steady state $\beta = 1/(1+r)$, therefore eq. (5) reduces to:

[1] When Ricardian equivalence holds, interest rates are unaffected by changes in the timing of taxation. See Ashworth and Evans (1998) for an analysis with variable interest rates.

$$E_t T_{t+1} = L'(T_t)\,, \tag{6}$$

which states that the marginal social costs of taxation must be equated in every period. Alternatively, eq. (6) implies that the marginal cost of taxation is a martingale. If the loss function is quadratic in taxation levels,[2] the intertemporal first-order condition (6) becomes:

$$E_t T_{t+1} = T_t\,. \tag{7}$$

which is the Barro's result that tax collections are a martingale. If the social cost function is homogeneous, the above result is extended to the average tax rate. If future government expenditure were known with certainty, the optimal tax rate would be constant. Because future government spending is uncertain, the optimal tax rate sets the present value of revenue equal to the present value of expected spending. As information about spending becomes available, the optimal tax rate changes.

The government will run a smaller budget surplus in the current period if government expenditure is expected to decline over the planning horizon. This enables the tax reduction to be smoothed over time. Conversely, when the government expects to increase its expenditure during the planning period, it will seek to increase the tax rate and therefore the budget deficit will fall.[3] Therefore, government debt and expenditure have an

[2] The adoption of a quadratic loss function is not motivated by any explicit microeconomic foundation.

[3] In this formulation the government does not engage in tax tilting, i.e., it has no incentives to systematically favour either budget deficits or budget surpluses. For example, a government that is unsure of its re-election prospects may favour higher current debt levels than are implied by the tax-smoothing hypothesis, in order to exert an influence on the future spending of rival political parties should they come in power. The reason

anticyclical profile, as in the Keynesian theory.

3. Empirical literature

Tests of the tax smoothing hypothesis are quite limited in numbers. Barro (1979, 1986, 1987) shows that both the US and the UK government behave according the tax smoothing hypothesis over long time-spans. In the same line are recent empirical studies such as Huang and Lin (1993) and Ghosh (1995) that examine U.S. and Canadian evidence in a VAR framework and find that increases in the budget surplus signal future increases in government expenditure.[4] However, Sahasakul (1986) for the US over the period from 1937 to 1982 argue that only permanent government expenditure and initial public debt should have an explanatory power on the marginal tax rate. In contrast, he also found that temporary defence purchases, the general price level, and a time trend are significant, rejecting the theory. Trehan and Walsh (1988) for US data over the 1890-1986, arguing that it is not a sufficient condition that the tax rate follow a random walk, show that the that any permanent component of tax changes should be related in the long-run to any permanent component of government expenditure for tax smoothing to hold, but they are unable to find such a relationship. Olekalns (1997) for Australian data for the

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to do this is twofold. Firstly, previous empirical results found very limited evidence for tax tilting. Second, the substantial stability in government by incumbents may have avoided this policy, since the entrants were usually not likely to win the elections. See Ghosh (1995) for a theoretical and empirical analysis.

[4] Huang and Lin (1993) consider US data from 1929 to 1988 and argue that rejections of the tax smoothing hypothesis are related with the statistical properties of the series before and after 1947, and not because of a failure of the theory. Ghosh (1995) consider US data for 1961-1988 and Canadian data from 1962 to 1988.

period 1964-1995 using an approach similar to those applied here does not support the optimal fiscal policy model because the tax rate is too volatile.

As far as we know, there is only one paper that deals with optimal taxation over time in the Italian case. Attanasio and Marini (1988) use an OLS methodology and do not find evidence for tax smoothing over the period 1960-1983: the tax rate grows as nominal income increases. This phenomenon, called bracket-creep, is consistent with a progressive and non indexed fiscal system. Although they maintain that it is difficult to prove that this result is consistent with the optimal behaviour of the fiscal authority, they suggest that the government has tried keep constant the growth of government debt with respect to the growth of inflation to increase revenue from taxation and to reduce the real value of the debt. This is in accordance to the hypothesis that reductions of undesired government debt are obtained through money creation. Without providing a formal test, Fratianni and Spinelli (2001) maintain that tax rates have been set optimally over time also because of the use of money creation revenue.

4. An overview of the Italian fiscal policy[5]

In this Section we briefly sketch some historical facts about fiscal policy and its linkage with monetary policy, to give an idea behind the data of the different arrangements occurred in the analysed period. After unification in 1861, fiscal policy was expansionary.

[5] Most of the information of this Section is taken from Fratianni and Spinelli (2001).

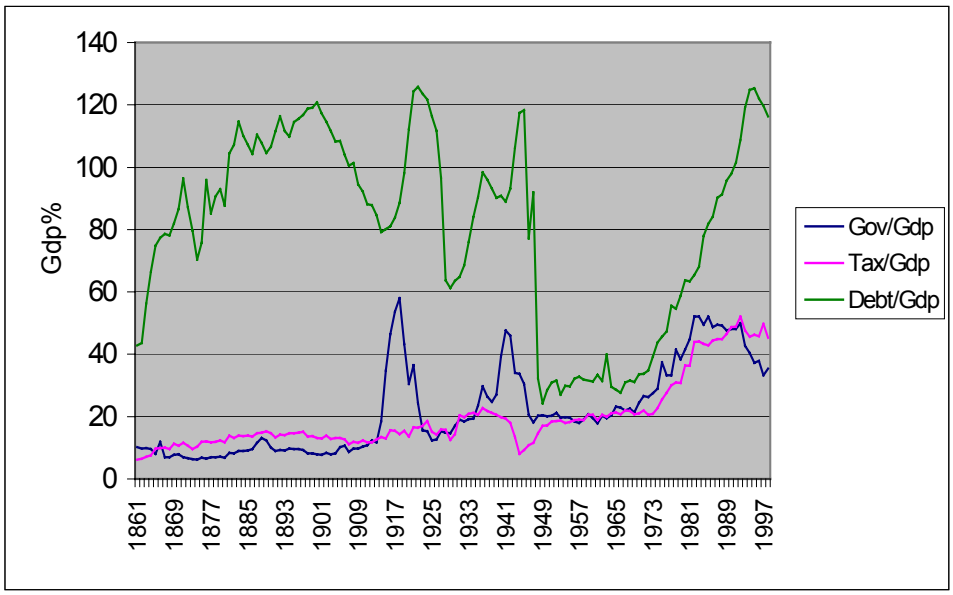

Fig. 1 – Italian fiscal aggregates, 1861-1998

The need to fund the unification of the new State through infrastructure and the nationalisation of railways, the obligation of repaying the debt issued by the Kingdom of Piedmont during the war for unification, and a new war of independence with Austria in 1966 put pressure on the budget policy. In this situation public debt grew until 80% of the GDP and the first fiscal consolidation took place through the increase in taxes.

During the ruling years of the Left (1876-1896), public budget was used to fund investments in railways, iron industry, and military industry. Taxes were not increased accordingly and an increase in government deficit occurred. However, this deficit was not funded through seigniorage, because Italy returned to the Gold Standard in 1883. This decision was not deflationary: it caused a strong inflow of foreign investments, which helped industrial development. The Gold Standard was again abandoned during the economic crisis in 1887-1895, when both government deficit and debt increased because of the active fiscal policy. During the Giolitti period (1901-1913) there was a positive

interaction between fiscal consolidation and business cycle. Government expenditure was almost constant, while taxes grew in real terms, therefore both were reduced with respect to GDP, but the former at a faster rate. Together with a reduction in international interest rates, and in particular of the spread of the Italian ones with respect to those of other major countries, this situation made it possible the second fiscal consolidation in 1906, in which bondholders were allowed to choose either to exchange their bonds in a perpetuity yielding a 3.75% interest rate or getting repaid at the par value. Only 6% of bondholders decided of being refunded and this voluntary conversion was successful because the government gained credibility against financial markets and savers.

From 1914 onwards, there are three major episodes of fiscal deficits: before and during the two World Wars, and at the end of the period of increasing fiscal expansion post-1960. During the World War I military expenditure raised at almost 50% of the GDP and in 1920 public debt was over 120% of the GDP. During the Fascist regime there were two episodes of fiscal consolidation. The minor one took place in 1922-1926 through a strong reduction in government expenditure, a high rate of inflation that reduced the real value of the government debt, and a remission of debt from the US and the UK. This resulted in a return to the gold standard at an overvalued exchange rate (the so-called *quota 90*) which, in the light of rising fiscal deficits and military expenditure, could only be defended through the imposition of capital controls and trade barriers. In addition, there was a compulsory switching of all government bonds with a residual duration of less than seven years into 5% nine-year bonds in the second and more important fiscal consolidation of the Fascist government. While the first consolidation was obtained by raising taxes, the second was achieved through credibility of the government and

voluntary switching from bondholders, the third one was made possible by the authoritaranism of the regime.

The financial needs of Word War II were quite demanding because of the isolation of the Italian government. There was an attempt at funding government expenditure through forced government bond at a low interest rate, but the government debt to GDP ratio skyrocketed again. In 1941 Bank of Italy increased its funding leading to an increase in inflation that reduced the above ratio to a quarter. However, until 1947 the inflation rate was about 100% per year. Fiscal consolidation was mainly achieved through the inflation-tax.

In the post-World War II period, Italy joined the Bretton Woods system and, as in many other developed economies, monetary policy continued to be dominated by the stance of fiscal policy, with the stabilisation of interest rates as the main objective. In the 1970s the increase in government expenditure was devoted to the expansion of the Welfare State. However, an increase in government debt did not occur because while the primary deficit increased, the debt service decreased because the interest rate was lower than the rate of growth of the economy. Interest rates were exceptionally low because of restrictions that prevented the diversification abroad of the financial wealth. When these constraints were removed the interest rates increase together with the government debt. The pattern follows that of the high-inflation OECD countries from the mid-1960s to the early 1980s, with rising deficits leading to higher inflation.

The fiscal dominance of monetary policy was only broken in the early 1980s, when the Bank of Italy gradually acquired greater independence in setting monetary policy, and did so independently of fiscal considerations. In addition, in 1978 the entry in the European Exchange Rate System imposed an additional constraint on monetary policy,

namely on inflation. In 1979 the so-called divorce between the Treasury and the Bank of Italy took the form of the removal of the obligation on the part of the Bank to buy unsold Treasury Bills at auctions. In the 1990s the objective of both fiscal and monetary policies has been to achieve inflation convergence with the Euro-area and exchange rate stability to fulfil the Maastricht criteria. A reduction of the debt over GDP ratio was achieved through a reduction in government expenditure, in particular public employees and pension schemes, and an increase in taxes to obtain a substantial primary surplus.

4. Methodology and data

The theory discussed so far yields to a number of testable restrictions on the data for both tax- and revenue-smoothing. For the former it must be noted that the tax rate, if set optimally, should follow a random walk. The second implication is that the budget surplus should be stationary, even if public expenditure has a stochastic trend. The budget surplus under tax smoothing will be equal to the present discounted value of the stream of anticipated changes to government spending. If the level of government expenditure is $I(1)$, its changes will be $I(0)$. This also implies that the budget surplus will be $I(0)$ too. The third implication is that budget surplus should Granger cause changes in government expenditure. Since a change in the budget surplus implies the arrival of new information concerning future spending plans, the government has more information about the evolution of its expenditure than is contained in its past values of government spending. Then this additional information should be reflected in the budget surplus.

This analysis is applied to Italian annual data from 1861 to 1998. Expenditure is defined as the sum of total budget outlays less interest payments on debt, calculated as a

ratio to GDP. The average tax rate is the ratio of government revenue to GDP. All data are in nominal terms. Data for GDP, debt, interest payments on outstanding debt are taken from Fratianni and Spinelli (2001). Government expenditure and taxes are taken from Spinelli and Fratianni (1991) for the period 1861-1980, and from Istat (various years) for the remaining period.

5. Empirical results

Table 1 reports the unit-root tests for the period 1861-1998. We use three tests: the standard Augmented Dickey-Fuller and the nonparametric Breitung (2002) test where the null hypothesis is unit root and the alternative is stationarity and the KPSS test (Kwiatkovsky et al., 1992) that has stationarity as null hypothesis and unit root as alternative. The use of test statistics in which the null hypothesis in one is the alternative in the other helps in making correct inference in specificating a process, since not rejecting the null does not imply to accept it. The Breitung test is nonparametric in the sense that it does not need to specify the short-run dynamics of the process. It is robust against misspecification and structural breaks in the short-run components. Therefore, it appears particularly well suited for our time span. Let $y(t)$, $t = 1,..., n$, be a unit root process: $y(t) = y_{t-1} + u_t$, where u_t is a zero-mean stationary process. Compute the partial sums $Y(t) = y_1 + y_2 + ... + y_t$, and then the ratio

$$B(n) = \frac{[Y_1^2 + Y_2^2 + ... + Y_n^2 / (n^2)}{[y_1^2 + y_2^2 + ... + y_n^2]/n} . \qquad (8)$$

Under the unit root hypothesis $B(n)/n$ converges in distribution to a function of a standard Wiener process, which is free of nuisance parameters. On the other hand, if $y(t)$ is stationary then $B(n)$ itself converges in distribution, hence $B(n)/n$ converges in probability to zero.

The truncation lag of the ADF test is firstly set at $p = cn^r$, where $c = 5$ and $r = 0.25$, and then a Wald test is employed to reduce the number of lags only to those that are significant at the 5% level. The KPSS test employs a Newey-West (1987) type variance estimator of the long-run variance of $u(t)$, with truncation lag $m = cn^r$, where $c = 5$, $r = 0.25$.

Table 1 – Unit root tests for tax smoothing.

	T_t	G_t	ΔG_t	Sur_t
ADF	5.7130	-2.2307	-3.8737	-3.2707
	(17)	(1)	(17)	(1)
Breitung	0.06512	0.05731	0.00033	0.00962
KPSS	0.4562	0.6816	0.0590	0.2110
	(17)	(17)	(17)	(17)

For the ADF test asymptotical critical values at the 5% and 10% significance levels are respectively –2.89 and –2.58; for the Breitung test they are respectively 0.01004 and 0.01434, and for the KPSS they are respectively 0.463 and 0.347. Figures in brackets are the lag-lengths.

According to these statistics we cannot reject the existence of a unit root in the tax rate series, so it does follow a random walk, in accordance with the theory. For the government expenditure series also, we cannot reject the null hypothesis of a unit root both in levels (at the 10% significance level according to the ADF test, and at the 5% level according to the other two statistics), but we can do this in first-differences. For the budget surplus series we can reject the null hypothesis of unit root at the 5% significance level in

all the tests used. Therefore, the budget surplus series fulfils the second condition for optimal taxation over time.

We apply Granger causality to test whether the current budget surplus has a predictive power on future changes of government spending. We have used six lag-lengths and we have chosen lag one, which minimises the Akaike Information Criterion (Akaike, 1973, AIC thereafter). Table 2 reports the results of the test for the full period, both coefficients are highly significant and the value of the F-statistic enables us to reject the null hypothesis of no Granger causality at the 1% significance level. This is consistent with the idea that taxes are raised in advance of predictable increases in government expenditure, so reducing the required size of the tax-increase. Given the sensitivity of the Granger-causality test to the number of additional lags, we have also considered the test with up to six lags. The above result is always confirmed at the same significance level.[6]

Table 2 – Granger causality test.

$$\Delta G_t = c + \sum_{i=1}^{p} \alpha_i \Delta G_{t-i} + \sum_{i=1}^{p} \beta_i sur_{t-i}$$

	lag	α_1	β_1	F
$sur_t \rightarrow \Delta G_t$	1	0.337	0.114	9.541
		(4.084)	(3.120)	[0.01]

Numbers in round brackets are t-statistics; the figure in square brackets is the p-value. The F-statistic tests in this case the null hypothesis that $\beta_1 = 0$.

The dynamic relationships between government expenditure and government debt may be studied in a VAR framework, tracing out the impulse response functions derived

[6] Results are available upon request from the author.

from unexpected shocks on the variables of interest[7]. We estimate a non-structural VAR (Sims, 1980) with four lags, as suggested by the AIC, with intercept and trend. Dots represent plus and minus one and two standard errors bands, and the standard errors of the innovation responses are computed according to the method proposed by Baillie (1987). The time-span is set in fifteen years. Inspection of the four panels (Figure 2) reveals a substantial confirmation of the above results: the variables absorb almost completely the shocks hitting them. After a shock on government expenditure debt is sticky and takes some time to deviate from its original level. It reaches a maximum in the 7th year after the shock, and then starts declining to its original level. This is the only case in which a shock appears to last more, but still without permanent effects. A shock of government expenditure on itself lasts about four years. However, it does not tend to a level lower than the starting one to accumulate a budget surplus consistent with optimal taxation over time. A shock on debt has a zero effect on government expenditure[8] since the zero line is always included in the estimation deviations. A shock on debt on itself lasts about four years and then there is a small tendency to attain the original level.

6. Conclusions

In this paper we have shown some evidence that fiscal policy has been set in an optimal fashion in the period 1861-1998. Indeed our three tests fulfil the restrictions that the theory imposes on the data. Some caution about this result is given by the impulse

[7] To conduct this analysis we have tested for the presence of a unit root in the debt series, and we cannot reject this hypothesis. Therefore both series are $I(1)$. Details are available upon request from the author.

[8] Recall that this measure of government expenditure excludes interests on debt.

response analysis, in which government expenditure and debt do not appear to follow a pattern completely consistent with the prescriptions of tax smoothing. A possible extension of this model could include revenue created through seigniorage, therefore considering a model of revenue smoothing (Mankiw, 1987). One can also analyse in more detail specific periods, for example the post World War II, in which an expanding pattern of government expenditure is observed, without an external shock that starts at a point in time and then comes to an end (e.g., war, recession). Indeed, most of the studies that reject tax smoothing are concentrated on this or even more recent periods.

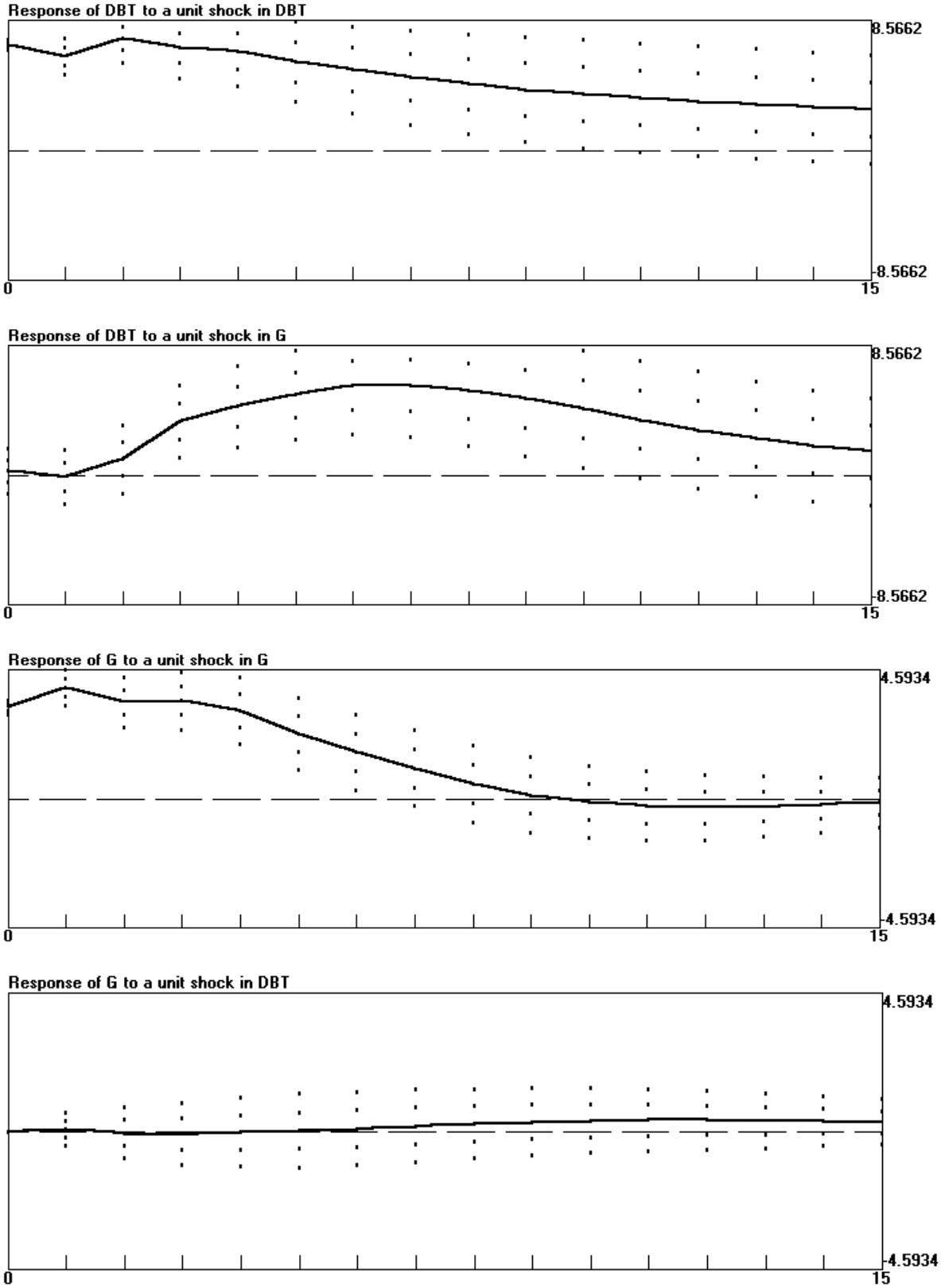

Fig. 2 – Impulse response functions of the VAR between government expenditure and government debt

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