An (Un)Pleasant Arithmetic of Fiscal Policy: the Case of Italian Public Debt

Marattin, Luigi and Marzo, Massimiliano

University of Bologna

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Luigi Marattin[*] Massimiliano Marzo[÷]

(University of Bologna) (University of Bologna)

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Abstract

Using the simple arithmetic of government budget constraint, we perform an analysis on the Italian case, investigating the consequences on the main public finance aggregates of the adoption of a fiscal policy rule responding to past real debt/GDP ratio. Such a rule, firmly grounded in the economic analysis, would allow the reduction of Italy's outstanding stock of debt without requiring the strict adherence to the 3% criterion for deficit/GDP ratio, as prescribed by SGP. We perform a forecasting exercise under five alternative scenarios, analyze the details of a structural debt reduction strategy with alternative yearly step, and finally carry out a counterfactual exercise by applying our proposed rule to the period 1994-2006.

JEL classification:E61, E62, H63

Keywords: fiscal consolidation, public debt reduction, fiscal policy.

[*] luigi.marattin@unibo.it Dipartimento di Scienze Economiche – Strada Maggiore 45- Bologna (Italy)- 0039-051-2092647

[÷] massimiliano.marzo@unibo.it Facoltà di Economia – P.zza Scaravilli 2 – Bologna (Italy). Tel:0039-051-2098019

1. Introduction

Since the early Nineties, most western economies had to undertake various processes of fiscal consolidation, aimed at reducing both public debt and deficits and achieve more solid fiscal positions. For EU economies, this path took the form of the run-up to the Euro (pre-1998) and the struggle to comply to the Stability and Growth Pact (before and after the 2005 reform), which governs the necessary coordination of Member States' fiscal policies after the establishment of the European Monetary Union. Episodes of fiscal consolidations have been often studied in the economic literature. In one of the most comprehensive of these studies, Alesina and Perotti (1997) examine a full sample of OECD countries (and then focus on Denmark, Ireland and Italy), and find that adjustments relying on government expenditure cuts had a better chance of being successful and expansionary; on the other hand, if they are based on tax increases and cuts in public investments, tend not to be non-persistent and contractionary.

However, the policy debate on the issue is still far from reaching a widespread consensus on the public finance objectives that are most suited to modern economies, and on the strategies to achieve them. There is indeed consensus on the need to reduce debt/GDP ratios, as an excessive accumulation of government liabilities puts upward pressures on interest and inflation rates, crowds-out private spending and employs too many resources to debt service payments; such a requirement is even more binding in a monetary union, in order to prevent spillover effects. Nonetheless, the policy debate still seem to devote the best attention on deficit/GDP ratios: in particular, EMU public finance criteria prevents member states to exceed the 3% ceiling in that respect. The reform of the SGP, in March 2005, confirms this parameter, although emphasizing the importance of the whole debt reduction strategy.

This paper carries out a simple but meaningful exercise: based on the simple arithmetic of public finance, we assume the existence of a fiscal policy rule in which fiscal pressure responds to past real debt/GDP ratio; we distinguish between tax revenue not immediately responding to macroeconomic variables ("independent taxation") and tax revenue which is promptly available to policy-makers to be manoeuvred in response to, in our case, accumulation of government liabilities. In this second group we adopt the strict definition of "fiscal pressure", that is the sum of direct and indirect taxation; we chose to put social contributions into independent taxation, since governments tend to manoeuvre this source of revenue mainly in reference to sustainability of pensions systems, rather than macroeconomic stabilization. We calibrate the resulting debt dynamics equation with 2007 data, and perform a number of simulation regarding the evolution of public finance aggregates, under alternative macroeconomic scenarios, for the period 2008-2026. We also carry out a counterfactual exercise, applying our feedback fiscal rule to the period 1994-2006, to analyze what would have happened if the government had followed explicitly a kind of fiscal rule such as the one we propose. The whole analysis is targeted at the italian case, given the outstanding stock of public debt, which make Italy the only nation in Europe (and one of the few in the world) with a debt/GDP ratio above the 100% threshold.

The remaining of the paper is organized as follows: section 2 sets the simple framework and the proposed fiscal rule, briefly discussing the related theoretical issues, while section 3 calibrates the model with the latest official data available. Section 4 proceeds with the simulations, divided in three different steps: the short-term evolution of public finance aggregates according to the fiscal policy parameter chosen, the medium-long term evolution under five alternative macroeconomic scenarios, and the discussion on alternative debt reduction strategy (featured by a yearly step of, respectively, 1% and 2%) using our proposed fiscal rule. Section 5 performs a counterfactual exercise, applying our fiscal rule to the period 1994-2006 and comparing actual debt/GDP and deficit / GDP series with simulated ones. Section 6 concludes, discusses some policy implications and possible future extensions.

2. The framework:debt/GDP dynamics and fiscal rule

The basic dynamic of public debt is:

$$B_t = (1 + i_t)B_{t-1} + P_t(G_t - T_t) \tag{1}$$

where:

$B_{t,t-1}$ = stock of nominal public debt

i_t = nominal interest rate

$P_t(G_t - T_t)$ = primary deficit in nominal terms

Few simple algebraic steps (to be found in the Appendix) leads to the following:

$$b_t = b_{t-1} + (i_t - \pi_t - g_t)b_{t-1} + \frac{G_t - T_t}{Y_t} \tag{2}$$

where:

$b_i(i = t, t-1) =$ real public debt/GDP ratio

g_t = rate of growth of real GDP at time t

π_t = rate of inflation at time t

$\frac{G_t - T_t}{Y_t} =$ primary deficit / GDP ratio

Rearranging the terms:

$$\frac{T_t - G_t}{Y_t} = (i_t - \pi_t - g_t)b_{t-1} + \Delta b_t \tag{3}$$

where Δb_t is the desired debt/GDP reduction at the end of time t and it is defined as:

$$\Delta b_t = -(b_t - b_{t-1}) \tag{4}$$

Literature on fiscal policy has always based its considerations on the analysis of government intertemporal budget constraint:

$$\frac{B_t}{P_t} = E_t \sum_{j=0}^{\infty} \beta^j (T_{t+j} - G_{t+j}) \tag{5}$$

Equation (5) simply states that the stock of real debt at time t must be equal to the current value of future primary surpluses. Different opinions on the nature of that relationship gave rise to two alternative theories of price level determination. In fact, if we interpret (5) as a constraint given the price level P_t, it implies that the government is obliged to generate current or future primary surpluses in case it looses control on the evolution of public debt; under this theory, P_t is entirely determined by the monetary policy authority, according to the standard prediction of the Quantitative Theory of Money. If, instead, we view (5) as an equilibrium relationship that has to hold under any circumstances, it means that if nominal debt increases, primary surpluses do not necessarily have to change accordingly: adjustment might occur via change in the price level, so to guarantee the fulfilment of the equilibrium relationship. Thus, fiscal indiscipline can cause a movement in P_t; not surprisingly, this simple interpretation gave rise in the 90s to the Fiscal Theory of the Price Level (Sims 1994, Cochrane 2001, Woodford 2001 and many others), arguing that price level determination is not necessarily a merely monetary issue. Emphasizing the inflationary pressures implied by accumulation of excessive public debt, the Fiscal Theory of the Price Level is, at least partially, at the heart of the theoretical justifications of the public finance requirements for the European Monetary integration process. As first showed by Leeper 1991, the kind commitment for government, implied by the above considerations, can be achieved by the introduction of a fiscal rule such as:

$$T_t = T_0 + \phi \frac{B_{t-1}}{P_t} \tag{6}$$

with $0 < \phi < 1$ being the elasticity of (lump-sum) taxation to the past stock of real public debt, and T_0 being that component of tax revenue which moves independently from debt dynamics. With such a rule, government adjust fiscal pressure so to respond to accumulation of past nominal liabilities deflated at the current price level. In the Leeper's terminology, such a rule depicts a "passive" policy, as the fiscal authority is not free to choose a decision rule that depends on current or expected future variables, but has to passively adjust direct taxes in order to balance the budget, being constrained by the active authority (the monetary policy one) and, in microfounded frameworks, by consumers' optimization. Under assumption of active monetary policy (responding more than proportionally to an increase in inflation) as it seems widely established in modern economies, Leeper derives the conditions for equilibrium determinacy with regard to the fiscal policy rule, which implies the parameter ϕ lying in the following range:

$$\beta^{-1} - 1 < \phi < \beta^{-1} + 1 \tag{7}$$

where β is the intertemporal rate of preferences by which consumers discount utility in the next period and that is equal, in dynamic general equilibrium models, to the steady-state real interest rate. As the value commonly accepted in the literature for β ranges from 0.95 to 0.99 (corresponding, respectively, to a real net interest rate ranging from 5.26% to 1.01%), we see that the range of values of ϕ consistent with determinacy is very wide to ensure that with a fiscal rule such as (6), there is no risk of an explosive path for the price level even in the presence of a nominal debt shock, since the feedback rule ensures that the government will modify fiscal pressure so to keep constant the value of real debt. Therefore, this kind of fiscal rule is the one most suited to target a specific strategy of public debt reduction, while preserving price stability.

On the basis of this theoretical background, we borrow the above fiscal rule and verify its usage in a debt-reduction strategy based on the Italian case. Equation (6) can be modified so as to account for measures relative to GDP, as we did in (2).

$$\frac{T_t}{Y_t} = \frac{T_0}{Y_t} + \phi \frac{B_{t-1}}{P_t Y_t}$$

$$\frac{T_t}{Y_t} = \frac{T_0}{Y_t} + \phi \frac{B_{t-1}}{P_{t-1} Y_{t-1}} \frac{P_{t-1}}{P_t} \frac{Y_{t-1}}{Y_t}$$

$$\frac{T_t}{Y_t} = \frac{T_0}{Y_t} + \phi \left(\frac{b_{t-1}}{1 + \pi_t + g_t} \right) \tag{8}$$

(8) is a fiscal rule which makes the fiscal pressure at time t (measured by the amount of total tax revenue relative to GDP) responding to the past real debt/GDP ratio, deflated by the current inflation rate and real GDP growth.

Inserting the fiscal rule (8) into the debt/GDP dynamics (equation 2), we obtain:

$$b_t = b_{t-1} + \frac{G_t}{Y_t} + (i_t - \pi_t - g_t) b_{t-1} - \frac{T_0}{Y_t} - \phi \frac{b_{t-1}}{(1 + \pi_t + g_t)}$$

$$b_t = \frac{G_t}{Y_t} - \frac{T_0}{Y_t} + \left(1 + i_t - \pi_t - g_t - \frac{\phi}{(1 + \pi_t + g_t)} \right) b_{t-1} \tag{9}$$

3. Data and calibration

In order to calibrate the simple model, we use data from the *Nota di aggiornamento al DPEF per gli anni 2008-2011,* the main policy paper that Italian government utilizes in order to define the public finance intertemporal framework. Data refer to year 2007. Latest news anticipation about Italy's public finance (to be officially released at the end of march 2008) give better results on 2007; nevertheless, we stick to the latest official news available. Furthermore, we have to consider that our exercise aim at providing some general and useful insights, more than representing a proper forecasting exercise; the analysis can easily be updated along with the release of new data.

TABLE 1

debt service / GDP	$\frac{i_{2007}B_{2006}}{Y_{2007}}$	4.82%
debt/GDP	$\frac{B_{2006}}{Y_{2006}}$	106.8%
primary government expenditure /GDP	$\frac{G_{2007}}{Y_{2007}}$	44.19%
tax revenue / GDP	$\frac{T_{2007}}{Y_{2007}}$	46.6%
independent taxation / GDP	$\frac{T_0}{Y_{2007}}$	17.10%
euro-wide nominal interest rate	i_t^{ECB}	4%
GDP real growth	g_{2007}	1.9%
inflation	π_{2007}	1.9%

Obviously interest rate on government debt does not exactly corresponds to the level of short-term interest rate, which in the euro area is set by the European Central Bank; in order to pin down the effective measure, we divide the debt service by the stock of public debt with respect to the GDP:

$$i_{2007}\frac{B_{2006}}{Y_{2006}} = 4.82\%$$
$$i_{2007}106.8\% = 4.82\%$$
$$i_{2007} = 4.51\%$$

We obtain an average implicit interest rate of 4.51%, which is consistent with an official ECB rate of 4%, augmented by a small spread.

It is important to stress that data for $\frac{T_{2007}}{Y_{2007}}$ include all tax revenue (direct and indirect taxation, social contributions and other types of revenues), whereas $\frac{T_{2007}-T_0}{Y_{2007}}$ is the proper definition of fiscal pressure[1], and it is the component who respons to public debt movements.

Let us calibrate the fiscal policy parameter ϕ according to our fiscal rule (equation 8):

$$0.466 - 0.1710 = \phi_{2007}\frac{1.068}{1 + 0.019 + 0.019}$$
$$\phi_{2007} = 0.2867$$

Italian government fiscal stance for the year 2007 implied, therefore, that tax revenue/GDP ratio response to increases in the stock of public debt over GDP is equal to 0.2867.

4. Simulations

4.1. The evolution of public finance aggregates at the end of time t

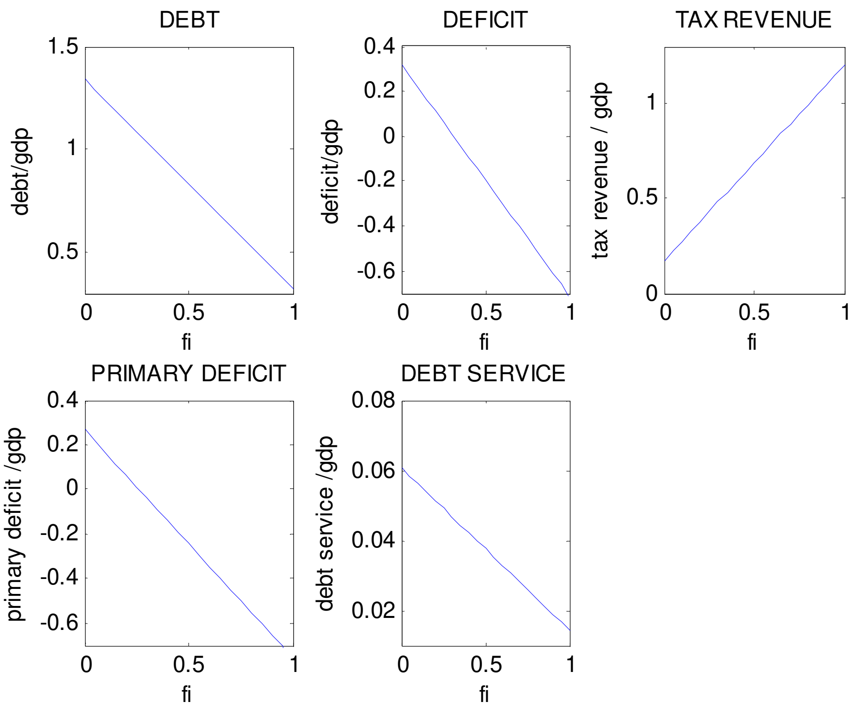
Using data from previous section, we now use equation (9) in order to calculate the possible evolution of public debt, and other fiscal policy aggregates, at the end of time t as a function of the parameter ϕ (elasticity of tax revenue to debt/GDP ratio). We also distinguish the ϕ_{2007} (calibrated as above)

[1]We calibrated it so to include only direct and indirect taxation, since social contributions are increasingly meant to respond to sustainability of pensions systems rather than public debt evolution.

and the ϕ_{stab} , the value of ϕ that stabilizes the debt/GDP ratio at the same level as 2006. All the experiments are carried out under the assumption that public expenditure's share of GDP is kept constant at the 2006 level.

Here is the figure picturing the evolution of the fiscal variables:

FIGURE 1



The following table shows the corresponding quantitative values as we pick, alternatively, the fiscal policy parameter calibrated as in 2007 ($\phi_{2007} = 0.2867$) or the value that stabilizes the debt/GDP ratio at the 2006 level ($\phi_{stab} = 0.2707$).

TABLE 2

ϕ	$\frac{B_{2007}}{Y_{2007}}$	$\frac{D_{2007}}{Y_{2007}}$	$\frac{G_{2007}-T_{2007}}{Y_{2007}}$	$\frac{T_{2007}}{Y_{2007}}$	$\frac{i_{2007}B_{2006}}{Y_{2007}}$
ϕ_{2007} =0.2867	105.15%	2.41%	-2.41%	46.60%	4.74%
ϕ_{stab} =0.2707	106.8%	4.05%	-0.76%	44.95%	4.82%

Not surprisingly, given our calibration procedure, the first line pins down exactly the predictions of Italian government for the year 2007. The second line shows the behaviour of main fiscal aggregates if the government adopts a strategy of debt/GDP stabilization; as we see, the ceiling of 3% for the deficit /GDP ratio would be violated by a considerable extent.

4.2. Evolution of fiscal variables over time

We now carry out a simple exercise regarding the evolution of fiscal policy variables over time from the year 2008 onwards, under given values of other macroeconomic variables. In particular, we analyse the following scenarios:

TABLE 3

BASELINE	**SCEN. 1**	**SCEN. 2**	**SCEN.3**	**SCEN.4**	**SCEN.5**
ϕ =0.2867	ϕ =0.2867	ϕ =0.2867	ϕ =0.2867	ϕ ***=0.30***	ϕ ***=0.30***
$\frac{G_t}{Y_t}$ =44.19%	$\frac{G_t}{Y_t}$ =44.19%	$\frac{G_t}{Y_t}$ =44.19%	$\frac{G_t}{Y_t}$ ***gradual cut***	$\frac{G_t}{Y_t}$ =44.19%	$\frac{G_t}{Y_t}$ ***gradual cut***
$\frac{T_0}{Y_t}$ =17.10%	$\frac{T_0}{Y_t}$ =17.10%	$\frac{T_0}{Y_t}$ =17.10%	$\frac{T_0}{Y_t}$ =17.10%	$\frac{T_0}{Y_t}$ =17.10%	$\frac{T_0}{Y_t}$ =17.10%
π_t =1.9%	π_t ***=2.4%***	π_t ***=1.5%***	π_t =1.9%	π_t =1.9%	π_t =1.9%
i_t^{ECB} =4%	i_t^{ECB} ***=5%***	i_t^{ECB} ***=3%***	i_t^{ECB} =4%	i_t^{ECB} =4%	i_t^{ECB} =4%
g_t =1.9%	g_t ***=1.1%***	g_t ***=2.5%***	g_t =1.9%	g_t =1.9%	g_t =1.9%

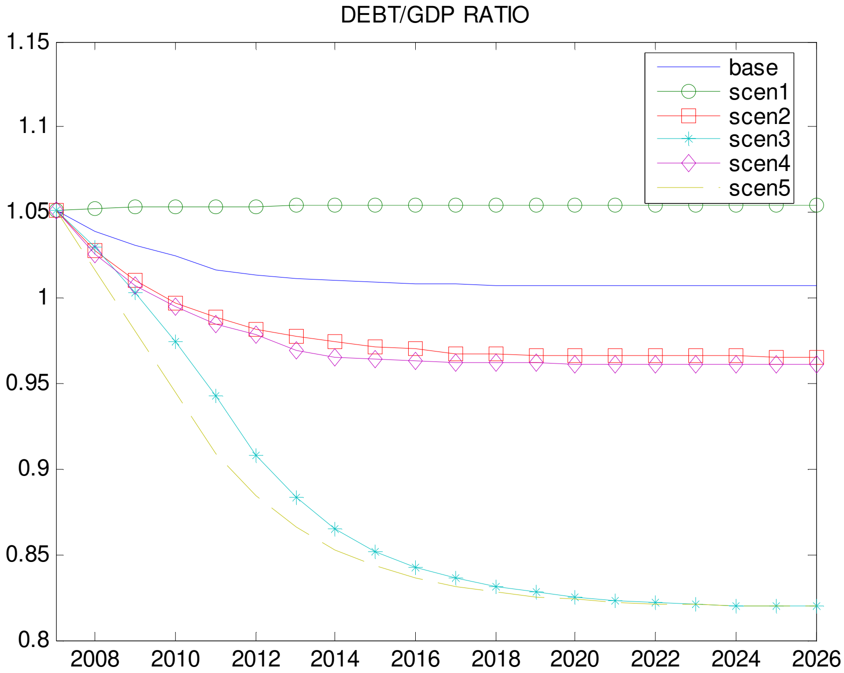
Scenario 1 depicts "bad" macroeconomic conditions, with the rate of growth falling slightly above 1%, inflation accelerating to 2.4%, and tight credit conditions (nominal interest rate at 5%). Conversely, scenario 2 depicts "good" macroeconomic environment, with low inflation and interest rate, and real growth in line (or slightly above) potential. The first two scenarios are analyzed under given fiscal policy stance (same public expenditure/GDP ratio and same feedback parameter). Scenario 3 comes back to "medium" macro conditions, but with a reduction of (primary) public expenditure of 1% per annum, for four years (so to reach the value of 40.19% of GDP); scenario 4 uses a stronger feedback response to past debt/GDP ratio (ϕ =0.30), whereas scenario 5 is a mix of scenarios 3 and 4, thereby representing the more rigid fiscal scenario.

The next two subsections look at the evolution of the main fiscal aggregates under the five alternative scenarios, from 2008 to 2026 and, on the other hand, analyze the consequences of precise debt reduction strategies with, alternatively, a 1% and 2% yearly reduction step.

4.2.1. The path to 2026.

The following table depicts the evolution of fiscal aggregates under the alternative scenarios. Here is the debt/GDP ratio:

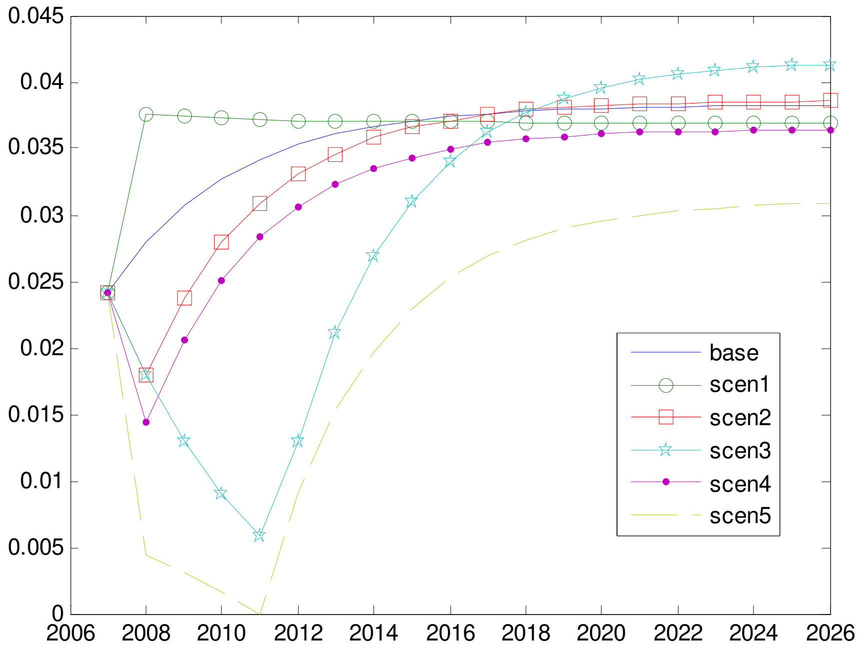
FIGURE 2



Under baseline scenario (that is, $\phi_{2007} = 0.2867$),debt reduction is quite slow, and converges to a level slightly above 100% of GDP. Bad (scenario 1) and good (scenario 2) macro conditions, respectively, worsen and improve the debt reduction trajectory, keeping constant the fiscal stance. Scenario 4 ($\phi = 0.30$) produces almost exactly the same trajectory as scenario 2, meaning that increasing the response of tax revenue to last year debt/GDP to the level of 0.30 can substitute for adverse macroeconomic conditions. The best results are achieved under scenarios 3 and 5, depicting a 1% per year reduction of primary public expenditure from 2008 to 2012; scenario 5 achieves best results, initially, because it implies a stronger response to last year debt.

The evolution of deficit / GDP ratio is interesting:

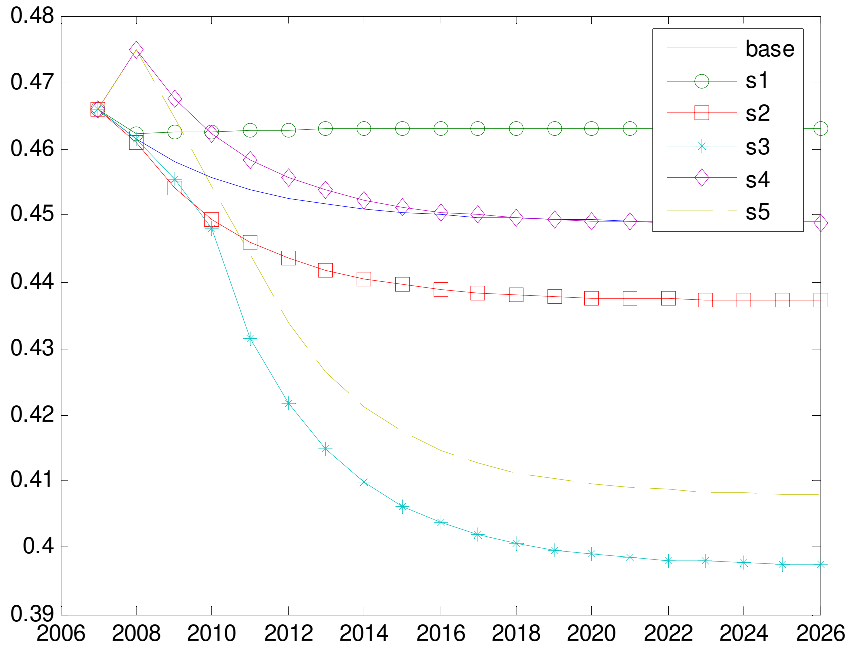
FIGURE 3



Under baseline and scenario 1, it increases steadily until it reaches (respectively), 3.82% and 3.69%. The reason is that since tax revenue is proportional to the debt/GDP ratio, as the latter decreases, the former decreases accordingly; since public expenditure is kept constant, deficit increases over time. Better macroeconomic conditions (scenario 2) make the deficit reduction stronger initially, and we have confirmation that scenarios 2 and 4 produce pretty much the same dynamics (although the convergence level are slightly different). Reduction of public expenditure (scenario 3 and 5) produce the best results, but if they are not accompanied by an increase in ϕ (scenario 3) they disappear in the long-run, ending up with the highest deficit/GDP level in 2026. The reason is that the permanent reduction of G by four points speeds up debt reduction, as we observed in Figure 2; this, under a fiscal feedback rule such as (8), decreases tax revenue by a greater amount, and thus, once G is stabilized at 40.16%, starts off the deficit upturn, which can be kept under control only if we increase permanently the response of taxation to debt (ϕ = 0.30). It is noteworthy that all the scenarios involve, in the long-run, a breaking of the 3% ceiling, even in presence of a (more or less pronounced) debt/GDP reduction.

The dynamic of fiscal pressure confirms the above results:

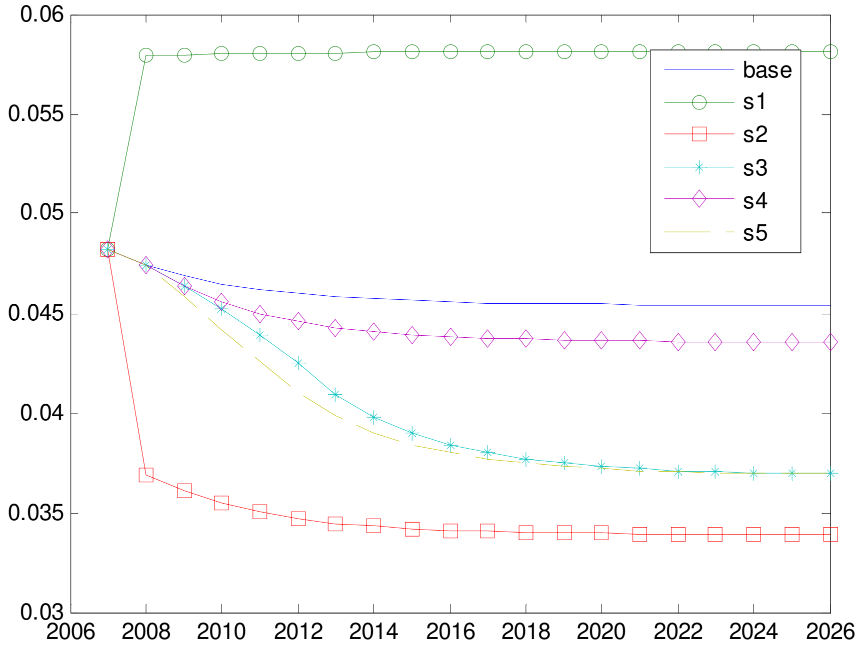
FIGURE 4



The strong reduction of tax revenue/GDP ratio under scenarios 3 and 5 (those featured by greater debt reduction), is the main responsible for the upraising of deficit. The feedback rule, however, leads to a reduction of fiscal pressure in all cases.

Debt service is reduced according to the downturn of debt/GDP ratio. We observe the big difference that an increase (scenario 1) or decrease (scenario 2) of 1% in the ECB interest rate can make for public finance.

FIGURE 5



4.2.2. Variable steps of debt/GDP reduction

So far we have set different macroeconomic conditions (including the fiscal policy stance) and we have observed how debt reduction proceeds in time. In this section we go the other way round: set different objectives of yearly debt reduction (under the first four scenarios), and see what fiscal policy parameter ϕ is needed in order to achieve that objective.

Manipulating equation (9), in fact:

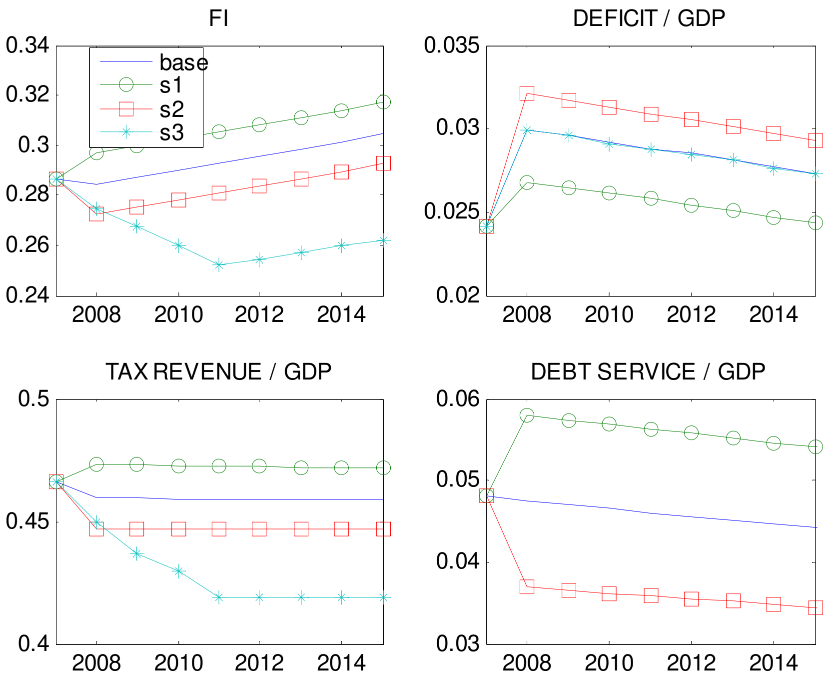
$$\frac{T_0}{Y_t} + \frac{\phi b_{t-1}}{(1+\pi_t+g_t)} - \frac{G_t}{Y_t} = (i_t - \pi_t - g_t)b_{t-1} + \Delta b_t$$

$$\phi = \left[(i_t - \pi_t - g_t)b_{t-1} + \Delta b_t + \frac{G_t}{Y_t} - \frac{T_0}{Y_t} \right] \left(\frac{1+\pi_t+g_t}{b_{t-1}} \right)$$

with Δb_t being the debt reduction step ($= -(b_t - b_{t-1})$). We see what happens if the government chooses to adopt a (more or less) drastic strategy of debt reduction, bringing down debt/GDP ratio by a constant amount each year. We only analyze the first three scenarios, as 4 and 5 differ exactly because they fix a new (and given) level for ϕ.

Here are the results for, respectively, $\Delta b_t = 1\%$, which would allow debt/GDP ratio to be below the 100% threshold by 2013, and to reach 97.15% in 2015.

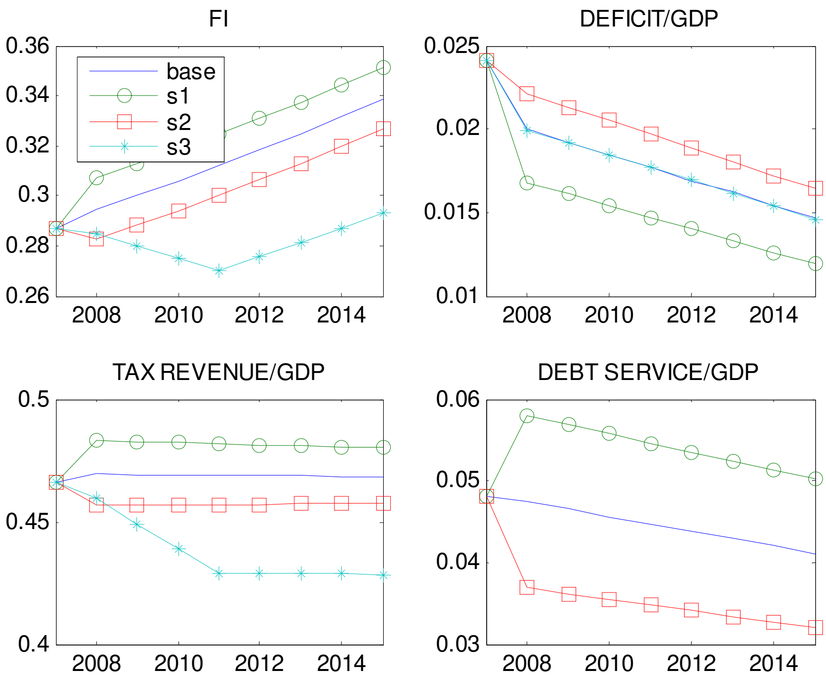
FIGURE 6



After the small decrease in 2008, the feedback parameter required to support a 1% yearly reduction of debt/GDP, increases over time, as it has to compensate the reduction in the stock of public debt. A permanent, although gradual, reduction in public expenditure (scenario 3) would allow ϕ to be on a decreasing path, at least until 2011 (at the same time, tax revenue/GDP can also decrease substantially). After an increase in 2008, deficit shows a decreasing path, with an interesting feature: baseline and scenario 3 overlap almost perfectly. In other words, if public expenditure is not permanently decreases, the dynamics of deficit is the same since the higher value of the ϕ parameter compensates; however, as shown in the lower-left panel, tax pressure would be higher.

If the debt reduction strategy adopts a 2% step per year, the ratio reaches 89.15% by 2015, and the behaviour of fiscal variables is:

FIGURE 7



We can observe the same path as above, with the only difference being the quantitative effects, which are obviously stronger in this case. Tax pressure is the same, since the quicker reduction of debt/GDP ratio is compensated by the higher fiscal parameter.

5. A counterfactual application

The two previous sections were concerned with predictions on the evolution of fiscal variables under different hypothesis and scenarios, assuming that the government explicitly adopted a fiscal rule such as equation (6). Here we ask ourselves what would have happened if such a fiscal policy rule had been applied in Italy in the last decade. We calibrate equation (9) using data from the time span 1994-2006. First we pin down the implicit parameter ϕ on the basis of the actual debt dynamics occurred in that period; then we obtain simulated debt/GDP and deficit/GDP series, analyzing what would have happened had the government adopted explicitly our fiscal rule, with given and alternative values for the feedback parameter.

Here is the table of data:

TABLE 4

	1994	1995	1996	1997	1998	1999
$\frac{G_t}{Y_t}$	42.9%	41.7%	41.4%	41.3%	41.3%	41.7%
$\frac{T}{Y}$	45.1%	45.6%	45.8%	48%	46.5%	46.7%
$\frac{T_0}{Y_t}$	18.04%	16.46%	17.93%	18.54%	16.15%	16.21%
i	9.65%	9.21%	9.25%	7.64%	6.63%	5.75%
π_t	3.48%	5.03%	5.28%	2.39%	2.71%	1.57%
g	2.2%	2.9%	0.7%	1.9%	1.4%	1.9%
$\frac{iB}{Y}$	11.4%	11.5%	11.5%	9.4%	8%	6.7%
$\frac{G-T+iB}{Y}$	9.3%	7.6%	7.1%	2.7%	2.8%	1.7%
Δb	-6.7%	0.5%	1.2%	2.5%	4%	1%

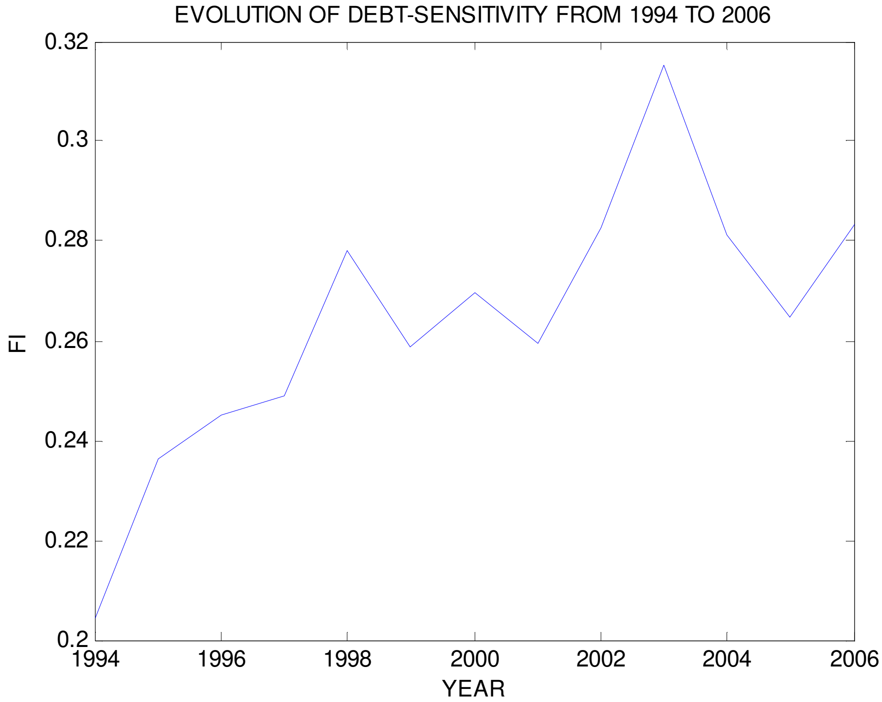
	2000	2001	2002	2003	2004	2005	2006
$\frac{G_t}{Y_t}$	41.2%	41.8%	41.9%	43.4%	43.3%	43.9%	45.9%

$\frac{T}{Y}$	45.8%	45%	44.5%	45.1%	44.6%	44.4%	46.9%
$\frac{T_0}{Y_t}$	15.82%	16.11%	16.25%	16.43%	16.65%	16.79%	16.8%
i	5.62%	5.84%	5.23%	4.89%	4.89%	4.34%	4.3%
π_t	2.19%	2.65%	3.06%	2.94%	2.62%	2%	2.2%
g	3.6%	1.8%	0.3%	0	1.1%	0	1.9%
$\frac{iB}{Y}$	6.5%	6.5%	5.8%	5.3%	5.1%	4.5%	4.58%
$\frac{G-T+iB}{Y}$	1.9%	3.1%	2.9%	3.4%	3.4%	4.1%	4.4%
Δb	4.3%	0.4%	2.6%	4.1%	0.4%	-2.6%	-0.4%

Implicit interest rates have been calculated using the same procedure as in the previous section (i.e. dividing the overall debt service expenditure by the existing stock of public debt).

Next we show the figure of the resulting implicit ϕ from 1994 to 2006 (quantitative data to be found in Appendix B):

FIGURE 8



Visual inspection of Figure 8 is a good way to assess Italian government's fiscal stance. Sensitivity of (direct and indirect) taxation to real debt/GDP ratio shows an increasing trend over the years, confirming the arising of the need of fiscal consolidation. In particular, we note two peaks: in 1997-1998, corresponding to the run-up to the Maastricht criteria, and in 2003, with the approaching of the Excessive Deficit Procedure for breaking the Stability and Growth Pact parameter.

The following exercises show what the debt and deficit dynamics would have been, had the government adopted, respectively, $\phi = 0.2637$ (the mean over the time span) , $\phi = 0.28, \phi = 0.30$. Simulated series are compared with the actual ones (quantitative results in Appendix B).

FIGURE 9

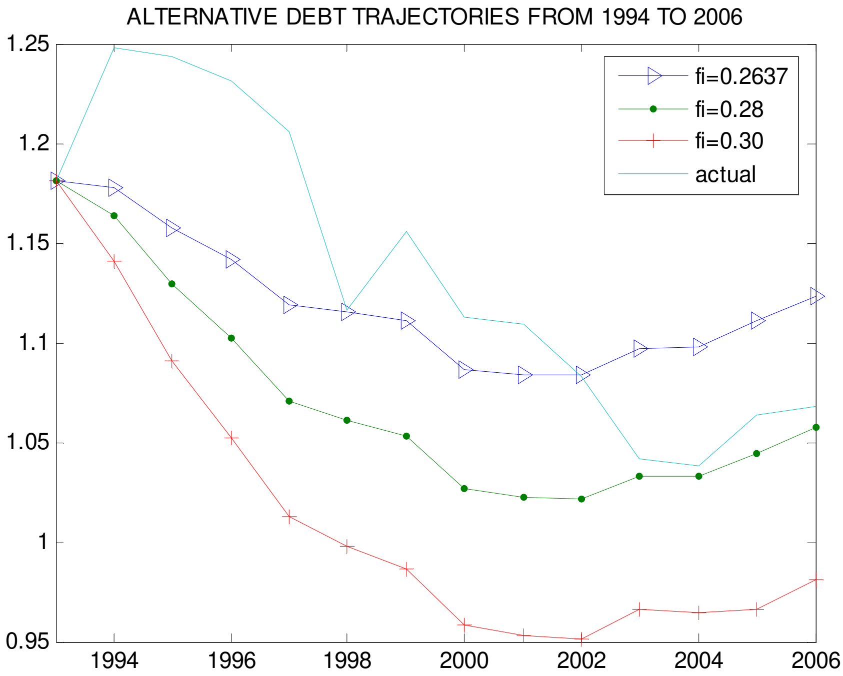

ALTERNATIVE DEBT TRAJECTORIES FROM 1994 TO 2006
1.25
1.2
1.15
1.1
1.05
1
0.95
1994
1996
1998
2000
2002
2004
2006
fi=0.2637
fi=0.28
fi=0.30
actual

FIGURE 10

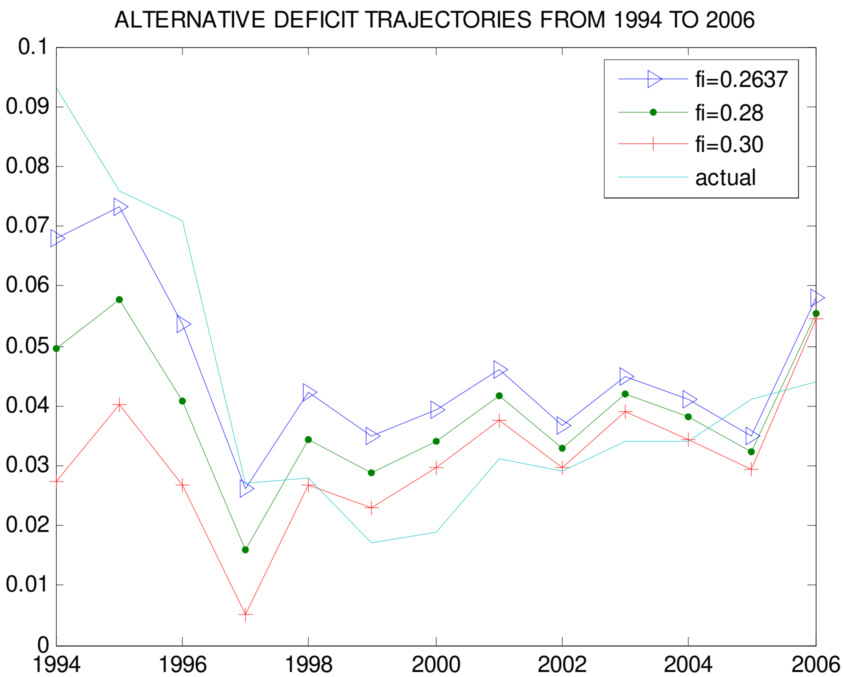

ALTERNATIVE DEFICIT TRAJECTORIES FROM 1994 TO 2006
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1994
1996
1998
2000
2002
2004
2006
fi=0.2637
fi=0.28
fi=0.30
actual

Figure 9 shows that adopting an explicit fiscal rule such as (6) would have ensured a steadier reduction of debt/GDP ratio until 2002, with an uprising henceforth. Nevertheless, final results in 2006 would have been, sensibly, improved only adopting a $\phi = 0.30$. With the average value ($\phi = 0.2637$), in fact, results would have been worse, whereas with $\phi = 0.28$ the final point would have been pretty much the same. It is noteworthy remember, however, that over the entire time span the distance between the actual and the simulated series is strongly in favour of the latter.

Figure 10 shows that if the alternatives debt reductions strategies had been put in place, the corresponding deficit/GDP ratios would have been more often above the 3% ceiling that they had actually been in reality. A further confirmation that the adoption of a fiscal policy rule responding to real debt/GDP ratio can manage to implement a successful reduction strategy without having to "tie the hands" to a given numerical parameter for deficit/GDP.

6. Conclusions

After the burst of the "tax and spend" Keynesian bubble, most industrialized economies have been faced with the pressing need of structural adjustment of public finance's imbalances. For European nations, this process was mainly governed by the advancement of the European Union economic integration, and the establishment of the European Monetary Union at the end of the last decade, which required the compliance with strict public finance criteria both before and after the starting of the single currency. In this overall context, Italy's situation has been particularly relevant, as it entered the euro with a debt/GDP ratio twice as much as the average value for admission; after that, reduction strategy has proven to be not as aggressive and determined as needed, in order to establish a credible fiscal consolidation plan.

In this paper, we tried to investigate the consequences for Italian public finance of the adoption of a simple fiscal policy rule, in which the "variable" component of tax revenue (that we identify with fiscal pressure) responds to the accumulation of past real debt/GDP ratio, with an elasticity given by the crucial feedback parameter ϕ. Our results show that the adoption of such a rule could help simplifying the understanding of the fiscal policy framework, and can be summarized as follows:

- from the policy point of view, a significant debt reduction can occur if the feedback response is slightly increased with respect to the recent tendency (up until 0.30) or if primary government expenditure is gradually reduced by four percentage points over the next four years. Better results, obviously, are achieved if the two above actions are taken jointly. Deterioration of general macroeconomic conditions (in particular, a rise in debt service) can significantly worsen the scenario.
- under given conditions, sustained debt reduction can be achieved also with a deficit/GDP ratio greater than 3% (the SGP parameter). The basic intuition is the following: if the tax revenue is permanently set to respond to public debt, the initial sustained reduction of the latter will cause a reduction of the former. The consequent negative effects on deficit are however partially compensated by the reduction in the debt service, but still prevent deficit/GDP ratio to be permanently reduced. At the same time, fiscal pressure can be set on a decreasing path.
- a consistent strategy of yearly one (two) per cent reduction of debt/GDP ratio would allow it to be at 97.15% (89.15%) by 2015, but it would require a constant increase in the feedback parameter ϕ. Nonetheless, fiscal pressure would remain steady, and deficit/GDP ratio would be under control.
- given all macroeconomic variables, if a fiscal rule such as the one we put forward was adopted in Italy from 1994, debt/GDP reduction would have been steady and smooth, although in the last couple of years more aggressive measure would have been needed. That result could have been achieved even in presence of repeated violation of the 3% ceiling for the deficit/GDP ratio.

This paper does not include any structural analysis, nor microfoundations. It is a fairly simple computational exercise showing the benefits of the adoption of a fiscal rule responding to debt/GDP accumulation. However, we believe it can be a contribution to the understanding of the real policy action needed in order to achieve a sustainable fiscal position and, at the same time, alleviate tax pressure on economic agents. Future research in this field can include the extensions of the comparative analysis at the EMU level, and a greater effort to strengthen the policy forecast of fully-microfounded models.

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Appendix A: Derivations

Derivations of the dynamic of real debt/GDP ratio

Start from equation (1):

$$B_t = (1 + i_t)B_{t-1} + P_t(G_t - T_t)$$

Divide both sides by the current real GDP (P_tY_t):

$$\frac{B_t}{P_tY_t} = (1 + i_t)\frac{B_{t-1}}{P_tY_t} + \frac{(G_t - T_t)}{Y_t} \tag{A1}$$

which can be seen as:

$$\frac{B_t}{P_tY_t} = (1 + i_t)\frac{B_{t-1}}{P_{t-1}Y_{t-1}}\frac{P_{t-1}}{P_t}\frac{Y_{t-1}}{Y_t} + \frac{(G_t - T_t)}{Y_t} \tag{A2}$$

It is also well known that:

$$\frac{P_{t-1}}{P_t} = \frac{1}{1 + \pi_t}$$
$$\frac{Y_{t-1}}{Y_t} = \frac{1}{1 + g_t}$$

where:

π_t = rate of inflation at time t

g_t = rate of growth of real GDP at time t

Plugging those expression is (A2):

$$b_t = \frac{1 + i_t}{(1 + \pi_t)(1 + g_t)}b_{t-1} + \frac{G_t - T_t}{Y_t} \tag{A3}$$

where $b_{t,t-1} =$ real debt/GDP ratio

Exploiting the well-known approximations:

$$(1+\pi_t)(1+g_t) \approx 1+\pi_t+g_t$$

$$\frac{1+i_t}{1+\pi_t+g_t} \approx 1+i_t-\pi_t-g_t$$

we get to equation (1):

$$b_t = b_{t-1} + (i_t-\pi_t-g_t)b_{t-1} + \frac{G_t-T_t}{Y_t}$$

Appendix B: Other Tables

Evolution of fiscal variables over time

Table B1
Baseline scenario

YEAR	$\frac{B_t}{Y_t}$	$\frac{D_t}{Y_t}$	$\frac{T_t}{Y_t}$	$\frac{G_t-T_t}{Y_t}$	$\frac{i_t B_{t-1}}{Y_t}$
2007	105.15%	2.41%	46.60%	-2.41%	4.82%
2008	103.94%	2.79%	46.14%	-1.95%	4.74%
2009	103.06%	3.07%	45.81%	-1.62%	4.69%
2010	102.42%	3.15%	45.57%	-1.38%	4.65%
2011	101.60%	3.42%	45.39%	-1.20%	4.62%
2012	101.35%	3.61%	45.16%	-0.97%	4.60%
2013	101.17%	3.67%	45.09%	-0.90%	4.56%
2014	101.03%	3.71%	45.04%	-0.85%	4.56%
2015	100.93%	3.74%	45%	-0.81%	4.56%
2016	100.86%	3.76%	44.98%	-0.79%	4.55%
2017	100.81%	3.78%	44.96%	-0.77%	4.55%
2018	100.77%	3.79%	44.94%	-0.75%	4.55%
2019	100.74%	3.80%	44.93%	-0.74%	4.54%
2020	100.72%	3.81%	44.92%	-0.73%	4.54%
2021	100.71%	3.81%	44.92%	-0.73%	4.54%
2022	100.70%	3.82%	44.92%	-0.73%	4.54%
2023	100.69%	3.82%	44.91%	-0.72%	4.54%
2024	100.68%	3.82%	44.91%	-0.72%	4.54%
2025	100.68%	3.82%	44.91%	-0.72%	4.54%
2026	100.68%	3.82%	44.91%	-0.72%	4.54%

Table B2: Scenario 1

YEAR	$\frac{B_t}{Y_t}$	$\frac{D_t}{Y_t}$	$\frac{T_t}{Y_t}$	$\frac{G_t - T_t}{Y_t}$	$\frac{i_t B_{t-1}}{Y_t}$
2007	105.15%	2.41%	46.60%	-2.41%	4.82%
2008	105.23%	3.76%	46.23%	-2.04%	5.79%
2009	105.28%	3.74%	46.25%	-2.06%	5.80%
2010	105.33%	3.73%	46.26%	-2.07%	5.80%
2011	105.36%	3.72%	46.28%	-2.09%	5.80%
2012	105.38%	3.71%	46.28%	-2.09%	5.81%
2013	105.40%	3.71%	46.29%	-2.10%	5.81%
2014	105.41%	3.70%	46.30%	-2.11%	5.81%
2015	105.42%	3.70%	46.30%	-2.11%	5.81%
2016	105.43%	3.70%	46.30%	-2.11%	5.81%
2017	105.44%	3.69%	46.30%	-2.11%	5.81%
2018	105.44%	3.69%	46.31%	-2.12%	5.81%
2019	105.44%	3.69%	46.31%	-2.12%	5.81%
2020	105.44%	3.69%	46.31%	-2.12%	5.81%
2021	105.44%	3.69%	46.31%	-2.12%	5.81%
2022	105.44%	3.69%	46.31%	-2.12%	5.81%
2023	105.45%	3.69%	46.31%	-2.12%	5.81%
2024	105.45%	3.69%	46.31%	-2.12%	5.81%
2025	105.45%	3.69%	46.31%	-2.12%	5.81%
2026	105.45%	3.69%	46.31%	-2.12%	5.81%

Table B3: Scenario 2

YEAR	$\frac{B_t}{Y_t}$	$\frac{D_t}{Y_t}$	$\frac{T_t}{Y_t}$	$\frac{G_t - T_t}{Y_t}$	$\frac{i_t B_{t-1}}{Y_t}$
2007	105.15%	2.41%	46.60%	-2.41%	4.82%
2008	102.74%	1.79%	46.09%	-1.90%	3.69%
2009	101%	2.37%	45.42%	-1.23%	3.61%
2010	99.75%	2.79%	44.94%	-0.75%	3.55%
2011	98.86%	3.09%	44.60%	-0.41%	3.50%
2012	98.21%	3.31%	44.35%	-0.16%	3.47%
2013	97.74%	3.46%	44.17%	0.02%	3.45%
2014	97.41%	3.58%	44.05%	0.14%	3.43%
2015	97.17%	3.66%	43.95%	0.24%	3.42%
2016	97%	3.71%	43.89%	0.30%	3.41%
2017	96.78%	3.76%	43.84%	0.35%	3.40%
2018	96.72%	3.79%	43.80%	0.39%	3.40%
2019	96.67%	3.81%	43.78%	0.41%	3.40%
2020	96.66%	3.82%	43.76%	0.43%	3.39%
2021	96.61%	3.83%	43.75%	0.44%	3.39%
2022	96.60%	3.84%	43.74%	0.45%	3.39%

2023	96.58%	3.85%	43.73%	0.46%	3.39%
2024	96.58%	3.85%	43.73%	0.46%	3.39%
2025	96.57%	3.85%	43.72%	0.46%	3.39%
2026	96.56%	3.86%	43.72%	0.47%	3.39%

Table B4: Scenario 3

YEAR	$\frac{B_t}{Y_t}$	$\frac{D_t}{Y_t}$	$\frac{T_t}{Y_t}$	$\frac{G_t - T_t}{Y_t}$	$\frac{i_t B_{t-1}}{Y_t}$
2007	105.15%	2.41%	46.60%	-2.41%	4.82%
2008	102.94%	1.79%	46.14%	-2.95%	4.74%
2009	100.33%	1.30%	45.53%	-3.34%	4.64%
2010	97.42%	0.9%	44.81%	-3.62%	4.52%
2011	94.29%	0.58%	44.01%	-3.82%	4.39%
2012	90.80%	1.30%	43.14%	-2.95%	4.25%
2013	88.29%	2.11%	42.18%	-1.99%	4.09%
2014	86.49%	2.69%	41.49%	-1.30%	3.98%
2015	85.20%	3.10%	40.99%	-0.80%	3.90%
2016	84.27%	3.40%	40.63%	-0.44%	3.84%
2017	83.60%	3.62%	40.38%	-0.19%	3.80%
2018	83.12%	3.77%	40.19%	0%	3.77%
2019	82.78%	3.88%	40.06%	0.13%	3.75%
2020	82.53%	3.96%	39.96%	0.23%	3.73%
2021	82.35%	4.02%	39.90%	0.29%	3.72%
2022	82.23%	4.06%	39.85%	0.34%	3.71%
2023	82.07%	4.09%	39.81%	0.38%	3.71%
2024	82.02%	4.11%	39.79%	0.40%	3.70%
2025	81.99%	4.12%	39.77%	0.42%	3.70%
2026	81.97%	4.13%	39.76%	0.43%	3.70%

Table B5: Scenario 4

YEAR	$\frac{B_t}{Y_t}$	$\frac{D_t}{Y_t}$	$\frac{T_t}{Y_t}$	$\frac{G_t - T_t}{Y_t}$	$\frac{i_t B_{t-1}}{Y_t}$
2007	105.15%	2.41%	46.60%	-2.41%	4.82%
2008	102.60%	1.44%	47.49%	-3.30%	4.74%
2009	100.76%	2.06%	46.75%	-2.56%	4.63%
2010	99.45%	2.51%	46.22%	-2.03%	4.54%
2011	98.50%	2.83%	45.84%	-1.38%	4.49%
2012	97.82%	3.06%	45.57%	-1.18%	4.44%
2013	96.98%	3.23%	45.37%	-1.04%	4.41%
2014	96.55%	3.35%	45.23%	-0.94%	4.39%
2015	96.42%	3.43%	45.13%	-0.87%	4.37%
2016	96.33%	3.50%	45.06%	-0.82%	4.36%
2017	96.26%	3.54%	44.01%	-0.78%	4.35%
2018	96.21%	3.57%	44.97%	-0.75%	4.35%
2019	96.18%	3.59%	44.94%	-0.73%	4.34%
2020	96.16%	3.61%	44.92%	-0.72%	4.34%
2021	96.14%	3.62%	44.91%	-0.71%	4.34%
2022	96.12%	3.63%	44.90%	-0.70%	4.34%
2023	96.11%	3.64%	44.89%	-0.70%	4.34%
2024	96.10%	3.64%	44.89%	-0.69%	4.34%
2025	96.10%	3.64%	44.88%	-0.69%	4.33%
2026	96.10%	3.65%	44.88%	-0.69%	4.33%

Table B6: Scenario 5

YEAR	$\frac{B_t}{Y_t}$	$\frac{D_t}{Y_t}$	$\frac{T_t}{Y_t}$	$\frac{G_t - T_t}{Y_t}$	$\frac{i_t B_{t-1}}{Y_t}$
2007	105.15%	2.41%	46.60%	-2.41%	4.82%
2008	101.60%	0.44%	47.49%	-4.30%	4.74%
2009	98.05%	0.31%	46.46%	-4.27%	4.58%
2010	94.50%	0.17%	45.44%	-4.25%	4.42%
2011	90.95%	0%	44.41%	-4.22%	4.26%
2012	88.40%	0.91%	43.39%	-3.20%	4.10%
2013	86.57%	1.53%	42.65%	-2.46%	3.99%
2014	85.25%	1.97%	42.12%	-1.93%	3.90%
2015	84.31%	2.30%	41.74%	-1.55%	3.84%
2016	83.63%	2.53%	41.47%	-1.28%	3.80%
2017	83.14%	2.69%	41.27%	-1.08%	3.77%
2018	82.79%	2.81%	41.13%	-0.94%	3.75%
2019	82.54%	2.90%	41.03%	-0.84%	3.73%
2020	82.36%	2.96%	40.96%	-0.77%	3.72%
2021	82.23%	3%	40.90%	-0.71%	3.71%

2022	82.14%	3.03%	40.87%	-0.68%	3.71%
2023	82.07%	3.05%	40.84%	-0.65%	3.70%
2024	82.02%	3.07%	40.82%	-0.63%	3.70%
2025	81.99%	3.08%	40.81%	-0.62%	3.70%
2026	81.97%	3.09%	40.80%	-0.61%	3.70%

Table B7
Implicit feedback parameter calculated for 1994-2006

YEAR	ϕ
1994	0.2045
1995	0.2364
1996	0.2450
1997	0.2489
1998	0.2779
1999	0.2587
2000	0.2698
2001	0.2594
2002	0.2826
2003	0.3154
2004	0.2814
2005	0.2647
2006	0.2834

Table B8
Actual and simulated debt/GDP ratios 1994-2006

YEAR	$\frac{B}{Y}_{\phi=0.2637}$	$\frac{B}{Y}_{\phi=0.28}$	$\frac{B}{Y}_{\phi=0.30}$	$\frac{B}{Y}_{actual}$
1994	117.77%	116.36%	114.12%	124.8%
1995	115.74%	112.90%	109.10%	124.3%
1996	114.20%	110.23%	105.25%	123.1%
1997	111.91%	107.09%	101.26%	120.6%
1998	111.53%	106.14%	99.78%	116.6%
1999	111.14%	105.33%	98.61%	115.6%
2000	108.63%	102.65%	95.86%	111.3%
2001	108.40%	102.25%	95.35%	110.9%
2002	108.42%	102.11%	95.11%	108.3%
2003	109.73%	103.30%	96.62%	104.2%
2004	109.77%	103.27%	96.45%	103.8%
2005	111.07%	104.45%	96.63%	106.4%
2006	112.31%	105.71%	98.13%	106.8%

Table B9
Actual and simulated deficit/GDP ratios 1994-2006

YEAR	$\frac{D}{Y}_{\phi=0.2637}$	$\frac{D}{Y}_{\phi=0.28}$	$\frac{D}{Y}_{\phi=0.30}$	$\frac{D}{Y}_{actual}$
1994	6.79%	4.97%	2.73%	9.3%
1995	7.31%	5.77%	4.03%	7.6%
1996	5.38%	4.08%	2.68%	7.1%
1997	2.61%	1.59%	0.52%	2.7%
1998	4.22%	3.45%	2.68%	2.8%
1999	3.48%	2.87%	2.30%	1.7%
2000	3.92%	3.42%	2.96%	1.9%
2001	4.61%	4.17%	3.76%	3.1%
2002	3.66%	3.30%	2.96%	2.9%
2003	4.50%	4.19%	3.90%	3.4%
2004	4.12%	3.81%	3.43%	3.4%
2005	3.50%	3.24%	2.93%	4.1%
2006	5.79%	5.55%	5.46%	4.4%