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THE MACROECONOMICS OF FISCAL CONSOLIDATIONS IN A MONETARY UNION: THE CASE OF ITALY

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The macroeconomics of fiscal consolidations in a Monetary Union: the case of Italy

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Abstract

This paper lays down a dynamic stochastic general equilibrium model with the aim of analyzing the macroeconomic effects of fiscal consolidation in one country of the Euro area, taking into account the single monetary policy and the interaction with the rest of the area. In particular the paper focuses on Italy, the country with the highest level of debt. For this purpose we use the IdEA (Italy and Euro Area) model, a two-region currency union model, calibrated to Italy and to the rest of the Euro area. The model features distortionary taxation on labor, capital income and consumption, while expenditures are detailed into purchases of goods and services, compensations for public employees, transfers to households and public investment. Purchases of goods and services and public employment are used to produce public goods that enter agents' utility function.

Our main results are: (1) reducing tax distortions entails significant welfare gains; (2) the best way to accomplish a fiscal consolidation is to lower taxes while at the same time reducing expenditures (by more); (3) among expenditures, it is preferable to cut purchases of goods and services or public employment than transfers to households; (4) cutting taxes immediately rather than with a delay entails no slowdown in the pace of public debt reduction and delivers a higher level of welfare during the transition; (5) the spillover effects of the fiscal consolidation to the rest of the euro area are limited.

1 Introduction

In this paper we present a Dynamic Stochastic General Equilibrium model of the Italian economy to study the macroeconomic and welfare implications

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of different fiscal consolidation scenarios. The model, referred to as the IdEA (Italy and Euro Area) model, is a two-region currency-union dynamic stochastic general equilibrium (DSGE) model, calibrated to Italy and to the rest of the Euro area. The choice of modelling Italy as a part of the Euro area allows to properly take into account the role of the common monetary policy and the spillover from (and to) the rest of the area. The basic structure of the model is akin to the Global Economy Model (GEM) developed at the IMF[1]. It allows for monopolistic competition in the goods and labor markets[2]. The model also includes real and nominal frictions to match the persistence usually found in the data as well as a feedback rule for the central bank. A detailed description of the IdEA can be found in Forni, Gerali and Pisani (2007).

In this paper we enrich the basic structure of the IdEA model to analyze fiscal policy issues. We break down the Ricardian equivalence by introducing distortionary taxes on labor income, capital income and consumption, allowing for a more realistic treatment of fiscal policy. On the expenditure side, we depart from the simplifying assumption that public expenditures are "pure waste" and instead carefully distinguish between different uses of public money: spending on final goods and services, public employment, transfer to families and public investment. We believe that decomposing public expenditures in its main components is important, as each one has different macroeconomic implications[3]. In particular, we assume that spending on final goods and services and public employment are combined to produce public goods that enter the utility function. Therefore, we are able to capture an important trade-off of tax cuts: on one side tax cuts bring about reductions in tax distortions and increases in disposable income; on the other side they might lead to reductions in expenditures - and therefore of public goods provision - that entail welfare costs.

We will focus on fiscal consolidation scenarios that entail permanent changes in the different tax rates and expenditure items. In his Presidential Address to the AEA 2003 discussing the "Macroeconomic Priorities", R. Lucas argues that the welfare gains from long-run supply side policies (as changes in the tax structures) are much bigger than the gains from short run demand management or countercyclical policies. In his opinion the gains from supply side fiscal policies would be equivalent to increases of about 5

[1]See Bayoumi (2004) for a non-technical description of the GEM. Several central banks have developed DSGE models for policy analysis. Among the others, the Fed has developed SIGMA (see Erceg et al (2006)), the European Central Bank the New Euro Area Wide Model (see Coenen et al (2007)).

[2]Judd (2002) has shown that market power can substantially change the analysis of optimal tax policy. On this issue see also Jonsson (2007).

[3]Moreover, Rogerson (2007) argues that "it is essential to explicitly consider how the government spends tax revenues when assessing the effects of tax rates on aggregate hours of market work."

to 15 percent in overall consumption levels[4], about the levels that we find, versus gains from countercyclical policies of the order of 0.05 per cent[5]. Notwithstanding these significant potential gains, the analysis of structural aspects of fiscal policy in a general equilibrium framework is still a rather underdeveloped research area, although it is gaining more importance over time. Just to give some examples, Mankiw and Weinzierl (2006) use standard growth models to assess the supply side effects of tax cuts and conclude that "in all models considered, the dynamic response of the economy to tax changes is too large to be ignored". They also show that the results obtained using the standard neoclassic growth model with infinitely lived agents - the framework considered in this paper - are robust to departures, as assuming agents with finite horizons or including a share of rule of thumb consumers[6]. Also Feldstein (2008) discusses "how the effects of taxes on economic behavior are important for revenue estimation, for calculating efficiency effects, and for understanding short-term macroeconomic consequences."

During the nineties a number of contributions have analyzed the so called non-Keynesian effects of fiscal policy (see, among the others, Alesina and Perotti,1995 and 1997, Giavazzi and Pagano,1990 and 1996, McDermott and Wescott, 1996, Alesina and Ardagna, 1998). This literature has considered fiscal consolidations (variously defined) of OECD countries in order to obtain some indications on the characteristics that most likely would lead to successful (i.e. lasting) adjustments. The main conclusion were that (i) adjustments concentrated on the expenditure side of the budget more than

[4]R. Lucas (2003): "Tax structures that penalizes capital accumulation and work effort, and tax-financed government provision of private goods all have uncompensated costs amounting to sizable fractions of income".

[5]Most of the analysis at the basis of Lucas assertions assume a labor supply elasticity around 1 (see, for example, Prescott 2002 and 2006). Many studies using micro data conclude that this elasticity is much lower for prime aged married males, while others studies have found larger values for married females. Similar findings are presented in the recent OECD publication Going for Growth, 2008.

However, Rogerson (2006) argues that existing evidence from microdata is likely to be of little use in determining the relevant elasticity to study the consequences of changes in aggregate tax rates. He shows that "much of the variation in wages is idiosyncratic and, given the need to coordinate working times across individuals, one would not expect much response of individual hours to idiosyncratic wage changes". Rogerson and Wallenious (2007) considers a model that incorporates changes in both the intensive (hours of work) and extensive (whether or not to work) margins and "use it to assess the consequences of changes in tax and transfer policies on equilibrium hours of work." They find that the macro Frish labor supply elasticity ranges between 2.3 and 3 and that "changes in taxes have large aggregate effects on hours of work. Moreover, ...there is no inconsistency between this result and the empirical finding of small labor elasticities for prima age workers." These results are consistent with the values for the labor supply elasticity usually estimated in DSGE models (around 2). In our baseline calibration we will use a value of 2 and perform robustness on this parameter in section 6.2.

[6]We will extend the model to include non Ricardian (or rule-of-thumb) agents in the robustness section 6.2 and confirm the findings of Mankiw and Weinzierl (2006).

on the revenue side and (ii) large adjustments (measured by the reduction in the debt/GDP ratio) tended to have more non-Keynesian effects. The main theoretical argument behind these results, although never spelled out in a model, was that agents are mainly Ricardian and therefore any sustainable reduction in public expenditure would generate a wealth effect (agents foresee less taxes) leading to an increase in consumption, investment and economic activity. This wealth effect could – under certain circumstances (as in cases of very high debt/GDP ratio at the beginning of the consolidation phase) – dominate against the (Keynesian) direct depressing effect on the economy related to cuts in public expenditures.

Our general equilibrium model formalizes most of these effects and allows weighting them in a sound quantitative manner. In particular we assume Ricardian agents; distortionary taxation (on labor, capital and consumption) and that public expenditure are not pure waste (as they are used to produce public goods that enter the utility function). Therefore in our model not only we can trade off the impact of the wealth effect due to cut in expenditures with the welfare cost of reducing public expenditures, but also see how this trade off changes depending on which tax rate or expenditure item is reduced.

Two papers strongly related to ours are Coenen and McAdam (2005) and Coenen, Mohr and Straub (2006). In particular, the latter analyzes costs and benefits of fiscal consolidation scenarios in the Euro area, although using a less detailed description of fiscal policy that we use. Their results point to significant positive long-run effects on the main macroeconomic variables, mainly when the improvement in the budget position is used to lower distortionary taxes.

Our main result is in line with the finding that reducing tax distortions entails significant welfare gains. In addition, having a richer description of fiscal policy and an open economy model, we can add important qualifiers to this conclusion. Specifically: (i) tax cuts have clear welfare-improving implications; (ii) hence, the best way to accomplish a fiscal consolidation is by lowering tax rates while, at the same time, reducing expenditures by more than would be needed with unchanged tax rates; (iii) given our parametrization, among expenditures it is preferable to cut purchases of goods and services or public employment rather than transfers to households; the reduction in transfers directly curtails the amount of resources available, thus inducing households to consume less and to work more; in the other two cases, the effects are more mediated and depend upon the parameters of the production function for public goods as well as those governing how public and private goods enter the utility function; (iv) cutting taxes immediately rather than with a delay entails no slowdown in the pace of public debt reduction and delivers a higher level of welfare during the transition; (v) the spillover effects of the fiscal consolidation to the rest of the euro area

are limited. These results seems to be robust to the assumed calibration: in section 6.2 we repeat the analysis for different values of some important parameters and show that qualitatively our conclusion are not modified.

The paper is organized as follows. Section 2 provides a brief discussion of the model, while section 3 presents in some detail the way we model fiscal policy and the main factors that drive the results. Section 4 discusses the calibration of the model, section 5 describes the fiscal consolidation scenarios that we consider. Section 6 presents the results for the baseline consolidation scenario (dividing the analysis in steady state comparisons and analysis of the transition phase) and provides some robustness checks. Section 7 concludes.

2 The setup

There are two regions, Italy and rest of the Euro area, having different sizes and sharing the same currency. In each region there are households and firms. Each household consumes a final composite good made of non-tradable and tradable goods, the latter produced both at home and abroad. Households participate in financial markets and smooth consumption by trading a short-term nominal riskless bond. They also own domestic firms and capital stock, which is rented to domestic firms in a perfectly competitive market. All households supply differentiated labor services to domestic firms and act as wage setters in monopolistically competitive markets by charging a markup over their marginal rate of substitution.

On the production side, there are perfectly competitive firms that produce the final goods and monopolistic firms that produce the intermediate goods. The three final goods (a private consumption, a private investment and a public consumption good) are produced combining all available intermediate goods using a constant-elasticity-of-substitution (CES) production function. Tradable and non tradable intermediate goods are produced combining capital and labor in the same way. Tradable intermediate goods are split in domestically-consumed and export goods. Because intermediate goods are differentiated, firms have market power and restrict output to create excess profits.

We will mainly focus on steady state comparisons, but for the baseline consolidation scenario we will discuss also the dynamic adjustment to the new steady state. To capture the empirical persistence of the aggregate data and generate realistic dynamics, we include adjustment costs on real and nominal variables, ensuring that, in response to a shock, consumption and production do not immediately jump to a new long-term equilibrium. On the real side, quadratic costs prolong the adjustment of the capital stock.

On the nominal side, they make wages and prices sticky[7].

3 Fiscal policy

Fiscal policy is set at the country level. The government budget constraint is:

$$\left[\frac{B_{t+1}}{R_t} - B_t\right] = P_t C_t^g + W_t L_t^g + Tr_t + P_t I_t^g - T_t \tag{1}$$

where $B_t \geq 0$ is nominal public debt[8], C_t^g is government purchases of goods and services[9], $W_t L_t^g$ is compensation for public employees (in the National Accounts $C_t^g + W_t L_t^g = G_t$), Tr_t are transfers to households and I_t^g is public investment. Total government revenues T_t are given by the following identity:

$$T_t = \tau_t^w W_t L_t + \tau_t^c \left[P_t C_t + C_t^g\right] + \tau_t^k \left[R_t^k k_t + D_t\right] \tag{2}$$

where the τ are tax rates on labor income (τ_t^w), capital income (τ_t^k) and consumption (τ_t^c), L_t is total employment (including public employment), R_t^k is the capital rental rate and D_t stands for dividends.

Public employees together with purchases of goods and services (and an exogenously given stock of public capital, $\overline{K}_g$, mainly representing building and land) are combined (using a CES production function) to produce public goods (on a per-capita terms) Y^g (as health, education, security, justice...):

$$Y_t^g = \left[\gamma_{kg}^{\frac{1}{\alpha_g}} \overline{K}_g^{\frac{\alpha_g - 1}{\alpha_g}} + \gamma_{Cg}^{\frac{1}{\alpha_g}} {C_t^g}^{\frac{\alpha_g - 1}{\alpha_g}} + (1 - \gamma_{kg} - \gamma_{Cg})^{\frac{1}{\alpha_g}} {L_t^g}^{\frac{\alpha_g - 1}{\alpha_g}}\right]^{\frac{\alpha_g}{\alpha_g - 1}}$$

where α_g measures the degree of substitutability between the three kinds of input and γ_{kg}, γ_{Cg} are the weights of public capital and purchases of goods and services, respectively. Finally, public goods enter the utility function delivering utility to households. The expected value of household j lifetime utility is given by:

$$E_0 \left\{\sum_{t=0}^{\infty} \beta^t \left[\frac{\left[\widetilde{C}_t(j)\right]^{(1-\sigma)}}{(1-\sigma)} - \frac{\kappa}{\tau} L_t(j)^{\tau}\right]\right\}$$

where

$$\widetilde{C}_t(j) = \left[\omega^{\frac{1}{\theta}} C_t(j)^{\frac{\theta-1}{\theta}} + (1-\omega)^{\frac{1}{\theta}} {Y_t^g}^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}$$

[7] See Rotemberg (1982).

[8] We assume a unique euro area market for government bonds, that is all households hold bonds issued by both Italian and other euro area governments.

[9] We assume that C^g has the same composition as private consumption.

and θ measures the degree of substitutability between private and public goods while ω is the weight of the private good in the consumption bundle. When $\omega = 1$, the level of the public good does not alter private consumption decisions.[10]

Fiscal policy affects the economy in many different ways. Purchases of good and services are a demand component in the goods market, public employment is a demand component in the labor market and government investment I^g is used to build up public capital (typically infrastructures) that enters the production function of private goods (both tradeables and non tradables). Most of the effects can be appreciated through the budget constraint of a single agent:

$$\begin{aligned} & (1-\tau_t^w)W_t(L_t+L_t^g)+(1-\tau_t^k)\left[R_t^k\overline{k}_t u_t+D_t\right]+B_t+Tr_t \\ = \quad & (1+\tau_t^c)P_tC_t+P_tI_t+\frac{B_{t+1}}{R_t} \end{aligned}$$

where for simplicity we have abstracted from adjustment costs. The above budget shows how taxes enter the agents decisions, as well as public employment and transfers to households. It is easy to see how they induce intratemporal and intertemporal distortions. Agents deciding how much labor to offer (*intratemporal decision*) will base their decision on the purchasing power of the take home pay; the labor income tax wedge is given by:

$$\frac{1-\tau^w}{1+\tau^c}$$

which, based on our calibrated values (see the next section on calibration), is equal to 49%. That is, only 49% of labor cost is actually passed to workers in terms of consumption. Capital income (and, to a lesser extent, consumption) taxes have also relevant dynamic effects. From the first order condition on capital accumulation, it is easy to show that in steady state the real return to capital, r^k, equals:

$$r^k=\frac{1-\beta(1-\delta)}{\beta(1-\tau^k)}$$

where δ is the capital depreciation rate. In this case the tax wedge is given by $(1-\tau^k)$,which based on our calibration is equal to 71%. Out of steady state, also consumption taxes - if changing over time - affect the

[10]When $\theta = 0$, we have a "Leontief" aggregator, i.e. C_t and Y_t^g become perfect complements. When $\theta = 1$, we have a "Cobb-Douglas" aggregator of the form $\widetilde{C}_t(j) = C_t(j)^{\omega} Y_t^{g(1-\omega)}$. As θ goes to infinity, the aggregator becomes of the form $\widetilde{C}_t(j) = C_t(j) + Y_t^g$ and the two goods are perfect substitutes.

intertemporal trade-off, in particular through the Euler equation. In this latter case the wedge is given by:

$$\frac{1+\tau_t^c}{1+\tau_{t+1}^c}$$

Finally, in order to close the model, we need a fiscal rule able to stabilize the level of debt as a percent of GDP. We therefore assume a policy rule that uses a single instrument among the three tax rates and the three expenditure items to bring the debt close to the target level (b^*). In particular we assume the following rule:

$$\frac{i_t}{i_{t-1}} = \left(\frac{b_t}{b^*}\right)^{\phi_1} \left(\frac{b_t}{b_{t-1}}\right)^{\phi_2} \tag{3}$$

where i_t is either an expenditure item expressed as a percent of GDP (in the case of public employment the rule is defined on the *level* of public employment) or a tax rate, b is the debt level as a ratio to GDP; ϕ_1 and ϕ_2 are coefficients lower than zero when the rule is defined on an expenditure item (calling for a reduction in expenditures whenever the debt level is above target, and for a larger reduction whenever the dynamics of the debt is not converging), greater than zero when the rule is on tax rates. It is important to stress that rule (3) is not intended to be a realistic description of the fiscal authority. It is a technical device to generate tax or expenditure paths consistent with the achievement of the debt target.

Overall the model is able to take into account the diverse implications for the economy related to the different tax and expenditure items. This is essential in order to better understand the macroeconomic effects of consolidation scenarios that might differ in size and composition. For an earlier work along these lines see Forni, Monteforte and Sessa (2007).

4 Calibration

The model is calibrated at a quarterly frequency. Some parameter values are pinned down by the requirement that steady-state ratios need to be consistent with national accounts data. For the rest of the parameters we resort to previous studies and estimates available in the literature [11]. Table 1 contains parameters that regulate preferences and technology. We assume that discount rates and elasticities of substitution have the same value across the two regions. The discount factor β is set to 0.9875, so that the steady state real interest rate is equal to 5 per cent on an annual basis. The value for the intertemporal elasticity of substitution, $1/\sigma$, is 1. The Frisch labor elasticity is set to 2. The weight of the private good ω in the utility function

[11] Among others, see Cristadoro, Gerali, Neri e Pisani (2007) and Forni, Monteforte and Sessa (2007).

is 0.9[12], while the elasticity of substitution between private and public goods, θ, is set at 1.5[13]. The depreciation rate of (private and public) capital δ is set to 2.5 per cent on a quarterly basis. In the production functions of tradables and non-tradables the elasticity of substitution between labor, private and public capital is set respectively to 0.85 and 0.79. The biases towards private capital, labor and public capital are set to 0.75, 0.21 and 0.04 in the tradable sector; 0.7, 0.26 and 0.04 in the non tradable sector. In the production function of the public sector the elasticity of substitution between inputs (labor, fixed stock of capital and intermediate goods) α_g is equal to 0.79, the biases towards capital γ_{kg}, intermediate goods γ_{Cg} and labor $(1 - \gamma_{kg} - \gamma_{Cg})$ are respectively equal to 0.7, 0.1 and 0.2.

In the final consumption and investment goods the elasticity of substitution between domestic and imported tradable is set to 1.5, while the elasticity of substitution between tradables and non tradables to 0.5. The bias for non tradeable to 0.5. The bias for the domestically produced rest of the Euro area) and that for the composite tradable good (equal to 0.5 in both regions) are chosen to match the Italy-Euro area import and export to gross domestic product ratios. The population size of Italy (we normalize the whole Euro area population to 1) is set to 0.2. Table 2 contains parameters that regulate the dynamics. Adjustment costs on capital are set to 1. Both nominal wage and price quadratic adjustment costs are set to 60, which corresponds to an average frequency of wage and price adjustment roughly equal to 4 quarters. Gross sector markups of Italy and rest of the Euro Area are all set to 1.2. The parameters regulating the adjustment cost paid by the Italian private agents on their net financial position are set to 0.01. This cost is introduced to make the model stationary.

Tax rates are calibrated using effective average tax rates estimates for 2006 taken from Eurostat (2007): τ^w is set to 43.1 per cent in Italy and to 38.7 in the rest of the Euro area; τ^k to 29.0 and 30.1, while τ^c to 16.9 in Italy and to 19.2 in the rest of the euro area. The level of public debt is calibrated to the official 2006 values: 106.8 for Italy and to 60.7 for the rest of the euro area.

Regarding the bond market, we assume that government and private bonds can be traded internationally. On top of that, consistently with available data, we assume a zero steady state net foreign asset position for the

[12]There is not clear empirical evidence that we can use in the calibration of this parameter. We will check the robustness of our results with respect to our calibrated value in the robustness section 6.2.

[13]The degree of complementarity/substitutability between C_t and Y_t^g depends on whether θ is greater or smaller than the intertemporal elasticity of substitution, $1/\sigma$. If $\theta > 1/\sigma$, as is the case in our baseline, the two goods are substitutes. In the robustness section below we will discuss also the results when the two goods are complement (we will assume $\theta = 0.8$). Most contributions assume that private and public consumption are substitutes (Prescott, 2002, assumes they are perfect substitutes).

Italian economy: this implies that - in steady state - the *net* financial position of the Italian private sector equals the level of the Italian public debt.

Parametrization of systematic feedback rule followed by the monetary authority is reported in Table 3. The central bank of the Euro area targets the contemporaneous Euro-area wide consumer price inflation (the corresponding parameter is set to 1.7)[14]. Interest rate is set in an inertial way and hence its previous-period value enters the rule with a weight equal to 0.9). In the fiscal policy rule we set $\phi_1 = \phi_2 = 1.5$.

Table 4 reports model-based and actual steady-state great ratios under our baseline calibration. Private consumption, bilateral imports and exports match the data rather well, while private investment in Italy is somehow underestimated. As for fiscal policy variables, it must be noted that some expenditure items (as purchases C^g and investment I^g) are perfectly matched as they are exogenous. For other items, as the public wage bill and the interest expenditure, we calibrate quantities (i.e. the share of public employees over the total number of employees and the level of public debt to GDP) to replicate the actual data; as the wage and interest rates are endogenous, however, we don't match exactly the corresponding expenditure components. Regarding revenues, the model produces steady state values higher than in actual data. In the case of Italy the overestimation is evenly distributed across labor and capital income taxes, while for the rest of the euro area the model produces a strong overestimation of capital income tax revenues. As our focus is on the Italian economy and - as will show in the rest of the paper - the spillover effects from the Italian fiscal consolidation to the rest of the area are limited, we believe that the mismatch concerning euro area revenues does not alter our conclusions.

5 Consolidation scenarios

In the following we will consider scenarios that achieve reductions of the debt to GDP ratio through different combinations of tax and expenditures changes[15]. As for the size of the debt reduction, we assume that the debt to GDP would fall from 106.8 (the 2006 official data) to 95 over a five years horizon[16].

It must be stressed than in our model the debt level affects the economy

[14]The Euro Area-wide consumer price inflation rate is a weighted (by sizes of the two regions) geometric average of regional inflation rates.

[15]Among expenditures, we do not consider cuts in the public investment level, as this item has been heavily reduced in the past to very low levels by historical standards. Moreover, changes in public investment generate larger fiscal multipliers than the ones associates to the other expenditure items, as they not only decrease aggregate demand but also aggregate supply.

[16]This scenario is the one envisaged by the Economic and Financial Planning Document (DPEF) presented by the Italian government in July 2007.

mainly through the level of interest expenditure[17]. This effect in our baseline scenario is not very significant, as the reduction we assume for the public debt does not entail a sizeable decline in interest expenditure (around 0.5 per cent of GDP). Also, the model does not consider spreads or threshold effects related to the debt level (as a country risk premium). For these reasons, we will consider different consolidation strategies holding the size of the debt to GDP reduction unchanged across scenarios.

In the following we consider fully credible and fully anticipated reduction in the debt target b^* and run perfect-foresight simulations. We first compare steady states before and after the consolidation and then study the adjustment path of endogenous variables towards the new steady state level. Before analyzing the consolidation scenarios, however, we will present some results on the effects of reducing tax distortions and tax levels leaving the debt level unchanged.

6 Results

6.1 Baseline scenarios

6.1.1 Long-run effects of reducing tax distortions and tax levels

In order to better understand the results of the consolidation scenarios, we begin by showing the effects of changing the level of distortionary and non distortionary taxation in our model. We will simulate reductions in tax rates and in the overall level of taxation and report the long-run effects (i.e. steady state effects). Table 5 shows percentage changes with respect to the initial steady state levels for the main macroeconomic variables, in Italy and in the rest of the euro area. We also report two welfare measures. Both are expressed in term of consumption equivalents, that is the constant percentage change in consumption level that would deliver the same utility as the one achieved in the scenario under consideration. The first one (steady state) is simply a comparison of the level of utility in the pre-consolidation and after-consolidation steady states; the second one expresses utility in present discounted value terms (using the agents' discount factor) and includes also the transition phase to the new steady state.

The first three columns of the table show the long-run effects of reducing

[17] In different setups than the one considered in this paper the level of debt might have more significant real effects. In particular, in OLG models a fiscal expansion financed with debt has positive effects on consumption if agents expect not to live enough to pay their entire share of the financing (bonds are therefore net wealth). If the economy is closed, the additional debt crowds out private investment and leads to an increase in the real interest rate. However, the cross-country empirical evidence on the relation between level of debt and the real interest rate is rather weak (Ardagna, Caselli and Lane 2005), partly because the closed economy assumption is not appropriate for most countries.

transfers to households (Tr) by 1 per cent of GDP and exactly compensating this expenditure reduction with tax rates reductions (either on labor income, capital income or consumption) as to leave the level of debt as a ratio to GDP unchanged. Since transfers are in the model equivalent to a negative lump sum tax, this procedure delivers a reduction in tax rates leaving unchanged the total amount of net taxes (that is taxes minus transfers, as a percentage of GDP) that agents have to pay.

The table shows that reducing tax rates by 1 per cent of GDP produces an increase in welfare between 0.4 and 1.2 per cent. The reduction in labor income tax rates induces a decrease in labor costs while at the same time a substantial increase in after-tax real wages, employment and consumption. The increase in employment brings about also an increase in investment. In the case of a reduction in capital income tax, the increase in investment is the main determinant of the increase in output, and the rise in consumption is subdued as the reduction in capital income taxes makes current consumption relatively more costly. Similarly, the cut in consumption taxes leads to a reduction in effective labour costs and to an increase in employment; however, the latter is mild as the increase in the demand components and in output is limited[18].

The size of the welfare gains are rather robust to alternative calibrations. In particular, we have performed some robustness check with respect to the parameters of the production function (as the elasticity of substitution between labor and capital) and utility function (as the intertemporal elasticity of substitution and the level of the disutility of the working effort). While the size of the reported effects is not altered, the relative rank in terms of welfare of cutting labor versus capital income taxes is heavily affected by the level of the intertemporal elasticity of substitution. In particular for an elasticity equal to 2 (is 1 in our baseline) the steady state welfare gains are almost the same for labor and capital income tax cuts; are higher in the case of capital income taxes for higher values of the elasticity. The reason is that higher values of the elasticity of substitution makes it less costly to reallocate intertemporally after a capital income tax cut.

It is important to note that compensating the tax rate reduction with cuts to expenditure items other than transfers (as purchases or public employment) would have very different effects. First of all, it would not simply reduce tax distortions as the tax rate reduction would be compensated by expenditure items that are not lump-sum. In particular, purchases and public employment (but not transfers) are used to produce public goods. Therefore there will be a level of tax rates cuts above which welfare decreases. In figure

[18]Cuts to consumption taxes apply to both domestically produced and imported goods, while cuts to labor income or capital income reduce the cost of production only of domestically produced goods. This increase in competitiveness is reflected in a higher increase in export, although mild due to a strong response of the term of trade.

1 we report the welfare level for different combinations of labor and capital income taxes, while setting all other parameters at their baseline value. The picture reports the welfare level assuming that the reduction in tax revenues is compensated by cuts in one of the three expenditure items (purchases, public employment and transfers) in order to leave the debt level unchanged. The point labelled initial steady state has a welfare level normalized to 1; in the initial steady state $\tau^w = 0.431$ and $\tau^k = 0.29$. The picture shows that reducing one or both rates increases the welfare level. Welfare increases almost linearly when the reduction in tax rates and revenues is compensated by cuts in transfers, as the move simply reduces tax distortions. When the expenditure reduction is concentrated on Cg, the welfare increases up to a maximum of about 3% (with τ^w at about 29% and τ^k at about 23% at the maximum level of welfare); when it is concentrated on Lg, welfare goes up to about 2% (with τ^w at 29% and τ^k at 25%). It is interesting to note, although not straightforward to see from the picture, that the surface is steeper along the τ^w axis than the τ^k one, suggesting the reduction in the former leads to higher welfare gains compared to an equal reduction in the latter.

The last two columns of the table show the effects of reducing the overall level of taxation without changing tax distortions (that is, leaving unchanged tax rates). This is achieved by increasing lump-sum transfers by 1 per cent of GDP while at the same time reducing government purchases (column 4) or employment (column 5) in order to leave the debt level unchanged. The increase in transfers corresponds to a reduction in net taxes, without reductions in tax rates. This brings about a positive income effect, as agents feel richer and therefore work less and consume more. In both cases GDP decreases, mainly due to the reduction in the public component (either purchases of goods and services or the public wage bill, that are included in the GDP). The welfare gains are overall smaller than the ones of the first three columns.

It is important to understand the differences among these different scenarios. Reducing tax distortions brings about significant supply side effects (in terms of higher employment and investment). In particular, reductions in labor income taxes favor employment and therefore labor income and consumption. The increase in employment brings about also a significant increase in investment. Reducing capital income taxes leads to a strong increase in investment and a moderate one in employment (as firms substitute capital for employment) and consumption. Lower consumption taxes increase demand for goods and, by a similar amount, for factors of production, but do not have strong supply side effects on labor supply or investment. On the other hand, the impact of a reduction in the level of taxation (leaving tax rates unchanged) works mainly through the income effect and not through supply side effects. As already mentioned, the positive income

effect leads to a reduction in labor supply and an increase in consumption.

6.1.2 The long-run effects of the fiscal consolidation

We now consider the effects of reducing the debt to GDP from 106.8 (the 2006 official data) to 95 over a five years horizon. The first three columns of Table 6 - the ones labelled (B, τ^w), (B, τ^k) and (B, τ^c) - assume that the consolidation is achieved adjusting one tax rate at a time (respectively, on labor income, capital income and consumption), leaving expenditures (as a ratio to GDP) unchanged[19]. In the next three columns of Table 6 - labelled (B, C_g), (B, L_g) and (B, Tr) - the consolidation is achieved adjusting one expenditure item at a time (respectively, purchases, public employment and transfers), leaving tax rates unchanged. The columns after the sixth consider scenarios where, in order to reduce the debt level to the target value, both expenditures and taxes are adjusted.

In the scenarios where only tax rates are changed, these initially increase in order to reduce the level of debt and then - once the debt target is achieved and interest expenditure is reduced - can stabilize to a level below the initial one. In the scenarios where there are no changes in tax rates, expenditures are initially cut but eventually end up to a level above the initial one, as the lower interest outlays leaves room for increases in expenditures. Both types of scenarios entail a welfare loss during the transition. Lastly, in the scenarios where both expenditures and taxes are adjusted, one tax rate is reduced exogenously while at the same time one expenditure item reacts according to the policy rule (3), raising initially but eventually ending up to a level below the initial one.

We immediately note that the consolidation almost always positively affects output, investment and consumption. The only exceptions are when we assume that tax rates are not changed and a single expenditure item (as a percentage of GDP) is adjusted (columns from the fourth to the sixth). The reason is that tax cuts bring about significant supply side effects (that lead to increases in labor supply, investment and output), while the effects coming from changes in the expenditure items are less clear cut.

To better understand the effects on the expenditure side, we must remember that in our model (if distortionary taxes are kept constant) a form of Ricardian equivalence holds. This emerges most clearly from the results reported in column 6, where the reduction in interest expenditure due to the

[19]Results are slightly different if we assume that expenditures remain unchanged in real terms, instead of as a percentage of GDP. Since GDP increases for cuts in all three tax rates, fixed expenditures in real term would imply that they would decrease in terms of GDP. Therefore, the positive effects (on the macro variables and on steady state welfare) would be larger. As expenditures, especially in Italy, tend to grow with GDP, we feel more confident with our baseline assumption. In any case, with respect to the alternative, our assumption leads to slightly lower positive effects of the consolidation.

lower level of debt to GDP in the new steady state (approximately by 0.5 per cent of GDP) is compensated by an increase in transfers. Since transfers are essentially a negative lump-sum tax, the Ricardian equivalence applies and we therefore observe no change in real variables. The Ricardian equivalence instead does not apply when the reduction in interest expenditure is compensated by higher purchases (column 4) or more public employment (column 5). This is because these expenditure items are not lump-sum transfers to households. Their increase induces an overall negative income effect due to the higher level of public expenditure to be financed that leads to an increase in labor supply and to a fall in consumption; welfare decreases in both cases. Notice that in all the first six cases examined in Table 6 the consolidation is essentially not welfare improving, especially when taking into account the transition phase.

We now move to the analysis of scenarios in which both expenditures and taxes are adjusted. Columns (7)-(9) assume an exogenous reduction in labor income taxes of 5 percentage points and the policy rule (3) defined on one single expenditure item at a time. Columns (10)-(12) are analogous, with the only difference that now is the capital income tax rate to be reduced by 5 percentage points. Finally, in the last three columns labor and capital income taxes are both exogenously and simultaneously reduced by 5 percentage points. In all these scenarios, the policy rule eventually brings the expenditure item under consideration below its previous steady state level. The results show that, in all cases considered, tax cuts more than compensate for the welfare costs of reducing expenditures. For reductions in labor or capital income tax rates the supply side effects are significant: employment increases strongly in the former case, while investment in the latter. These effects bring about increase in consumption and output. It must be noted that, when capital income taxes are cut, employment increases mildly or decreases as the reduction in capital income taxes leads firms to reallocate inputs from labor to capital. When we combine the two tax rate reductions, both employment and investment increase. The measure that compares the level of welfare in the initial and final steady state (in terms of consumption equivalents) grows significantly.

Comparing columns from (7) to (12) we can try to answer the question of which expenditure items are most costly to cut. The scenarios where the cuts are concentrated on purchases of goods and services entail the higher level of welfare; those with cuts in public employment come second and in transfers third. To understand this ranking, remember that the reduction in transfers directly curtails the amount of resources available, thus inducing households to consume less and to work more (a strong negative income effect). In the other two cases, the negative effects are more mediated and depend upon the parameters of the production function for public goods as well as those governing how public and private goods enter the utility

function. In our baseline parametrization the net effect favors transfers, but the robustness analysis reported in Table 7 shows that changes in θ (the degree of complementarity/substitutability between the private and the public goods in consumption) on in ω (the weight of public goods in private consumption) can partially overturn this welfare implication.

Finally, the table shows also the effects of the Italian fiscal consolidation on output and consumption in the rest of the euro area. In general these effects are limited but not insignificant. Imports from the rest of the euro area increase much more than Italian exports, due to the appreciation of the term of trade.

6.1.3 Transition dynamics

In the previous section we have seen that it is possible to reduce significantly the level of debt (as a ratio to GDP) while at the same time achieving significant welfare gains. Expenditures and revenues should be reduced at the same time.

In this section we will restrict our attention to the scenarios where the debt to GDP level decrease to 95% and both taxes and expenditures are being cut by 5 percentage points (columns (13)-(15) of table 6). We will try to deepen our understanding of these scenarios focusing on the transition. In particular we investigate the issue of whether, for a given path of debt, an immediate tax reduction is preferable to a delayed one. An immediate tax reduction entails stronger expenditures cuts in the short run.

We consider a total of six scenarios: the tax reductions may be *immediate* (starting in period 1) or *delayed* (starting after five years); such reductions may be achieved by reducing one of the three different expenditure items: transfers –*scenario* Tr–, purchases of goods and services –*scenario* C_g–, or public employment –*scenario* L_g. In all cases we assume that the tax rates on labor and capital income decrease by 5 percentage points over five years and remain stable at the new value thereafter.

We start by comparing the three scenarios under the assumption that the reduction in tax rates is *delayed*. The behavior of deficit, debt and expenditures is very similar in all scenarios (Fig. 1)[20]. The budget balance reaches a surplus of about 0.5 per cent of GDP after three years and remains in surplus until the debt level achieves the target value (95 per cent of GDP), which occurs in approximately eight years.

The dynamics of revenues differ across scenarios. In particular, in the *scenario* L_g the fall in labor income revenues (as a ratio to GDP) is the

[20]In the figures we plot 60 periods (15 years) as under our baseline calibration (in particular regarding the parameters of the fiscal policy rule, ϕ_1 and ϕ_2, controlling the velocity of adjustment of the debt to GDP level to the target level) this is the time needed to achieve convergence to the new steady state.

largest. In fact, overall labor demand falls and brings about a decline in real wages. This, in turn, results in lower total employment (but higher private employment) and hence disposable income, leading to a contraction of output, while favoring investment (Figs. 2 and 3). The dynamics of the main variables is also affected by the cut in tax rates, although delayed. In particular, investment start to increase - although mildly - almost from the start of the consolidation period, implying an initial weakness of consumption. Employment mainly rises after the first five years. The dynamics of investment and employment is reflected in the one of output.

In Figure 4 we plot the level of utility (as a percentage deviation from the level in the initial steady state) achieved in each quarter under the three scenarios considered (first panel); we then decompose it - since the utility function is assumed to be additive - in the part due to consumption (second panel) and in the one due to labor effort (third panel). Finally, in the last panel we plot the discounted sum of period utilities (that is, the level of welfare) considering different horizons (for example, in correspondence with the 10th quarter we find the discounted sum of the time utilities of the first 10 quarters).

We have already noticed that *scenario* C_g and *scenario* L_g achieve higher levels of welfare. The intuition for this result is that the reduction in C_g or L_g, while reducing the demand for either goods or labor (reflected in a smaller output growth with respect to the scenario in which transfers are reduced), induces a positive income effect due to the lower level of expenditures to be financed and therefore to the higher future disposable income, leading to a lower increase in labor supply and to a higher in consumption, that explain the higher increase in welfare.

We consider next the same three scenarios under the assumption that tax rate cuts take place *immediately* (Figs. 5-8)[21]. The differences with the *delayed* tax cut are minor and can be summarized as follows: (i) the increase in real activity is anticipated; (ii) the target level of debt to GDP ratio is achieved slightly earlier (thanks to the anticipated positive response of output); (iii) the cut of expenditure items (as a percentage of GDP) is slightly larger during the consolidation phase, to make up for the lower fiscal revenues; (iv) the measure of the welfare level, including the effects of the transition, improves.

[21]It is worth remarking that, while the choice regarding which expenditure item or tax rate to cut affects the steady state equilibrium, the timing of the tax reduction does not. Therefore, in comparing the delayed and immediate tax reduction scenarios, we may focus on the transition periods only, as the long run effects are identical in both scenarios.

6.2 Robustness

We performed robustness checks on three important aspects of the model. First, with respect to the elasticity of labor supply, which drives the response of employment to tax cuts. Second, with respect to the role of the public good in the utility function, changing its weight (ω) and its degree of complementarity/substitutability with the private one (θ). Third, we introduced non Ricardian (or rule-of-thumb) agents, i.e. agents that do not participate in the financial markets and consume their current (labor plus government transfers) net income. The latter two robustness exercises are meant to increase the negative welfare effects of cutting expenditures and see whether, for realistic alternative calibration of these parameters, our main results (in particular, that the positive effects due to tax cuts more than compensate the negative effects coming from expenditures cuts) can be overturned.

The first three columns of table 7 report our baseline scenario (same as in the last three columns of table 6). The columns from forth to sixth assume $\tau = 5$, thus a Frish labor elasticity of 0.25 (instead of 2 as in the baseline scenario), a rather extreme value given that most estimated DSGE models place this elasticity in a range between 1 and 2. Results are somehow expected: employment increases by less, leading to a lower increase in investment, consumption and output.

The columns (7)-(9) replicate the baseline scenario assuming $\omega = 0.5$ (instead of 0.9), thus giving a weight equal to one half to the public good in the consumption bundle. In this case we observe a drop in the welfare gains of the fiscal consolidation, consistently with the fact that it requires cuts in expenditures. The drop is higher especially for cuts to public employment and purchases, as these expenditure items affect directly the production of the public good, while is much more limited for cuts to transfers. It must be noted, in any case, that welfare gains remain in general positive and significant. As for the effects on the macro variables, the reduction in expenditure items (especially C_g and L_g) leads to a reduction in a now more valuable public good. This negative income effect leads to a higher increase in labor supply. Moreover, as public and private goods are substitutes (in the baseline we assume $\theta = 1.5$), the drop in the public good leads to a slightly higher increase in private consumption.

In the next three columns, (10)-(12), we assume that public and private goods are complements ($\theta = 0.8$). This implies that reductions in purchases or public employment (that reduce the provision of the public good) decrease the marginal utility of private consumption. No surprise therefore that in this scenario private consumption increases by less, although moderately.

Finally we evaluate the robustness of our results with respect to the introduction of a share of non Ricardian agents (λ equal to 35 per cent). The results are shown in columns (13)-(15) and are only slightly different

from the baseline. This is in line with the finding of Mankiw and Weinzierl (2006), among others. The theoretical reason is that non Ricardian agents do not smooth consumption and therefore do not contribute to pin down the steady state levels of the capital stock. Moreover since, for simplicity, we assume that non Ricardians supply the same quantity of hours as Ricardian agents, they do not contribute to the choice of employment either. The difference is very limited also in terms of welfare.

Overall these robustness checks broadly confirm our baseline results, in particular in all cases we obtain that the reduction in debt obtained via a concomitant reduction in expenditures and revenues is welfare improving. In general, the consequences of the different assumptions on the parameter values that we have considered are rather limited, both on the macroeconomic variables and on the welfare levels.

7 Concluding remarks

We have simulated a DSGE-type model – calibrated to replicate the main Italian and euro area macroeconomic and fiscal policy aggregates – to analyze the macroeconomic and welfare effects of alternative fiscal consolidation strategies in Italy. We have presented the effects of a reduction of the debt to GDP ratio of about 10 percentage points over five years. Although we did not provide fully optimal fiscal policy scenarios, we have shown that a significant debt to GDP reduction achieved via reducing both expenditure and taxes can be welfare improving. The order of magnitude of these welfare gains is comparable with those suggested by Lucas (2003) .

Our simulations have highlighted a series of other results: (1) among expenditures, it is preferable to cut purchases of good and services or public employment than transfers to households; (2) tax cuts more than compensate for the welfare costs of reducing expenditures (by the same percentage of GDP); (3) cutting taxes immediately rather than with a delay entails no slowdown in the pace of public debt reduction and delivers a higher level of welfare during the transition; (4) the spillover effects of the fiscal consolidation to the rest of the euro area are limited. These conclusions seem to be robust to the assumed calibration.

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Table 1. Parametrization of Italy and the rest of the Euro Area
(Base-Case Parameters)

Parameter	Italy	Rest of the Euro Area
Rate of time preference $\left(1/\beta^4 - 1\right) * 100$	5.0	5.0
Intertemporal elasticity of substitution $1/\sigma$	1.0	1.0
Frisch elasticity of labor $1/\left(\tau - 1\right)$	2.0	2.0
Depreciation rate of (private and public) capital δ	0.025	0.025
Substitution between private and public goods in cons. bundle θ	1.5	1.5
Bias towards private goods in cons. bundle ω	0.9	0.9
Tradable Intermediate Goods		
Substitution between factors of production	0.85	0.9
Bias towards capital	0.75	0.7
Non tradable Intermediate Goods		
Substitution between factors of production	0.79	0.95
Bias towards capital	0.7	0.7
Final consumption goods		
Substitution between domestic and imported goods	1.5	1.5
Bias towards domestic tradable goods	0.3	0.7
Substitution between domestic tradables and non tradables	0.5	0.5
Bias towards tradable goods	0.55	0.5
Final investment goods		
Substitution between domestic and imported goods	1.5	1.5
Bias towards domestic tradable goods	0.3	0.7
Substitution between domestic tradables and non tradables	0.50	0.50
Bias towards tradable goods	0.55	0.50
Size	0.20	0.80

Table 2. Real and Nominal Adjustment Costs (Base-Case Parameters)

Parameter ("*" refers to rest of the Euro area)	Italy	Rest of the Euro Area
Real Adjustment Costs		
Capital accumulation ϕ_K, ϕ_K^*	1.00	1.00
Nominal Adjustment Costs		
Wages κ_W, κ_W^*	60	60
Price of domestically-produced tradables κ_H, k_F^*	60	60
Price of non tradables κ_N, κ_N^*	60	60
Price of imported intermediate goods κ_F, κ_H^*	60	60

Table 3. Euro Area Monetary Rule

Parameter	Value
Lagged interest rate at t-1 ρ_i	0.9
Inflation ρ_{Π}	1.7
GDP growth ρ_{GDP}	0.4

Table 4. Steady-state National Accounts Decomposition
(Base-Case Parameters)

	Italy		Rest of the Euro Area	
Ratio of GDP	data	model	data	model
MACRO VARIABLES				
Private consumption	59.7	56.8	57.1	59.5
Private Investment	20.7	14.2	21.1	19.8
Export	25.8	23.6	-	-
Imports	25.9	23.6	-	-
FISCAL VARIABLES				
Public purchases C_g	9.3	9.3	10.3	10.3
Transfer to households	17.1	16.7	16.1	18.3
Wage bill (wl_g)	11.0	11.9	10.1	10.1
Public Investment I_g	2.3	2.3	2.6	2.6
Primary total expenditures	39.7	40.2	39.1	41.3
Interests	4.6	5.3	2.5	3.0
Total expenditures	44.3	45.6	41.6	44.3
Labor income revenues	20.4	23.1	20.8	15.6
Capital income revenues	10.1	13.0	8.6	17.3
Consumption revenues	10.1	9.6	10.7	11.4
Sum of the above revenues	40.6	45.7	40.1	44.3

Data sources: National Account data for the macroeconomic variables (averages 1999-2006).

For the fiscal variables: expenditure figures are from AMECO database for 2006 (Bank of Italy 2007); revenues data are from Eurostat (2007) and refer to 2005 .

Table 5. Steady state comparisons: reduction in tax and expenditure distortions

	Tax distortions (1% of GDP)			Expenditure distortions (1% of GDP)	
	$[Tr, \tau_w]$	$[Tr, \tau_k]$	$[Tr, \tau_c]$	$[Tr, C_g]$	$[Tr, L_g]$
	(1)	(2)	(3)	(4)	(5)
Italy					
Output	1.8	1.7	0.7	-0.6	-0.6
Consumption	2.3	1.1	0.9	0.8	0.7
Investment	2.5	4.6	0.9	-0.8	0.5
Export	0.3	0.3	0.1	-0.1	0.1
Import	3.1	2.8	1.1	-1.0	0.6
Hours worked	2.4	0.5	0.9	-0.8	-1.3
Effective labour cost	-1.0	1.4	-0.4	0.3	-0.2
After-tax real wage	3.4	1.4	-0.4	0.3	-0.2
Terms of trade	2.0	1.8	0.7	-0.6	0.4
Welfare: steady state	1.2	0.8	0.5	0.7	0.4
Welfare: with transition	1.0	0.4	0.4	0.7	0.3
Rest of the Euro area					
Output	0.6	0.6	0.2	-0.2	0.1
Consumption	0.7	0.6	0.2	-0.2	0.1

Table 6. Steady state comparisons

	No change in expenditures			No change in taxes			Reduction in labor taxes			Reduction in capital taxes			Reduction in both taxes		
	$[B,\tau_w]$	$[B,\tau_k]$	$[B,\tau_c]$	$[B,C_g]$	$[B,L_g]$	$[B,Tr]$	$[B,C_g]$	$[B,L_g]$	$[B,Tr]$	$[B,C_g]$	$[B,L_g]$	$[B,Tr]$	$[B,C_g]$	$[B,L_g]$	$[B,Tr]$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Italy															
Output	1.1	1.0	0.4	0.4	0.4	0.0	2.8	2.7	3.6	2.7	2.6	3.6	5.2	5.1	7.4
Consumption	1.4	0.7	0.5	-0.5	-0.4	0.0	5.8	5.5	4.6	3.7	3.5	2.4	10.2	9.6	7.1
Investment	1.5	2.7	0.5	0.5	-0.3	0.0	3.7	5.6	4.9	8.6	10.8	10.0	12.2	17.4	15.3
Export	0.2	0.2	0.1	0.1	0.0	0.0	0.4	0.6	0.6	0.4	0.6	0.6	0.8	1.3	1.1
Import	1.8	1.6	0.7	0.6	-0.3	0.0	4.6	6.9	6.0	4.4	7.0	6.0	8.6	14.9	12.4
Hours worked	1.4	0.3	0.5	0.5	0.8	0.0	3.6	2.8	4.7	0.0	-1.0	1.2	3.1	1.1	5.9
Effective labour cost	-0.6	0.8	-0.2	-0.2	0.1	0.0	-1.5	-2.2	-1.9	3.4	2.5	2.9	2.1	0.1	1.0
After-tax real wage	2.0	0.8	-0.2	-0.2	0.1	0.0	7.2	6.4	6.7	3.4	2.5	2.9	11.0	8.9	9.8
Terms of trade	1.2	1.1	0.4	0.4	-0.2	0.0	3.0	4.4	3.9	2.8	4.5	3.9	5.5	9.4	7.9
Welfare: steady state	0.7	0.5	0.3	-0.4	-0.3	0.0	3.4	2.9	2.4	2.8	2.3	1.7	6.5	5.3	4.1
Welfare: with transition	-0.2	0.0	-0.1	-0.1	-0.1	-0.1	2.3	1.7	1.2	1.7	1.1	0.6	4.0	2.6	1.8
Rest of the Euro area															
Output	0.4	0.4	0.1	0.1	-0.1	0.0	1.0	1.4	1.2	0.9	1.4	1.2	1.8	3.0	2.5
Consumption	0.4	0.4	0.1	0.1	-0.1	0.0	1.0	1.4	1.3	0.9	1.5	1.3	1.8	3.0	2.5

Table 7. Robustness

	Baseline			$\tau = 5$			$\omega = 0.5$			$\theta = 0.8$			$\lambda = 0.35$		
	$[B, C_g]$	$[B, L_g]$	$[B, Tr]$	$[B, C_g]$	$[B, L_g]$	$[B, Tr]$	$[B, C_g]$	$[B, L_g]$	$[B, Tr]$	$[B, C_g]$	$[B, L_g]$	$[B, Tr]$	$[B, C_g]$	$[B, L_g]$	$[B, Tr]$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Italy															
Output	5.2	5.1	7.4	3.5	4.9	4.2	5.6	5.6	7.5	4.3	3.8	7.0	5.3	4.8	7.1
Total private consumption	10.2	9.6	7.1	8.0	8.9	3.0	10.8	10.2	7.4	9.4	8.3	6.7	10.4	9.4	6.8
Non Ricardian consumption													11.6	8.2	4.9
Investment	12.2	17.4	15.3	9.7	16.7	10.7	12.9	18.1	15.7	11.0	15.9	14.9	12.4	17.2	15.0
Export	0.8	1.3	1.1	0.5	1.1	0.6	1.0	1.5	1.3	0.6	1.0	0.9	0.8	1.3	1.1
Import	8.6	14.9	12.4	5.7	14.2	6.9	9.4	15.6	12.7	7.2	13.1	11.9	8.9	14.5	12.0
Hours worked	3.1	1.1	5.9	1.1	0.5	2.0	3.6	1.7	5.9	2.0	-0.5	5.5	3.2	0.8	5.5
Effective labour cost	2.1	0.1	1.0	2.9	0.3	2.6	1.9	-0.1	0.9	2.5	0.5	1.0	2.0	0.2	1.1
After-tax real wage	11.0	8.9	9.8	12.0	9.1	11.6	10.8	8.7	9.8	11.5	9.4	9.9	11.0	9.0	9.9
Terms of trade	5.5	9.4	7.9	3.7	9.1	4.5	6.0	9.8	8.0	4.7	8.5	7.7	5.7	9.2	7.7
Welfare: steady state	6.5	5.3	4.1	5.8	2.7	2.1	4.2	2.5	3.6	5.0	3.1	3.7	6.6	5.9	4.8
Welfare: with transition	4.0	2.6	1.8	3.6	0.7	0.6	2.3	0.6	1.6	3.0	1.1	1.6	4.0	3.1	2.3
Rest of the Euro area															
Output	1.8	3.0	2.5	1.1	2.7	1.3	2.0	3.3	2.7	1.4	2.5	2.2	1.8	3.0	2.4
Consumption	1.8	3.0	2.5	1.1	2.7	1.3	2.0	3.3	2.8	1.4	2.5	2.3	1.8	3.0	2.5

Figure 1. Welfare (% deviation from steady state), compensating the tax cuts with different expenditure items

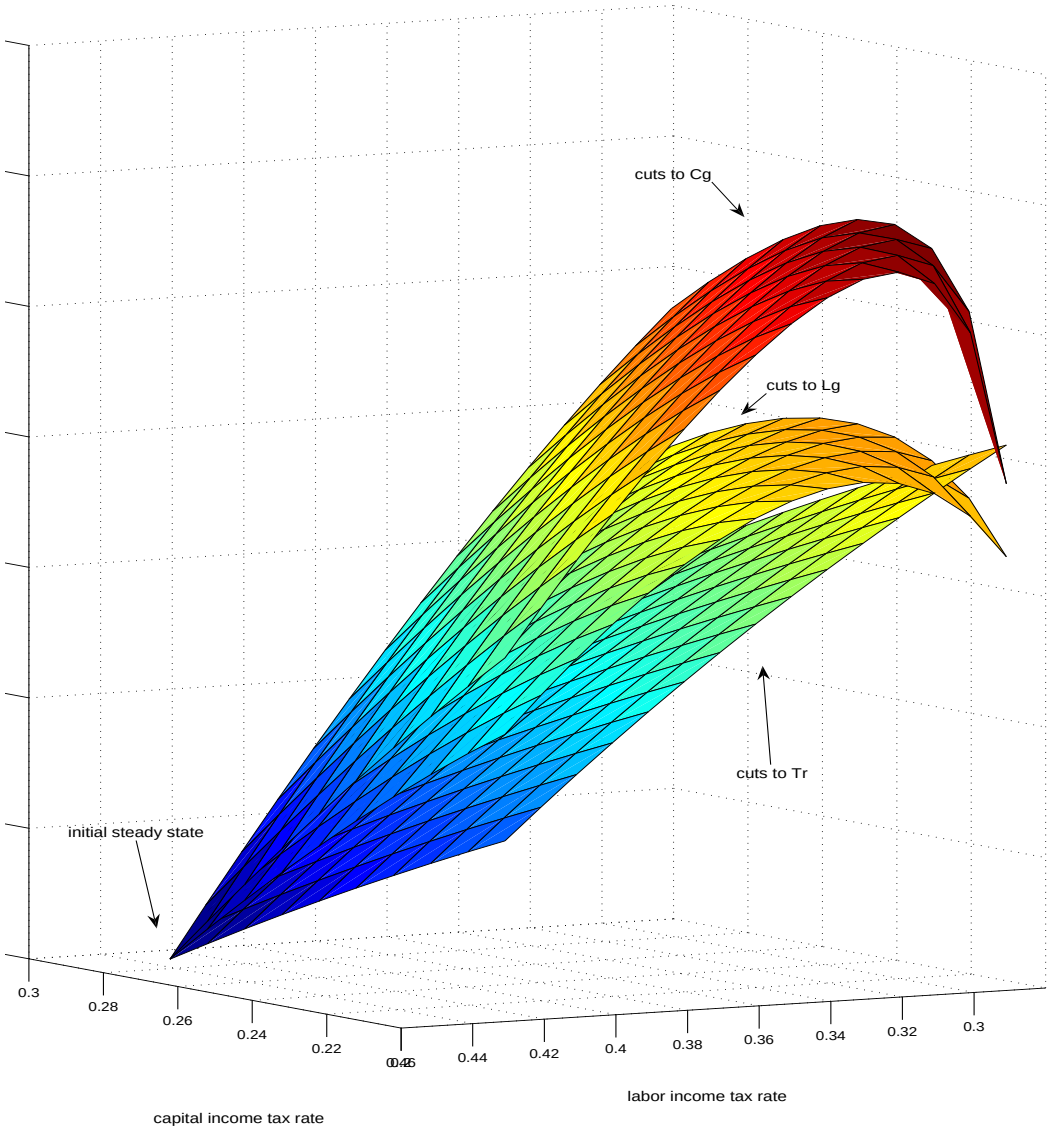

Figure 2. DELAYED reduction in tax rates

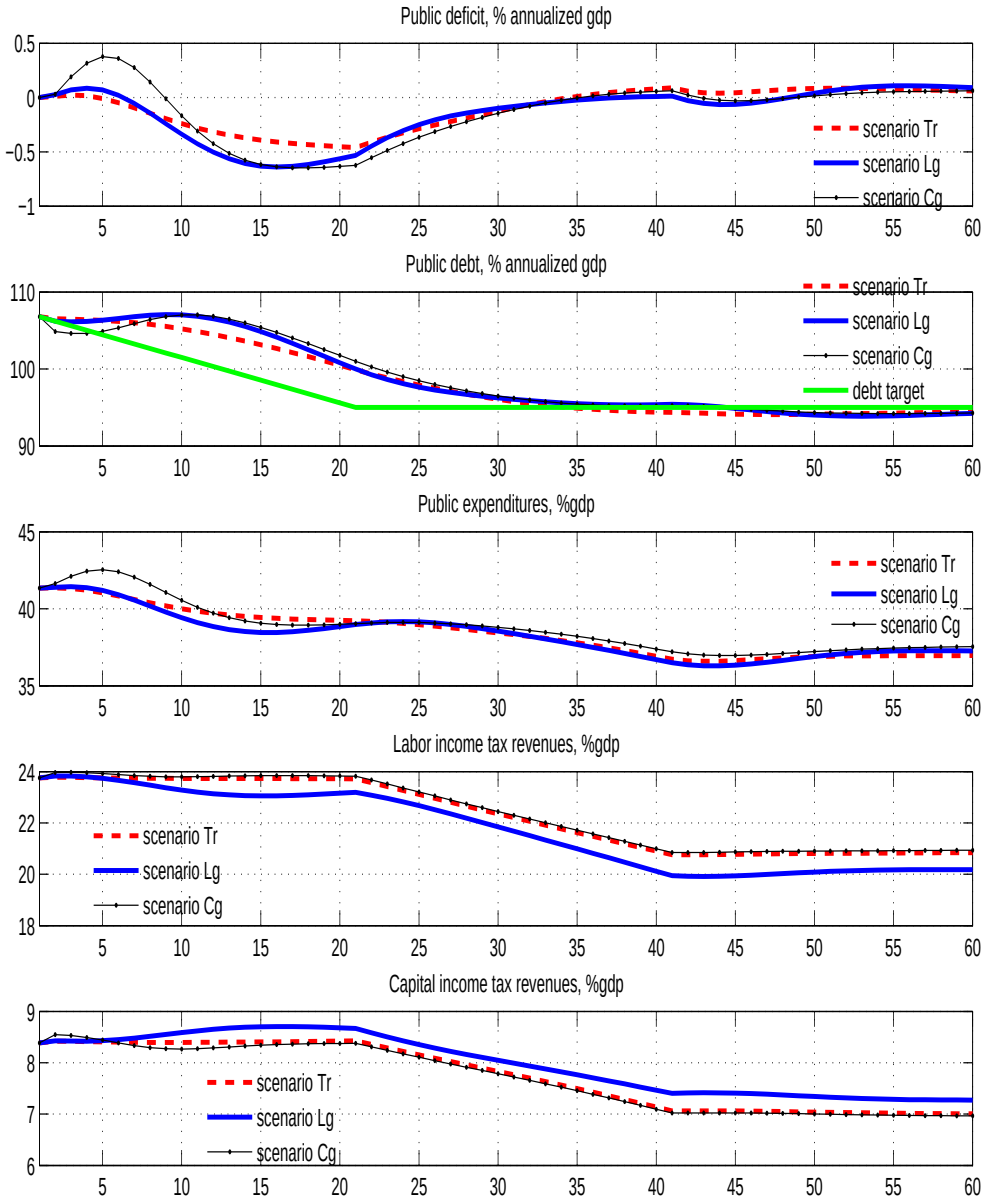

Figure 3. DELAYED reduction in tax rates

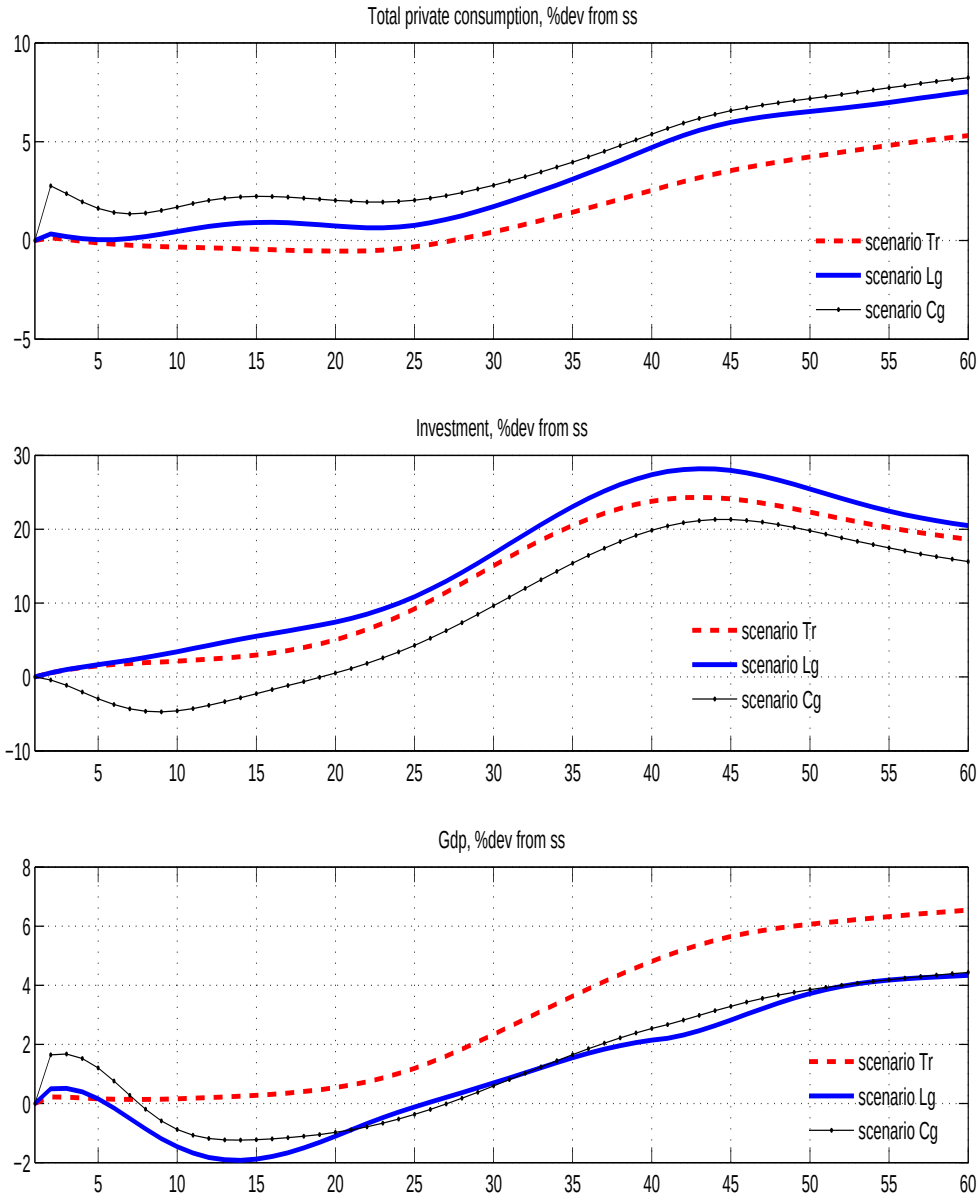

Figure 4. DELAYED reduction in tax rates

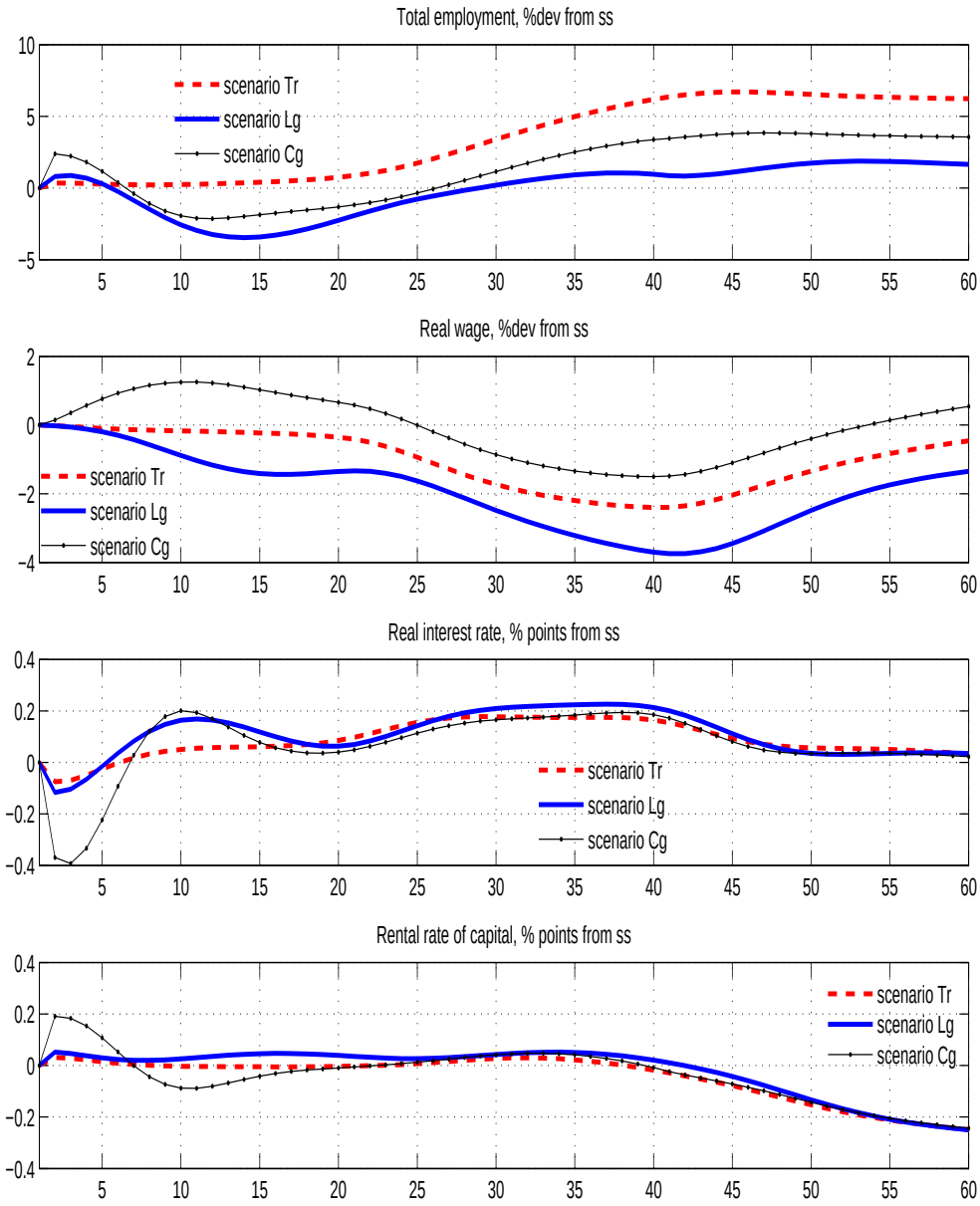

Figure 5. DELAYED reduction in tax rates

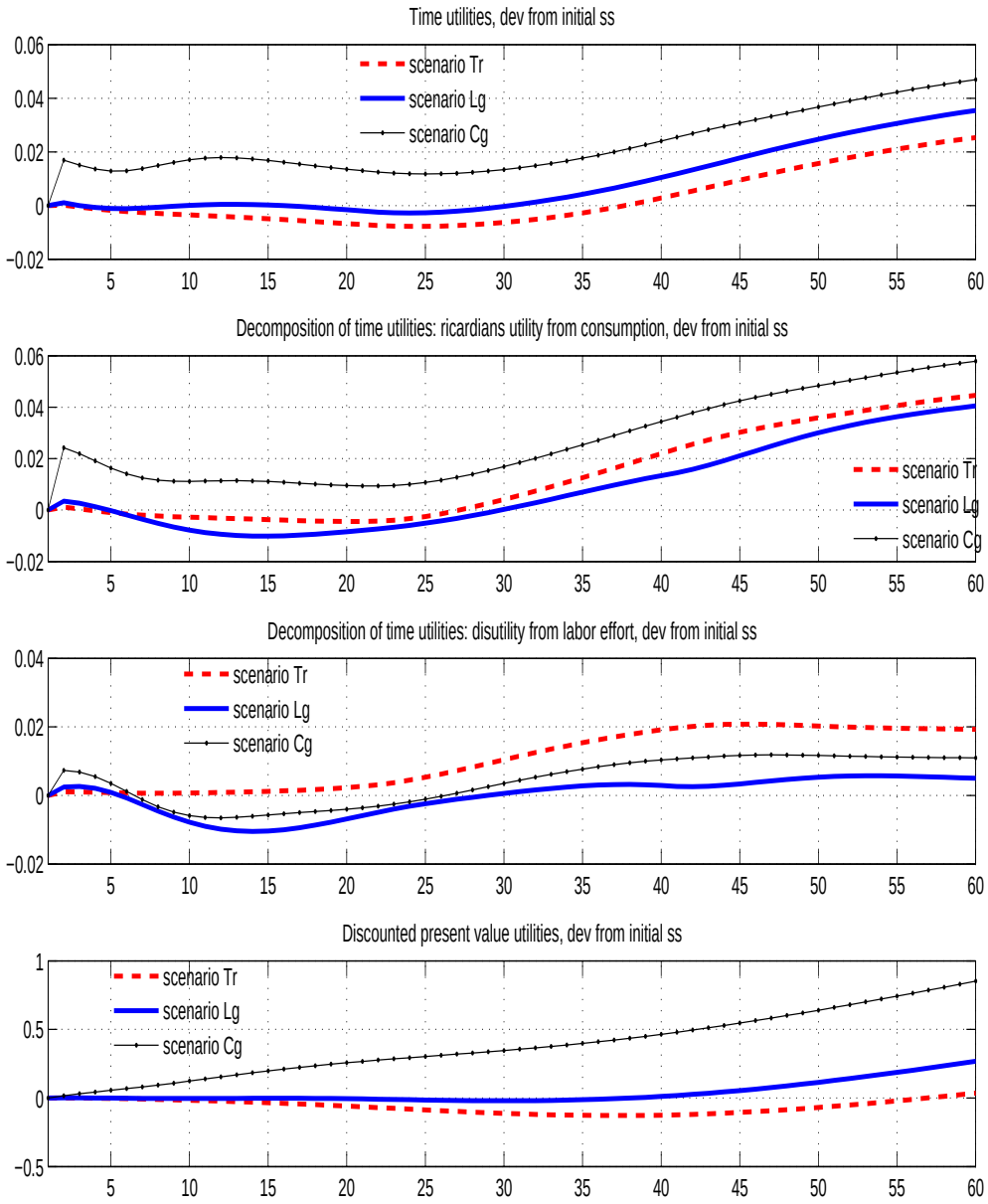

Figure 6. IMMEDIATE reduction in tax rates

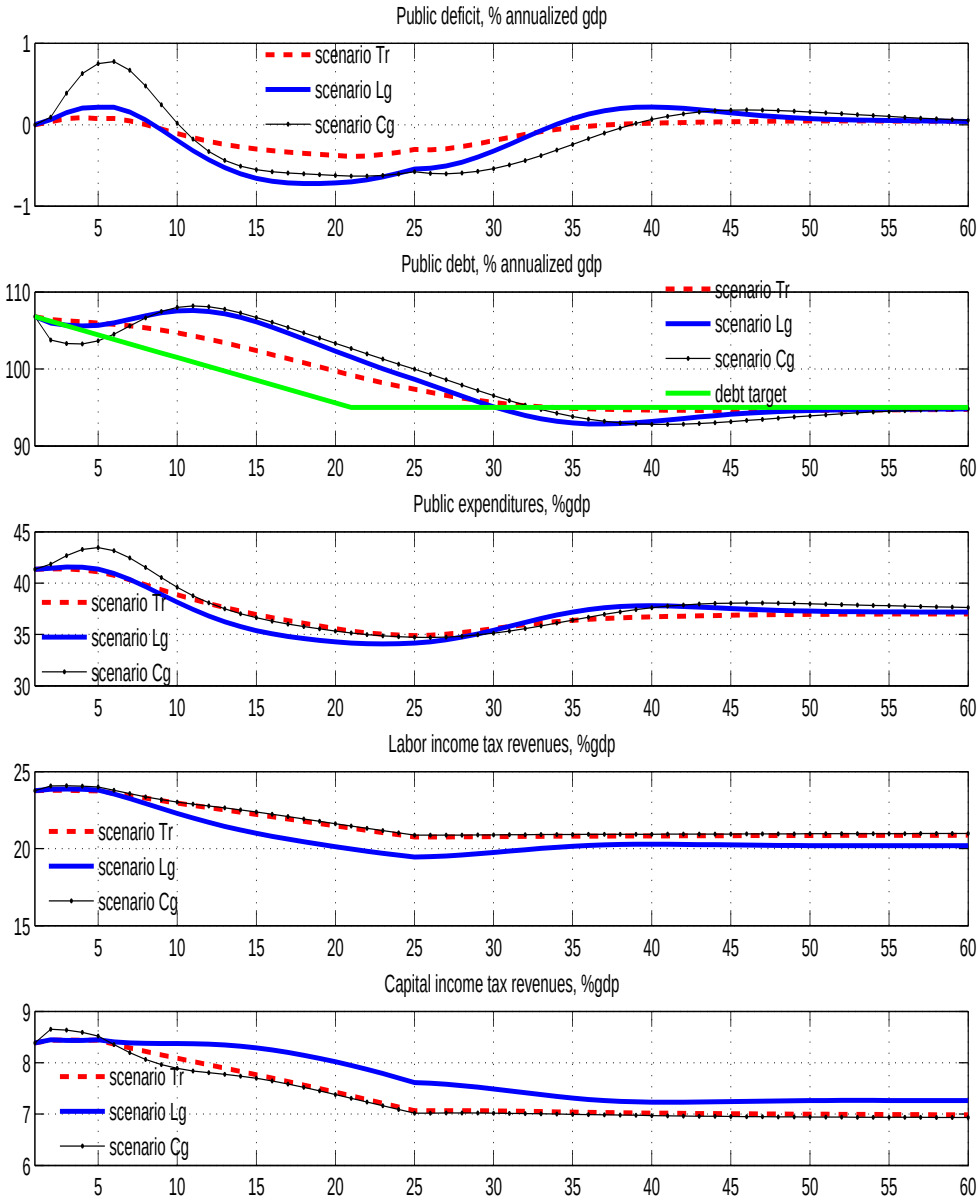

Figure 7. IMMEDIATE reduction in tax rates

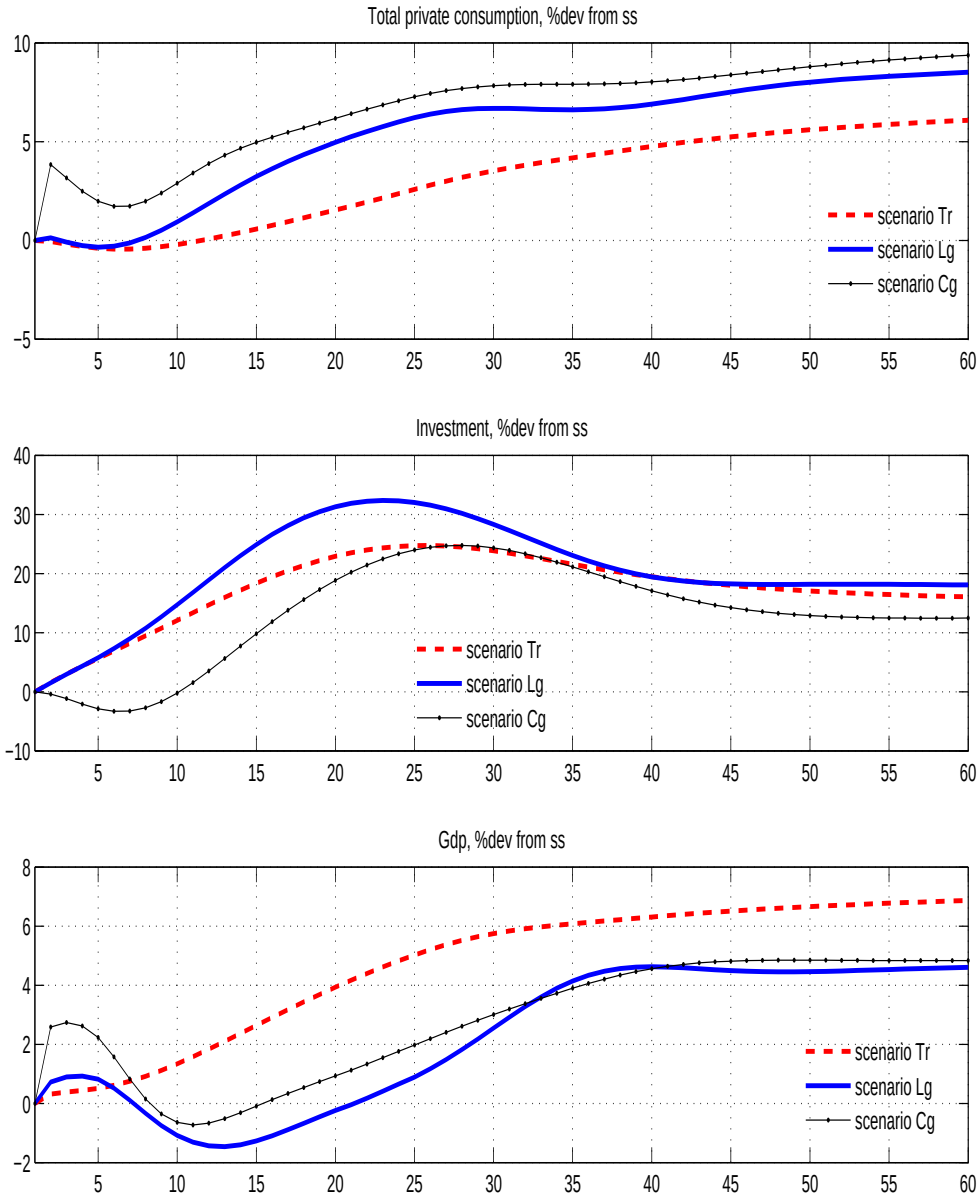

Figure 8. IMMEDIATE reduction in tax rates

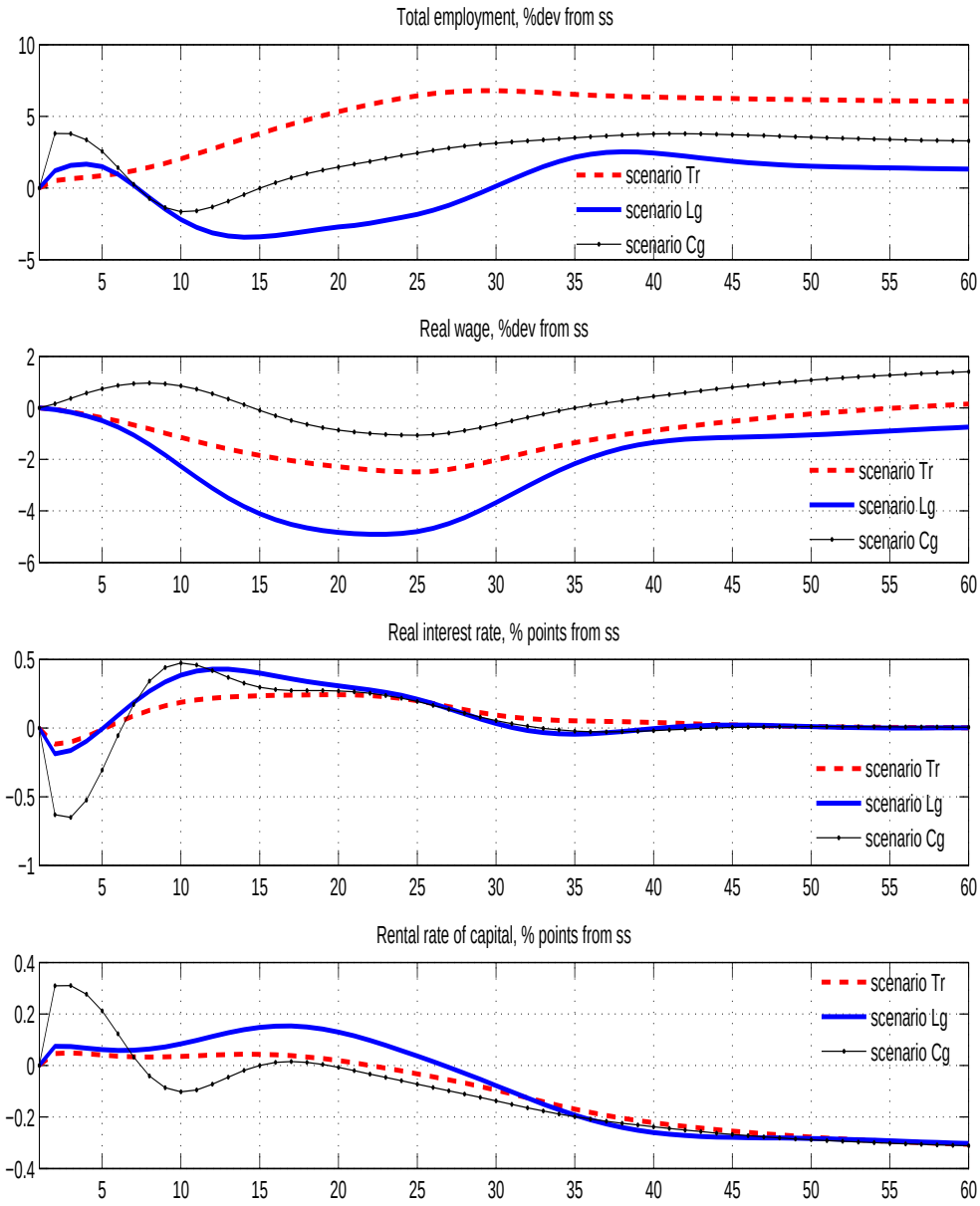

Figure 9. IMMEDIATE reduction in tax rates