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An evaluation of alternative fiscal adjustment plans^{*}

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Abstract. What advice can be given to the policymaker to reduce the burden of public debt after a crisis? In this situation, the debt consolidation calls for fiscal surplus based on increases in taxes and/or reductions in public spending. This paper aims at answering to the above question. Specifically, it evaluates different policy options on the table using the estimated model of the Italian dynamic General Equilibrium Model (IGEM). Our main message is that plans aimed at reducing the public debt based on tax increases rather than expenditure reductions are more effective. Therefore, consolidation should be designed on the former.

Keywords: Austerity; Public debt; Output; Fiscal adjustment plans.
JEL codes: E60, E62.

1. Introduction

Excessive debts have been accumulated in several European countries starting in 2010. The emerging fiscal imbalances then reopened the hash policy debate on “austerity policies,” i.e., fiscal measures aimed at aggressively reducing budget deficits. Responsible government should commit to a primary balance constraint, increasing primary surpluses in response to rising debt service to stabilize the public debt-to-GDP ratio at a reasonable level.¹

A policy issue that has been recently highlighted is the one concerning the different costs in recessionary terms of austerity measures based on revenue increases or on reductions of the government expenditure.² This paper aims to contribute to the policy debate by distinguishing austerity plans relying less on tax increases than on spending cuts (expenditure-based plans) from those relying more on tax increases than on spending cuts (tax-based plans).

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¹ See Bohn (1998, 2008), Mendoza and Ostry (2008), and Ghosh *et al.* (2013).

² See Alesina *et al.* (2018a, 2018b, 2019a, 2019b), Favero and Mei (2019) and Marattin *et al.* (2011). However, the idea of the effects of the “composition” of fiscal measure in the debate on consolidation goes back to Perotti (1996).

By estimating a linear stochastic version of the Italian dynamic General Equilibrium Model (IGEM),³ we explore the different effects of austerity measures based on revenue increases or on spending cuts. We build a policy experiment where we compare two benchmark multi-year fiscal consolidation programs, which are labelled as “expenditure-based” and “tax-based” consolidations. The former (latter) implies that 70% (30%) of the adjustment is made via increasing revenues, while 30% (70%) is made by government-spending cuts.⁴ Both plans are credible and last two years.

Our main result is that the tax-based austerity policy is much less costly than expenditure-based austerity and that the expenditure-based adjustments could become self-defeating when the zero-lower-bound constraint is binding. The rationale of the result is that government-spending multipliers are much higher than those associated to taxes.

There is a considerable amount of literature related to our paper.⁵ Austerity policies are attracting widespread interest since the introduction of the hypothesis of expansionary fiscal contractions developed by Giavazzi and Pagano (1990).⁶ According to this theory, consolidation policies can sometimes be expansionary, even in the short run. However, the result only holds for expenditure-based adjustments when accompanied by an appropriate set of related policies. Expenditure-based approaches are much less costly in terms of output losses than tax-based plans.

The above hypothesis has been implicitly and explicitly criticized from several points of view. Early empirical studies do not convincingly address the endogeneity problem stemming from the two-way interaction between fiscal policy and output growth and do not account for the multi-year nature of austerity policies, which cannot be ignored to the extent that expectations matter. Finally, Giavazzi and Pagano’s (1996) findings imply negative (or very small) fiscal

³ This theoretical model has been developed at the Italian Treasury Department, Ministry of Economy and Finance. It was originally formalized by Annicchiarico *et al.* (2013a) to evaluate the effects of alternative policy interventions, structural reforms and fiscal consolidation packages in Italy (Annicchiarico *et al.*, 2013b; 2015). IGEM is a DSGE model sharing several features with QUEST III, the model used by the European Commission (Breuss and Roeger, 2005; D’Auria *et al.*, 2009; Annicchiarico *et al.*, 2013c; in’ t Veld, 2019).

⁴ We broadly follow Favero and Mei (2019), who individuate expenditure-based and tax-based consolidation by a narrative approach comparing the policy episodes in 16 OECD countries between 1978 and 2014. For the sake of comparison, the two plans are more extreme in our experiment.

⁵ This literature cannot be summarized in this introduction, where we limit ourselves to mention the papers most related to our study. A full discussion on the issue can be found in, e.g., Alesina *et al.* (2019b).

⁶ Reviewed and summarized by Alesina and Ardagna (2010).

multipliers in contrast with the theoretical and empirical evidence. Therefore, although it received a large interest in current macroeconomic research, it missed a widespread scientific consensus (Anderson *et al.*, 2014; Romer and Romer, 2010; Guajardo *et al.*, 2014; Ramey, 2011).

Sovereign debt crises faced by several European countries have revitalized the policy debate on austerity. Recently, some researches have revisited the above hypothesis (Alesina *et al.*, 2018a, 2018b, 2019a, 2019b; Favero and Mei, 2019). These adopt the narrative method proposed by Romer and Romer (2010) to address the endogeneity problem⁷ and compare multi-year announced consolidation plans.⁸ The main finding from this literature is that fiscal adjustments based upon cuts in government spending are much less costly, in terms of output losses, than those based upon revenue increases. The results hold for several countries including Italy (see, e.g., Favero and Mei, 2019).⁹

The rest of the paper is organized as follows. In the next section, we provide an overview of IGEM and present the estimation of the model parameters. Section 3 is the core of the paper, it compares the effects of tax-based and expenditure-based austerity policy. Section 4 concludes.

2. The IGEM model

2.1 Model overview

The core of IGEM is represented by the formalization of a segmented labor market. There are four categories of workers: skilled and unskilled employees, atypical workers, and self-employed workers. Workers of each category can be organized into unions to bargain their wages. Households are grouped into two types. 1) Ricardian households accumulate physical capital and (domestic and foreign) financial assets. Therefore, they can smooth their consumption. 2) Non-

⁷ Changes in fiscal policy not implemented to achieve cyclical stabilization are identified through direct consultation of the relevant budget documents.

⁸ Indeed, three components of fiscal plans are considered: a) unexpected shifts in fiscal variables; b) current shifts which had been announced in previous years; c) announced shifts to be implemented in future years. For a full discussion on the issue, see Romer and Romer (2010), Alesina *et al.* (2019b).

⁹ Another issue that has recently provided further support to the idea of expansionary austerity is the sovereign risk channel hypothesis (Harjes, 2011; Corsetti *et al.*, 2013). The economic argument is that a front-loaded fiscal retrenchment, by reducing the level of debt, can lead to a reduction in the sovereign default risk and thus in bond and lending rates to the private sector. The improved credit conditions stimulate a recovery, eventually reversing the negative effects of the fiscal contraction. However, an investigation on this channel is beyond the scope of the present paper.

Ricardian households cannot trade in financial markets or accumulate capital; they simply consume their after-tax disposable income.¹⁰ The heterogeneity of the households is linked to the labor market: Ricardian households supply labor services as employees (skilled and unskilled) and self-employed, while Non-Ricardian consumers provide labor services as atypical workers and unskilled employees.

Ricardian and Non-Ricardian households are indicated by $i \in \{R, N\}$. All of them consume the final non-tradable goods, C_t , and supply labor, L_t , receiving a nominal wage for each kind of labor input $j \in \ell$ according to the share supplied, s_j , to maximize:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[Z_t \log (C_t^i - hC_{t-1}) + \sum_{j \in \ell} \frac{\omega_j}{1 - v_j} s_j^i (1 - L_{j,t}^i)^{1-v_j} \right] \quad (1)$$

where $\beta \in (0,1)$ is the subjective discount factor. Preferences display the external habit formation in consumption ($h \in [0,1)$ is the habit coefficient); Z_t is a consumption preference shock. The term s_j^i denotes the share of household members who are able to work in the j activity.

In the segmented labor market, the monopoly unions set wages of skilled and unskilled workers, who exhibit stable contracts and strong protection. Therefore, employees are price makers; however, they face both price (nominal wages) and quantity (hiring and firing) adjustment costs. Self-employed workers and professionals supply labor under contracts for services; therefore, they also have market power due to the existence of professional orders or their limited number. Like skilled and unskilled workers, they face price and quantity adjustment costs.

The market power of skilled, unskilled, and self-employed workers introduces a wedge between the real wage and the marginal rate of substitution of consumption for leisure. Atypical workers have no market power; in their case, there is no wedge. These workers provide labor services taking the real wage as given. As price takers, their wage is flexible, and they do not face adjustment costs.

Firms operate in four sectors that produce: tradable-intermediate goods, export goods, import goods, and final-consumption goods. Monopolistically competitive firms produce single tradable differentiated intermediate goods, Y , by using labor and physical capital as inputs in the

¹⁰ Among others, the relevance of liquidity constraints as an additional market imperfection has been highlighted by Gali *et al.* (2007), Di Bartolomeo and Rossi (2007), Coenen and Straub (2005), Forni *et al.* (2009), Di Bartolomeo *et al.* (2011), Albonico *et al.* (2017), and Ferrara and Tirelli (2017).

following production function:

$$Y_t = A_t \left[\left(e^{\mu_t^L} N_t^{HL} \right)^{\alpha_L} \left(e^{\mu_t^L} N_t^{SA} \right)^{\alpha_N} (u_t K_t)^{1-\alpha_L-\alpha_N} \right]^{1-\alpha_G} (G_t^K)^{\alpha_G} \quad (2)$$

where A_t denotes the total factor productivity,¹¹ N_t^{HL} and N_t^{SA} denote CES aggregates of labor inputs hired (N_t^{HL} is a combination of skilled and unskilled labor inputs, μ_t^L is a specific labor-intensity shock; u_t denotes the capital utilization rate; N_t^{SA} includes labor inputs from self-employed and atypical workers); and G_t^K is the stock of government capital whose level depends on investment decisions on public infrastructure. In changing labor inputs, firms are subject to convex adjustment costs.

In the export (import) sector, monopolistically competitive firms transform domestic (foreign) intermediate goods into exportable (importable) goods using a linear technology. The final goods are produced by combining a bundle of intermediate goods produced domestically with a bundle of imported intermediate goods according to a CES technology. Non-tradable final goods produced by the competitive firms can be used for private and public consumption and for private and public investment.

Several adjustment costs on nominal and real variables are modeled. These variables are assumed to be quadratic in the deviations from the steady state values and measured by a parameter γ that captures their relevance.¹²

Specifically, the model features two kinds of nominal frictions (convex costs on price, measured by γ_p , and wage adjustments, measured by γ_ℓ^W). The price adjustment equation is:

$$\gamma_p \Omega_t (\Omega_t - 1) = \gamma_p E_t \frac{\beta \varrho_{t+1}^i (\Omega_{t+1} - 1) \Omega_{t+1} Y_{t+1}}{Y_t} + 1 - \theta_Y (1 - \mathcal{M}_t M C_t) \quad (3)$$

where $\Omega_t = \Pi_t / (\Pi_{t-1}^{\kappa_p} \bar{\Pi}^{1-\kappa_p})$; ϱ_{t+1}^i represents the appropriate growth rate of the marginal utility of consumption/output; κ_p measures price indexation; θ_Y is a measure of firms' market power; and \mathcal{M}_t defines a markup shock.

Similarly, adjustments of wage of kind i (which can refer either to skilled, unskilled or self-employed workers) are described by

$$\frac{\gamma_s^W \Omega_t^i (\Omega_t^i - 1) Y_t}{(\sigma_i - 1) L_{S,t}} = \gamma_i^W E_t \frac{\beta \varrho_{t+1}^i \Omega_{t+1}^i (\Omega_{t+1}^i - 1) Y_{t+1}}{(\sigma_i - 1) L_{i,t}} + \mathcal{M}_t^i \frac{\sigma_i MRS_t^i}{\sigma_i - 1} - WRT_t^i \quad (4)$$

where $\Omega_t^i = \Pi_t WRT_t^i / (WRT_{t-1}^i \Pi_{t-1}^{\kappa_W} \bar{\Pi}^{1-\kappa_W})$, WRT^i is the real wage and κ_W measures price indexation; WRT^i is the post-tax real wage of workers of kind i and MRS^i is their marginal

¹¹ It evolves according to an $AR(1)$ process in logs.

¹² For instance, for a variable X_t , the adjustment cost is $\gamma(X_t - \bar{X})^2 X_t / 2$.

rate of substitution between labor and consumption; σ_i is the elasticity of substitution between workers of kind i ; \mathcal{M}_t^i is a wage-markup shock for skilled and unskilled workers.

In the model there are five sources of real rigidities (investment, γ_I , and labor adjustment cost γ_ℓ^L , variable capital utilization, external habit in consumption, and imperfect competition in product and labor markets). Regarding investment, Ricardian households own physical capital and control the rate of capital utilization. Physical capital accumulates according to:

$$K_{t+1} = (1 - \delta_K)K_t + I_t, \quad (5)$$

where δ_K denotes the depreciation rate of physical capital. Investment decisions are subject to a convex adjustment cost measured by $\exp(\mu_t^I)\gamma_I$, where μ_t^I is a stochastic disturbance.

A foreign sector and monetary and fiscal authorities adopting rule-based stabilization policies are exogenously assumed.

The government issues nominal debt in the form of interest-bearing bonds. Public consumption and investment, interest payments on outstanding public debt, transfers to households and subsidies to firms are financed by taxes on capital, labor and consumption and/or by issuance of new bonds. To ensure that the fiscal budget constraint is met, the fiscal authority is assumed to adopt a fiscal rule responding to public debt. Public consumption evolves according to $AR(1)$ processes in log deviations from its steady state. The tax dynamics are described by a fiscal rule, which captures the tax response to the public finance indicators (debt and deficit) and the stance of stabilization policies.

The external monetary authority (ECB) controls the nominal interest rate (R_t), which responds to some extent to domestic conditions. Specifically, the monetary authority adopts a Taylor-type interest rate rule, reacting to inflation (Π_t) and output (Y_t), augmented by past nominal interest rate (smoothing its effects) and nominal exchange rate (S_t) deviations from the long-run value. Formally, we model monetary policy as

$$\frac{R_t}{\bar{R}} = \left(\frac{R_{t-1}}{\bar{R}}\right)^{\iota_r} \left[\left(\frac{\Pi_t}{\bar{\Pi}}\right)^{\iota_\pi} \left(\frac{Y_t}{\bar{Y}}\right)^{\iota_y} \left(\frac{S_t}{\bar{S}}\right)^{\iota_s}\right]^{1-\iota_r} e^{u_t^R} \quad (6)$$

where \bar{R} is the equilibrium nominal interest rate, $\bar{\Pi}$ is the monetary authority inflation target, \bar{Y} is the steady state output, \bar{S} is the long-run (steady state) exchange rate; ι_R , ι_Π , ι_Y , ι_S are policy parameters; and u_t^R is an $AR(1)$ stochastic disturbance, capturing the effects of innovations in monetary policy.

The foreign sector is modeled as exogenous. The development of the net foreign asset position depends on the current account surplus and thus on the decisions of firms, households and government. The transmission mechanism from internal to external variables is further

complicated by the assumption that the domestic exporting and importing firms have market power in the prices they set, such that the net external position will depend on conditions in both financial and goods markets.¹³

2.2 Estimation

The model is estimated by Bayesian techniques.¹⁴ We use quarterly data from the Italian economy ranging from 1992:Q1 to 2012:Q4. Nine variables are observables: real GDP, real consumption, real investment, inflation, nominal interest rate, real wage and hours of skilled and unskilled workers. The series describing wages and hours worked come from the INPS database, while the source of other series is EUROSTAT. The band-pass filter was used to detrend the series.

We estimate a set of fifteen deep parameters,¹⁵ the standard deviations and persistence of nine stochastic processes (33 estimates). We consider a set of shocks equal to the number of observable variables to avoid stochastic singularity. We also allow for three measurement errors for the following observables: output gap, high-skilled hours, and unskilled hours to avoid the correlation between observables and to improve the fit of the model. All the shocks follow an $AR(1)$ stationary process, while the shock of monetary policy and measurement errors are based on a white noise process.

We estimate the price adjustment cost (γ_p) and price indexation (κ_p); wage adjustment costs for self-employed workers (γ_S^W), high-skilled workers (γ_H^W), and unskilled workers (γ_L^W); labor adjustment costs for self-employed workers (γ_S^L), high-skilled workers (γ_H^L), unskilled workers (γ_L^L), and atypical workers (γ_A^L); wage indexation (κ_W); the investment adjustment cost (γ_I); the Taylor rule parameters for inflation (ι_π), output (ι_y), exchange rate (ι_s), and past interest rate (ι_r). The remaining parameters of the model have been calibrated as in Annicchiarico *et al.* (2013a). Specifically, IGEM is calibrated on a quarterly basis to match steady-state ratios and specific features of the Italian economy. Regarding the main ratios, the private consumption share C/Y

¹³ See Schmitt-Grohé and Uribe (2003).

¹⁴ Estimation details are provided in Acocella *et al.* (2018). Instead, for a wider discussion on Bayesian methods applied to DSGE estimation, see An and Schorfheide (2007) and Fernández-Villaverde (2010).

¹⁵ We have selected the subset of parameters to be estimated based on the identification test proposed by Iskrev (2010). The subset of parameters that we estimate is mainly composed of parameters that influence the dynamics of the model, such as adjustment costs and nominal rigidities.

is 0.57, the investment share I/Y is 0.18, the public consumption share G/Y is 0.20.¹⁶

We consider nine shocks: total factor productivity (ε_t^{TFP}), public consumption (ε_t^G), monetary policy (ε_t^R), preference (ε_t^Z), investment specific (ε_t^I), price mark-up (ε_t^μ), wage mark-up for high-skilled workers (ε_t^{wh}), wage mark-up for unskilled workers (ε_t^{wu}), and labor intensity (ε_t^L).

Table 1 reports the priors used in the estimation and the posteriors obtained for the parameters characterizing the model. Prior distributions are centered on a mean equal to the calibrated value in IGEM for the correspondent parameter.¹⁷ The table provides the result of our estimation with the posterior mean and median estimates at the 90% credible intervals. The table also reports the estimated standard deviation of the shocks considered and their autocorrelation parameters¹⁸ (i.e., the estimated AR(1) coefficient for TFP shock, ρ_{TFP} ; investment specific shock, ρ_I ; labor intensity shock, ρ_L ; public spending shock, ρ_G ; price mark-up shock, ρ_μ ; preference shock, ρ_Z ; high-skilled wage mark-up shock, ρ_μ^H ; unskilled wage mark-up shock, ρ_μ^L ; monetary policy shock, ρ_{u^R}).

Table 1 – Prior and posterior distributions (model parameters and shocks).

	Prior distribution			Posterior distribution			
	Density	Mean	S.D. ¹⁹	Mean	Median	10%	90%
ι_r	Beta	0.750	0.100	0.851	0.850	0.819	0.885
ι_π	Normal	1.500	0.250	1.376	1.306	1.133	1.634
ι_y	Normal	0.125	0.050	0.225	0.229	0.147	0.302
ι_s	Normal	0.010	0.005	0.012	0.012	0.006	0.019
γ_s^W	Gamma	10	3	8.843	10.466	4.883	12.780
γ_H^W	Gamma	71	15	32.552	45.305	17.355	47.583
γ_L^W	Gamma	71	15	48.608	55.303	29.327	66.848
γ_s^L	Gamma	15	5	0.880	0.630	0.553	1.224
γ_H^L	Gamma	15	5	20.735	19.703	15.900	25.074
γ_L^L	Gamma	15	5	49.640	45.550	37.958	60.542
γ_A^L	Gamma	15	5	18.923	17.791	11.954	25.484
κ_W	Beta	0.500	0.150	0.106	0.084	0.036	0.175
γ_p	Gamma	330	50	309.400	314.202	235.582	387.795

¹⁶ See Acocella *et al.* (2018: Appendix C) for a discussion on IGEM calibration.

¹⁷ We choose a Beta distribution for all the parameters with support $[0,1]$, a Gamma distribution for the remaining parameters, whereas an Inverse Gamma distribution is used for the variances of the shocks. Posterior distributions are obtained by the Metropolis-Hastings algorithm. Mean and posterior percentiles come from two chains of 50,000 draws each from Metropolis-Hastings algorithm, where we discarded the initial 30% draws.

¹⁸ For the standard deviations, we have elicited an Inverse Gamma distribution with 2 degrees of freedom, while all the AR(1) follow a Beta distribution.

¹⁹ For the Inverse Gamma distribution, the degrees of freedom are indicated.

κ_p	Beta	0.500	0.150	0.121	0.105	0.041	0.198
γ_I	Gamma	75	25.00	112.657	96.351	73.432	151.860
ε_t^{TFP}	Inv. Gamma	0.01	2	0.010	0.001	0.008	0.012
ε_t^G	Inv. Gamma	0.01	2	0.019	0.018	0.016	0.022
ε_t^R	Inv. Gamma	0.01	2	0.002	0.002	0.001	0.002
ε_t^Z	Inv. Gamma	0.01	2	0.009	0.009	0.008	0.011
ε_t^μ	Inv. Gamma	0.01	2	2.041	2.045	1.457	2.587
$\varepsilon_t^{w_{lh}}$	Inv. Gamma	0.01	2	0.649	0.853	0.310	0.954
$\varepsilon_t^{w_{ul}}$	Inv. Gamma	0.01	2	1.271	1.410	0.719	1.816
ε_t^L	Inv. Gamma	0.01	2	0.010	0.010	0.009	0.011
ε_t^I	Inv. Gamma	0.01	2	0.004	0.003	0.002	0.005
ρ_G	Beta	0.5	0.1	0.780	0.796	0.676	0.877
ρ_{TFP}	Beta	0.5	0.1	0.953	0.953	0.935	0.971
ρ_Z	Beta	0.5	0.1	0.625	0.622	0.481	0.776
ρ^I	Beta	0.5	0.1	0.853	0.865	0.813	0.897
ρ_μ	Beta	0.5	0.1	0.119	0.108	0.022	0.205
$\rho_{\mu^w}^H$	Beta	0.5	0.1	0.228	0.228	0.094	0.342
$\rho_{\mu^w}^L$	Beta	0.5	0.1	0.214	0.210	0.075	0.352
ρ_L	Beta	0.5	0.1	0.574	0.583	0.375	0.768
ρ_{u^R}	Beta	0.5	0.1	0.071	0.058	0.014	0.123

Compared to the calibrated version of IGEM (priors), the estimated nominal wage stickiness is smaller for all types of work. By contrast, adjustment costs (including those for investments) are higher. The costs of adjustment of prices and wages indicate a considerable degree of nominal rigidity in the economy. The degree of price and wage indexation to past inflation is much smaller than the indexation levels assumed in the calibrated model. No substantial difference is found in the estimated monetary parameters. The estimated fiscal multipliers are slightly smaller than those obtained from the calibrated model. We also observe a high degree of persistence for the interest rate, which is in line with the literature. As expected, when considering shocks, the total factor productivity has a high degree of autocorrelation, which indicates a high degree of inertia, while mark-up shocks appear to be less persistent.

3. How to design austerity policies

This section compares the effects of austerity plans based on expenditure- and tax-based adjustments. Austerity plans could have very different compositions. As benchmarks, we consider two multi-year fiscal consolidation programs labelled expenditure-based and tax-based consolidation. As said, the *tax-based plan* implies that 70% of the adjustment is made via increasing revenues, whereas the rest is made via reducing expenditure. By contrast, the *expenditure-based plan* implies that 30% is made of tax increases and 70% of government-

spending cuts.²⁰ We assume that both plans are announced at the beginning of the policy experiment. The plans are mapped onto the IGEM model as follows. The expenditure-based adjustments are cuts in the government public expenditure, while the revenue-based adjustments are proportionally distributed upon the different tax instruments.²¹

Our results are illustrated in Figure 1 and 2. The figures reports the dynamics of the main macroeconomic variables when a tax-based or an expenditure-based austerity plan is implemented. The solid lines refer to the case of tax-based policy measure, and the dashed lines to the case of austerity based on public expenditure cuts. As explained above, both plans lead to the same initial consolidation, but differ in their compositions. Figure 1 refers to the case of “normal times,” i.e., when the central bank responds to the state of the economy (the results obtained from the estimated model). Figure 2 focuses on the zero-lower bound case, when the central bank does not (or cannot) vary the nominal interest rate during the consolidation. The figures report output, public debt, debt service, and the debt-to-output ratio. Output, public debt, and debt service are expressed as per-cent deviations from their baseline values (i.e., the steady state). The debt-to-output ratio reports simple deviations. The time period is the quarter.

In normal times, the central bank reacts to recession induced by fiscal adjustments by varying the interest rates. Compared to austerity plans based on tax increases, expenditure-based adjustments are less effective in stabilizing the public debt and are associated to a more recessionary impact on real output. Summarizing, we find that tax-based adjustments have lower costs than expenditure-based ones. The intuition of the result is straightforward. Government-expenditure multipliers are higher than those associated to taxes. This result is in line with the evidence provided by several institutional models summarized in Coenen *et al.* (2012).

²⁰ As argued, for the sake of comparison, we consider two limit cases. Favero and Mei (2019) document that the average composition of a tax- (expenditure-) based plan is such that 78 (60) per cent of the adjustment is made via increasing (reducing) tax revenues (expenditures). They investigate a sample of 16 OECD countries in the period 1978-2014.

²¹ The proportions are computed according to the current fiscal incidence of the different tax instruments. We also checked the robustness of our results to different assumptions about the distribution of revenues adjustments *vis-à-vis* tax instruments. Results are available upon request.

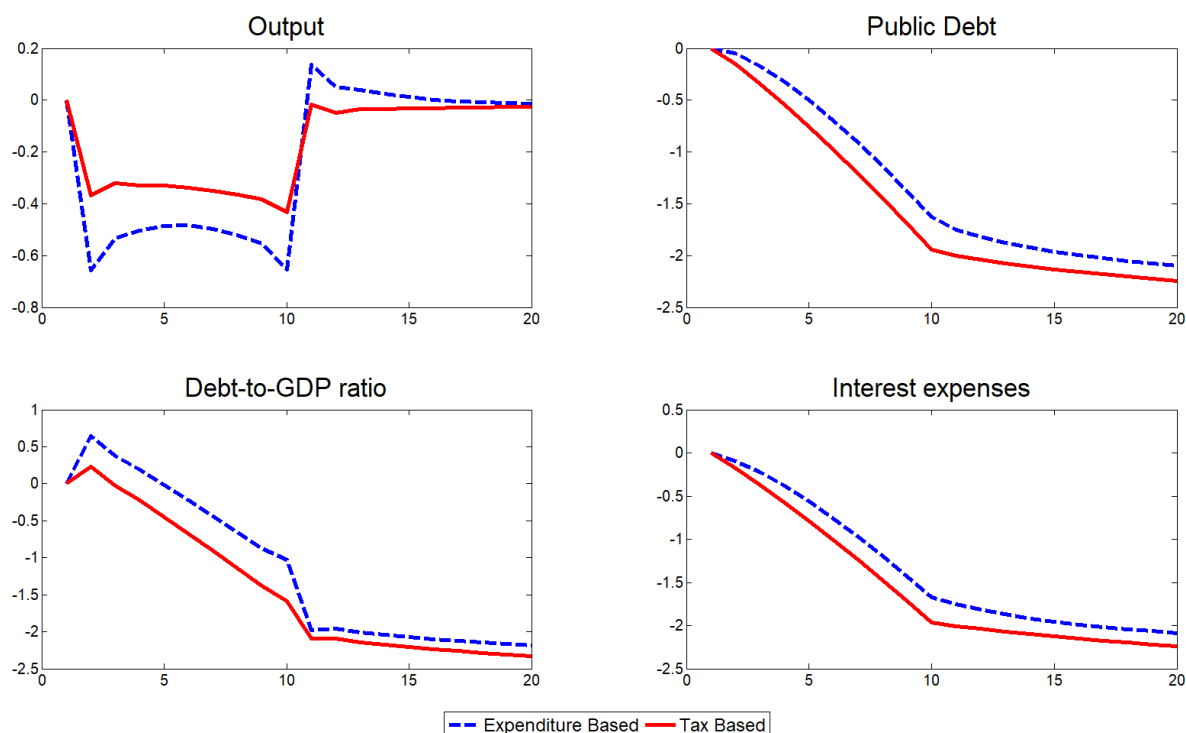


Figure 1 – Tax-based vs. expenditure-based austerity²²

Figure 2 provides a comparison between expenditure- and tax-based plans when the policy interest rate is set at the zero-lower bound, and therefore, the central bank does not react to the fiscal adjustment. It is worth noticing that austerity plans have a negative impact on the output. The central bank thus tends to react to them by cutting the interest rates and mitigating their recessionary effects. As a result, we should expect a larger cost in terms of output fall associated to austerity under the zero-lower bound.

The higher costs involved in austerity when the zero lower bound is binding are evident in the figure. The negative impacts on output are about 3/4 larger compared to the case illustrated in Figure 1. Tax-based adjustments have again lower costs than expenditure-based ones. Now, the expenditure-based adjustments are self-defeating, because the recessions it induced increases government debt as a ratio of GDP, as argued by Blanchard and Leigh (2014) for the case of the recent austerity episodes.²³ In such a case, government-expenditure multipliers are especially

²² The figure reports output, debt, and debt service per-cent deviations from the baseline and deviations of the GDP/debt from the steady state. The time period is one quarter.

²³ In the case of the zero-lower bound, indeed, the recessionary effects are so marked that the debt itself grows due to the reduction in tax revenues. We consider two extreme cases, assuming an expenditure-based plan associated to a larger proportion of taxes, we do not observe the increase in public debt. However, our results are unaffected by

high.²⁴

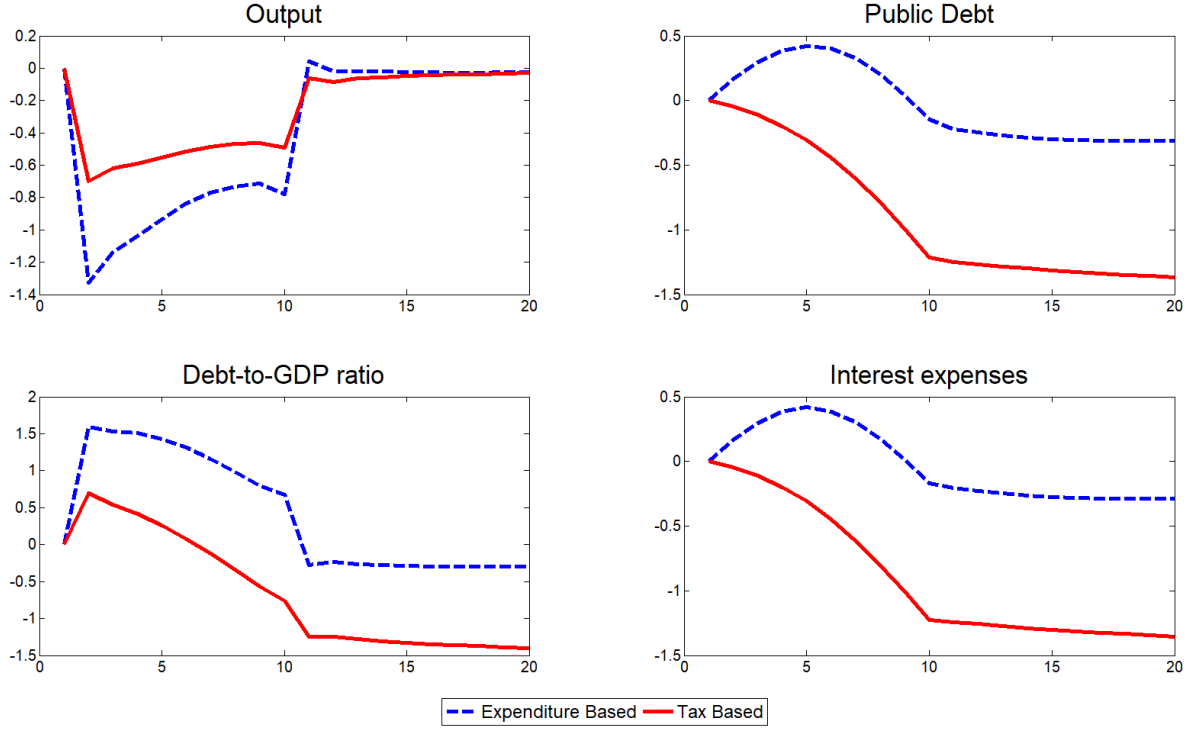


Figure 2 – Tax-based vs. expenditure-based austerity under zero-lower bound

Finally, Table 2 reports the fiscal multipliers associated to our policy experiment. We indicate the output multipliers associated with the tax-based and expenditure-based plans in two different scenarios, i.e. an accommodative and non-accommodative monetary authority. The multipliers are the average first-year instantaneous multipliers associated to the different plans.

The table shows that expenditure-based plans are much more recessionary than plans based on tax increases. The cost of austerity roughly double when the central bank does not accommodate. The values of multipliers are in line with Coenen *et al.* (2012).

the change since tax-based adjustments have still consistently lower costs than expenditure-based ones.

²⁴ Other studies report that, when interest rates are low as in a recession, the expenditure multipliers are non-negative and significantly larger than the tax multipliers. See the survey by Gechert *et al.* (2016) and De Nardis and Pappalardo (2018) for the case of Italy.

Table 2 – Consolidation multipliers of tax-based and expenditure-based plans²⁵

		Monetary policy	
		<i>non-accommodation</i>	<i>accommodation</i>
Fiscal policy	<i>expenditure-based</i>	-0.54	-1.11
	<i>tax-based</i>	-0.34	-0.61

Our results support the idea that consolidation of the public debt should be designed on policies based on tax increases rather than expenditure reductions. In general, expenditure-based approaches are much less costly than tax-based plans only if the expenditure multipliers are significantly smaller than the tax multipliers. Our results for Italy do not confirm this claim and are in line with those of Coenen *et al.* (2012), Auerbach and Gorodnichenko (2012), Blanchard and Leigh (2014), and Gechert *et al.* (2016), who however do not focus on the Italian case.

5. Conclusions

Sovereign debt crises faced by several European countries starting in 2010 have revitalized the hash policy debate on austerity policies. In time of recession, or post-recession, the policy options are two since the debt consolidation requires fiscal surplus which can be based either on increases in taxes or on reductions in public spending. This paper supports the idea that austerity plans aimed at reducing the public debt should be designed on tax increases rather than expenditure reductions.

Going more in detail, after estimating the small-open economy model of the Italian economy (IGEM) in use at the Treasury, we focused on different effects of austerity measures based on revenue increases or expenditure reductions. These policies are in fact recessionary. By counterfactual policy experiments, we compared a tax-based to an expenditure-based fiscal adjustment. The former implies that 70% of the adjustment is made via increasing revenues and 30% on government-spending cuts. The expenditure-based plan just reverts these figures, being composed of 30% of tax increases and 70% of spending cuts.

Our main message is that plans aimed at reducing the public debt should be designed on tax increases rather than expenditure reductions. Austerity plans based upon spending cuts are much more costly, in terms of output losses, than those based upon tax increases. The difference is

²⁵ The table reports the average first-year instantaneous multipliers associated to the tax-based and expenditure-based consolidation. As these policies are recessionary, the multiplier signs are negative.

larger when the zero-lower bound is considered. In this case, the large recessions induced by expenditure-based adjustments tend to increase government debt as a ratio of GDP. Therefore, austerity plans based on expenditure cuts tend to be self-defeating. The rationale of our result lies behind the size of estimated multipliers. Those associated to government spending are much higher than the multipliers associated to taxes. Considering the zero-lower bound, the difference in the multiplier sizes is even larger.

The reader should be aware that, beyond our exercise, it remains desirable to design fiscal interventions eliminating inefficiencies and public wastes by, e.g., a comprehensive spending review and focusing on the existing space for a more efficient taxation system (shifting taxation away from labor to e.g. property taxes, improving tax compliance, fighting tax evasion to fill e.g. the gap between theoretical VAT revenues and those actually collected).

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