COMPANION APPENDIX TO
Fiscal Consolidation with Tax Evasion and Corruption
(not intended for publication)

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A More extensions based on Blanchard and Leigh (2013)

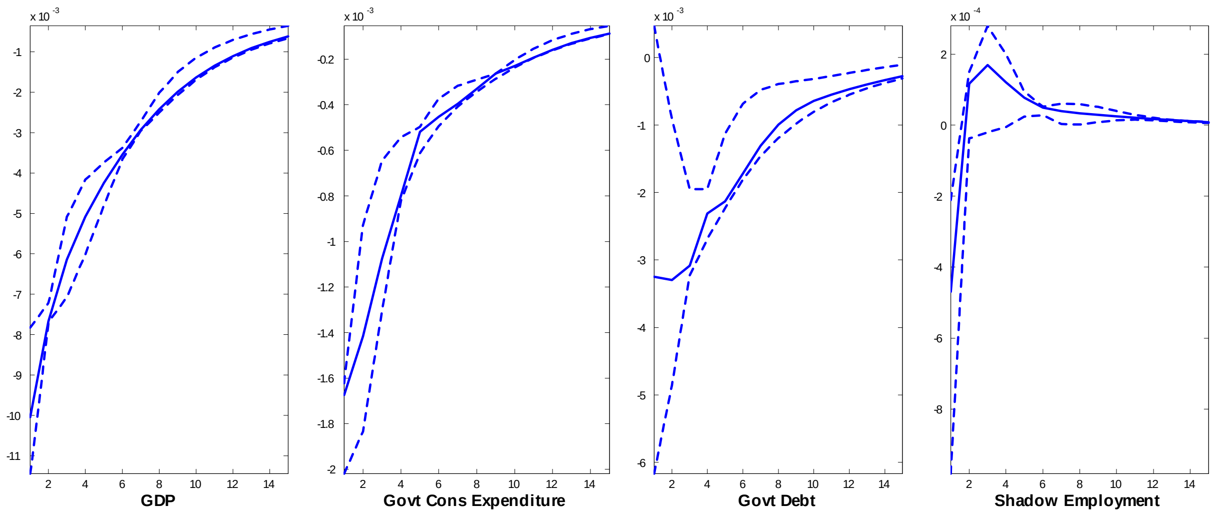
Table 1: Blanchard & Leigh (2013) Regressions with Additional Controls - Components of GDP and Unemployment

	DEPENDENT VARIABLE: Forecast error of the growth of				
REGRESSORS	Unemployment Rate	Priv. Consumption	Investment	Exports	Imports
Planned Fiscal Consolidation	0.562***	-0.285	-4.088***	-1.759	-2.072**
	(0.190)	(0.296)	(1.136)	(1.055)	(0.773)
High Tax Evasion	1.685**	-0.631	-13.324***	4.770	-4.630
and Corruption Dummy	(0.660)	(0.701)	(3.326)	(3.682)	(3.518)
Interaction	-0.147	-0.493	4.131***	0.422	3.312
	(0.349)	(0.334)	(1.367)	(2.285)	(2.150)
Constant	-0.787***	0.125	1.083	5.842***	7.362***
	(0.234)	(0.500)	(1.548)	(1.709)	(1.308)
Observations	23	23	23	23	23
R-squared	0.508	0.422	0.596	0.208	0.241

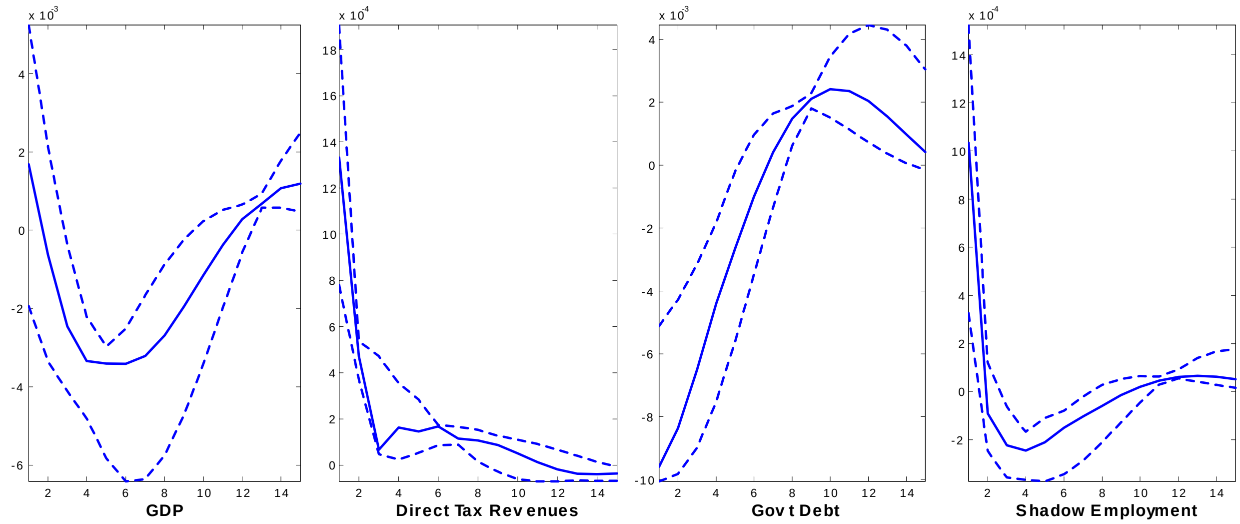
Robust standard errors in parentheses
$^{***}p \leq 0.01$, $^{**}p \leq 0.05$, $^{*}p \leq 0.1$

B Extensions of VAR Evidence

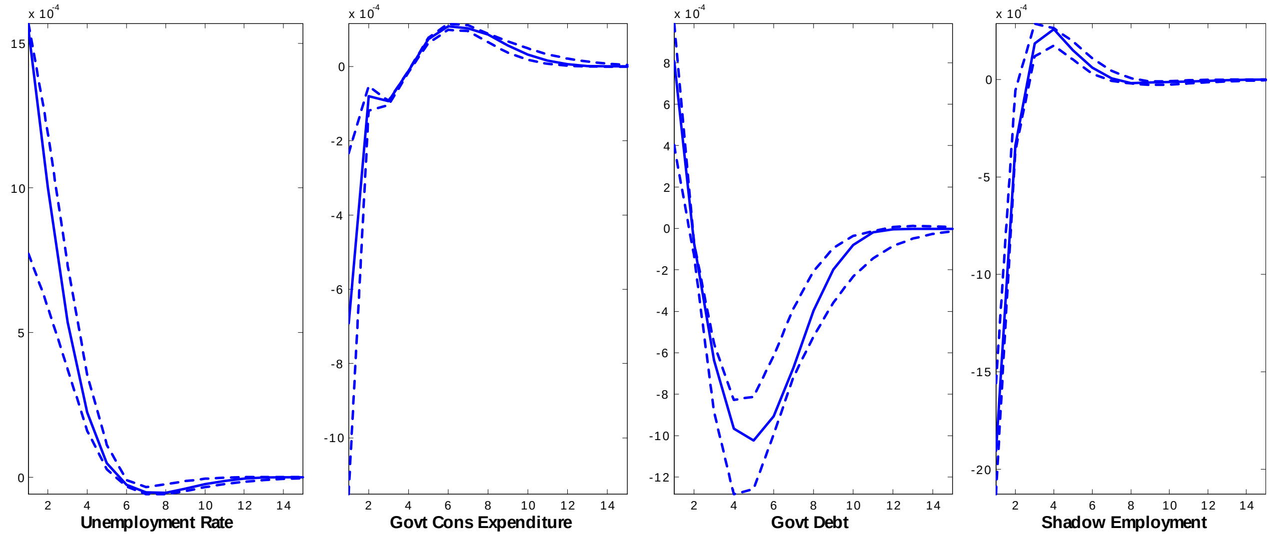
B.1 Full IRFs for Baseline Regressions



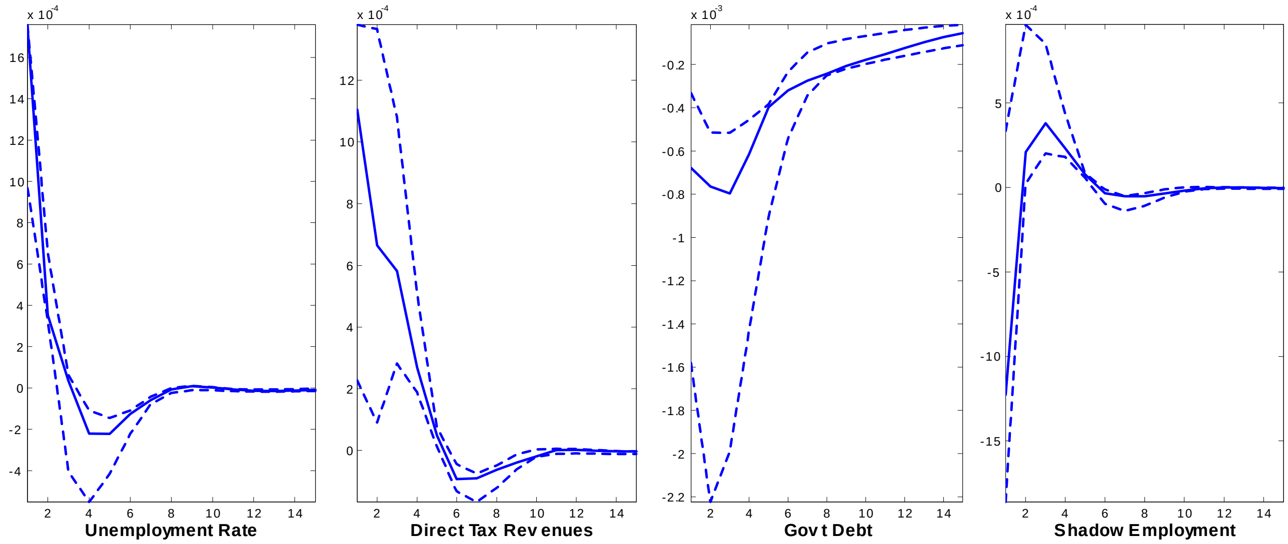
Empirical IRFs for Expenditure Cut - VAR with Output



Empirical IRFs for Tax Hike - VAR with Output



Empirical IRFs for Expenditure Cut - VAR with Unemployment



Empirical IRFs for Tax Hike - VAR with Unemployment

B.2 Robustness Checks

In order to verify the robustness of our baseline results to the identification strategy used, we present results from three alternative exercises aimed at ascertaining the effects of fiscal consolidations in Italy.

To begin with, we use a different set of sign restrictions to identify the two fiscal consolidation shocks jointly in one VAR regression. In particular, we estimate a five variable VAR with GDP, government final consumption expenditures, tax revenues, the share of informal workers in total workers, and government debt, and identify uncorrelated government spending and tax shocks. To do so, we impose that debt falls with a lag following both shocks, and use zero restrictions that ensure that only one instrument is active in each case. In other words, to identify a consolidation through a spending cut we assume that taxes do not move on impact after the shock, while the opposite is assumed in the case of a consolidation through a tax hike. All other responses are left unrestricted. The sign restrictions used are summarised in Table 2. As before, we then run the same regressions replacing GDP with the unemployment rate.

Table 2: Sign Restrictions - Five Variable VAR

Variable:	Govt Expenditure	Tax Rate	Debt-to-GDP
Shock:	$t = 0, 1$	$t = 0, 1$	$t = 2$
Expenditure Cut	–	0	–
Tax Hike	0	+	–

The resulting impulse response functions are shown in Figures 1-4. As with the baseline regressions presented in the paper, we see that both types of consolidations are contractionary, both in terms of reducing output and increasing unemployment. Furthermore, in both the GDP and unemployment specifications of the VAR, we again see that shadow employment falls significantly after a spending cut, and rises significantly after a tax hike.

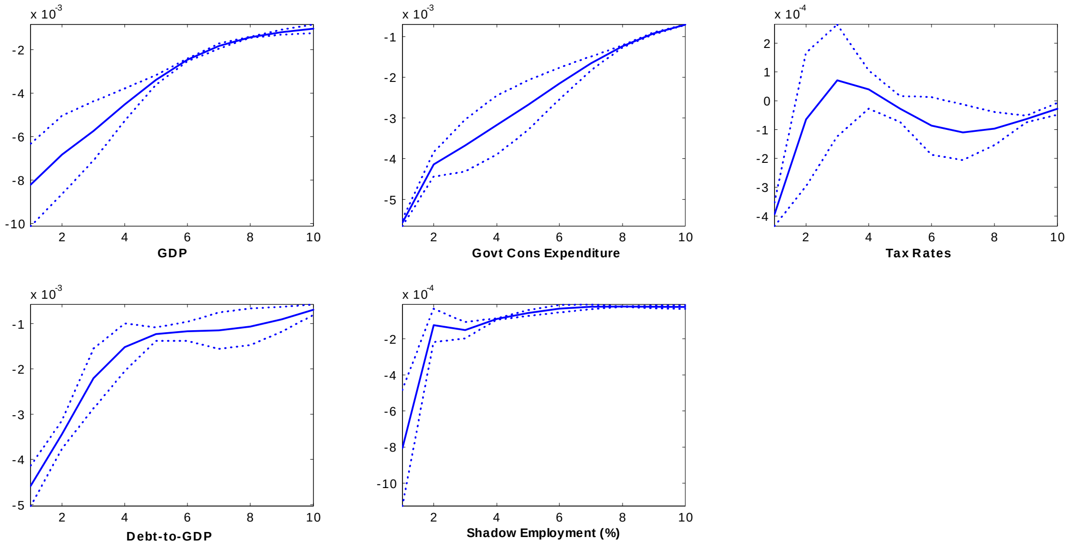


Figure 1: Empirical IRFs for Expenditure Cut - Five Variable VAR with Output

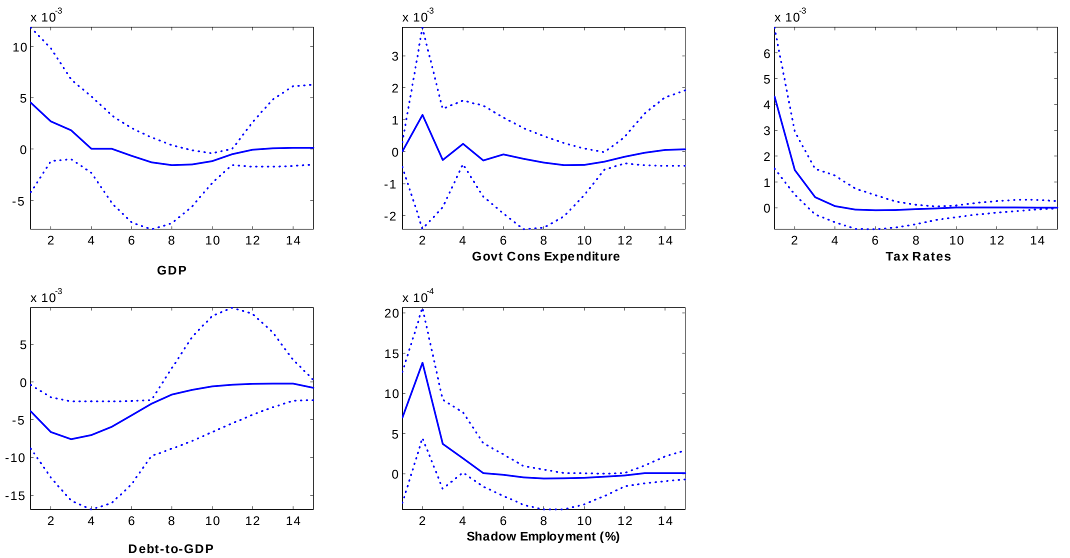


Figure 2: Empirical IRFs for Tax Hike - Five Variable VAR with Output

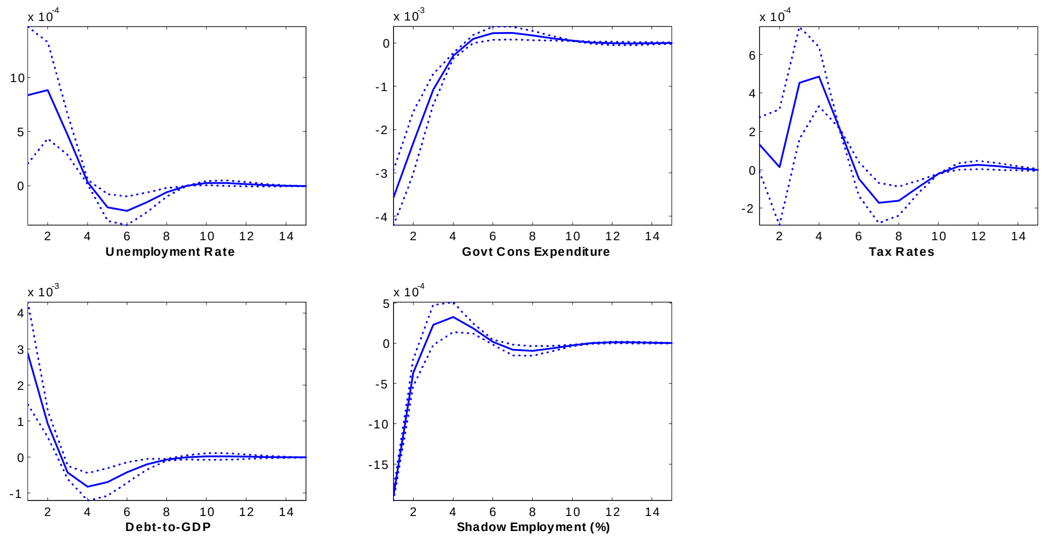


Figure 3: Empirical IRFs for Expenditure Cut - Five Variable VAR with Unemployment

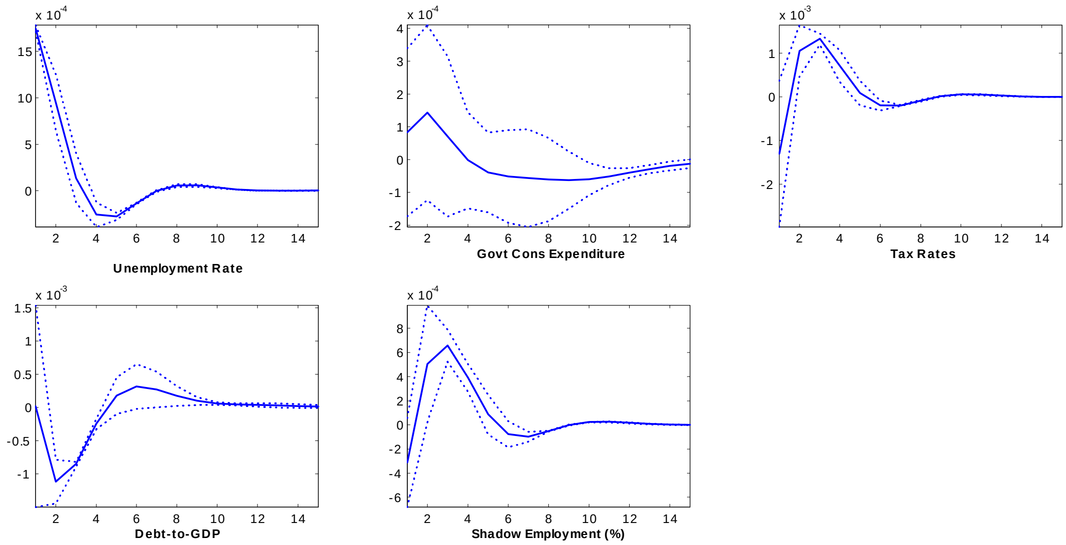
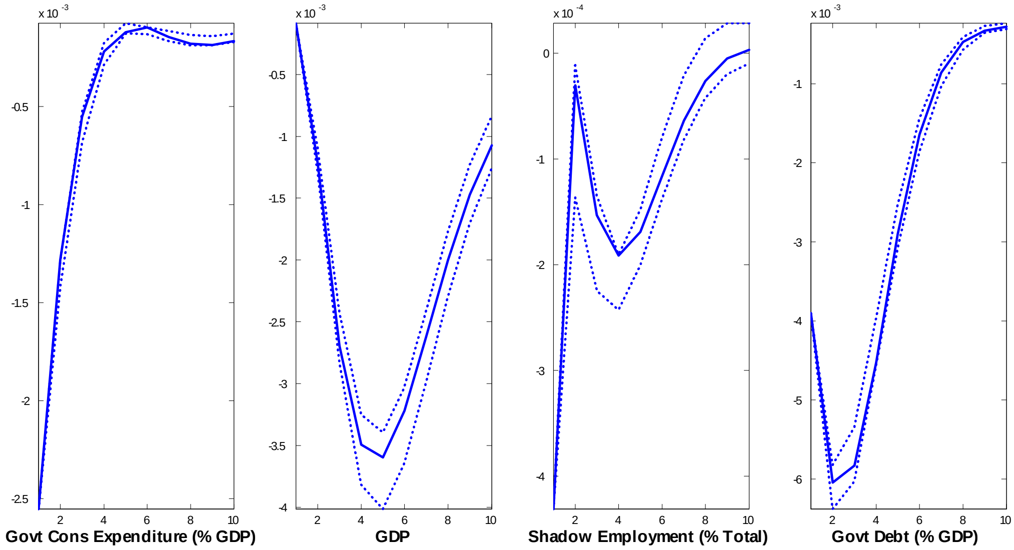


Figure 4: Empirical IRFs for Tax Hike - Five Variable VAR with Unemployment

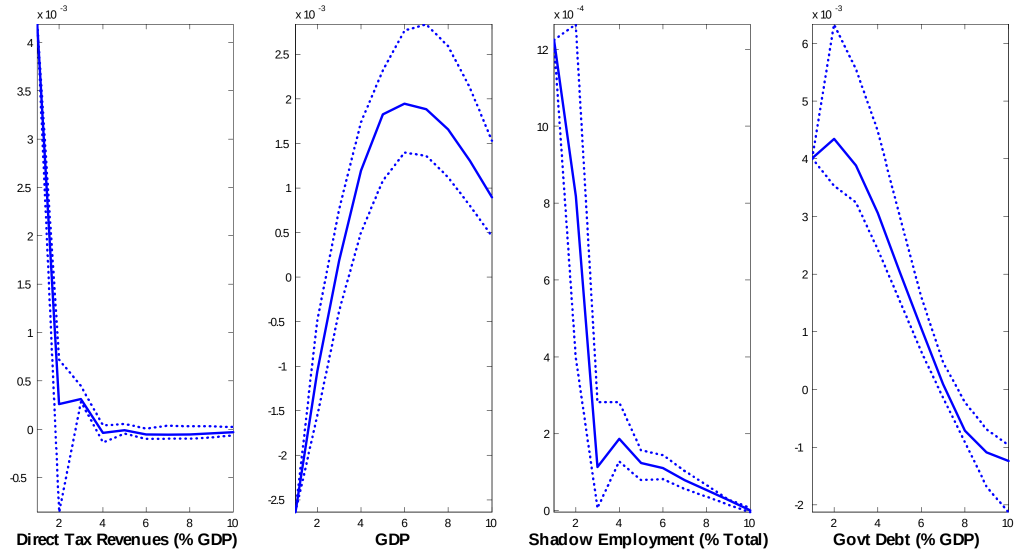
As a further exercise, we leave behind the sign restriction methodology and instead use simple Cholesky decompositions to identify the shocks. We again separate the analysis into two VARs for spending and tax based consolidations respectively. In each case, we order the endogenous variables as follows: $\{Inst, GDP, Debt, ShadowEmployment\}$, where $Inst$ is either government spending or tax revenues. Again, we repeat the exercise using the unemployment rate in place of GDP. The results are shown in Figures 5 and 6.

Finally, we attempt to use the narrative fiscal consolidation episodes identified by Devries et al. (2011) to identify the effects of consolidation on shadow employment. We use the methodology of Guajardo et al. (2014), who incorporate these episodes in a VAR to identify the effects of both tax based and spending based fiscal consolidations. We replicate their exercise, restricting to the case of Italy and adding the informal employment series. We then repeat the same exercise, replacing GDP with unemployment. It should be noted that, since we are looking at only one country, these estimates are based on relatively few consolidation episodes, making it difficult to obtain significant results. Nonetheless, Figures 7 and 8 show that the median response using the fiscal consolidation episodes confirms the previous result: informal employment falls after a spending based consolidation and rises after a tax based consolidation.

Figure 5: Empirical IRFs - VAR with Output - Cholesky Decomposition

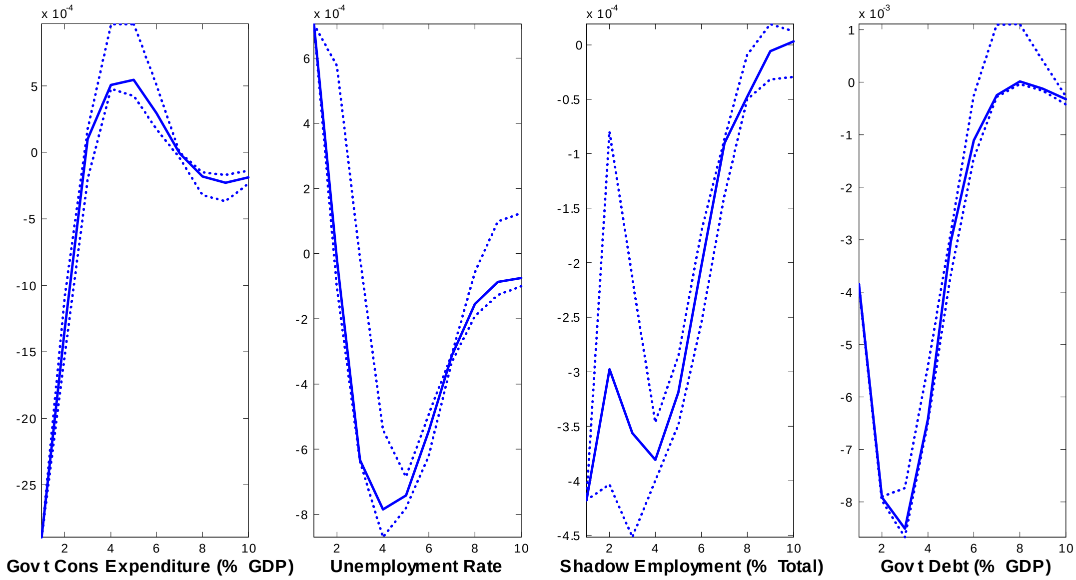


Expenditure Cut

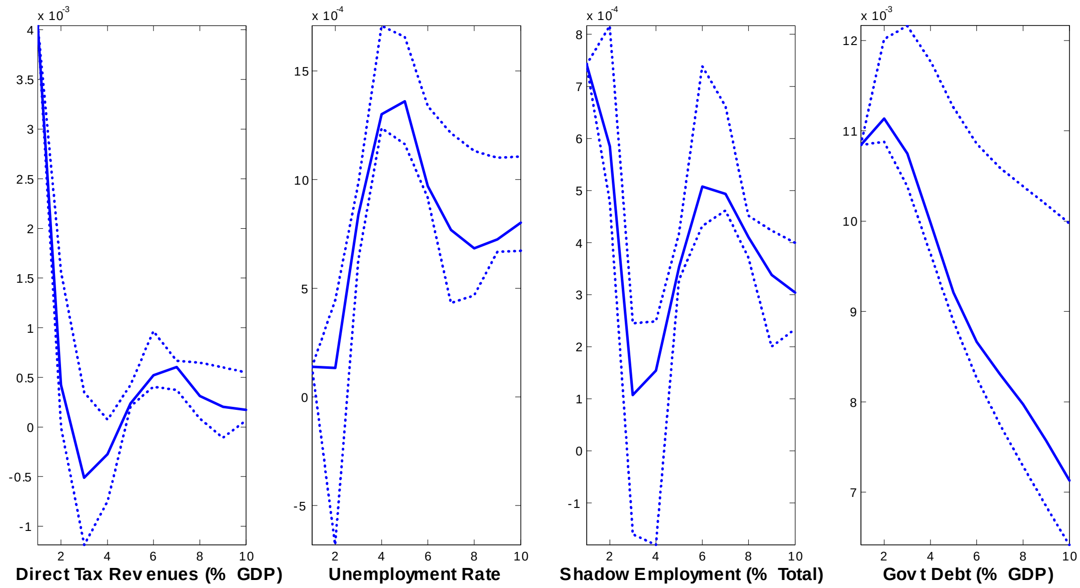


Tax Hike

Figure 6: Empirical IRFs - VAR with Unemployment Rate - Cholesky Decomposition



Expenditure Cut



Tax Hike

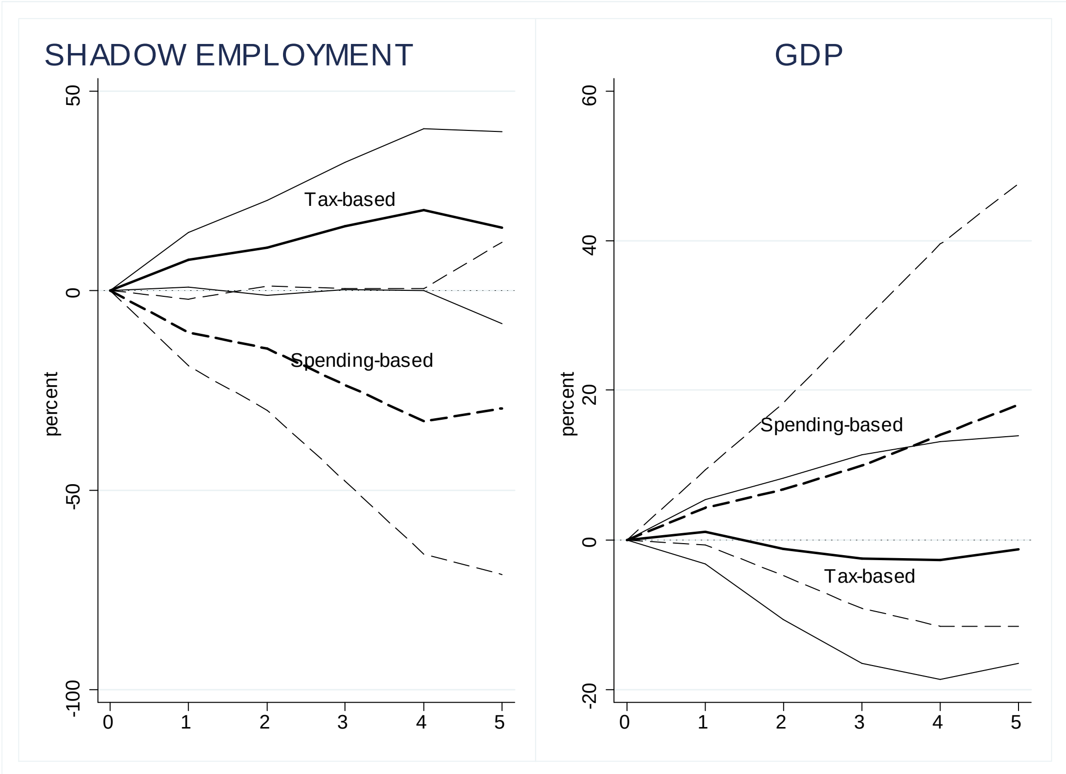


Figure 7: Empirical IRFs - Narrative Fiscal Consolidation Episodes - with Output

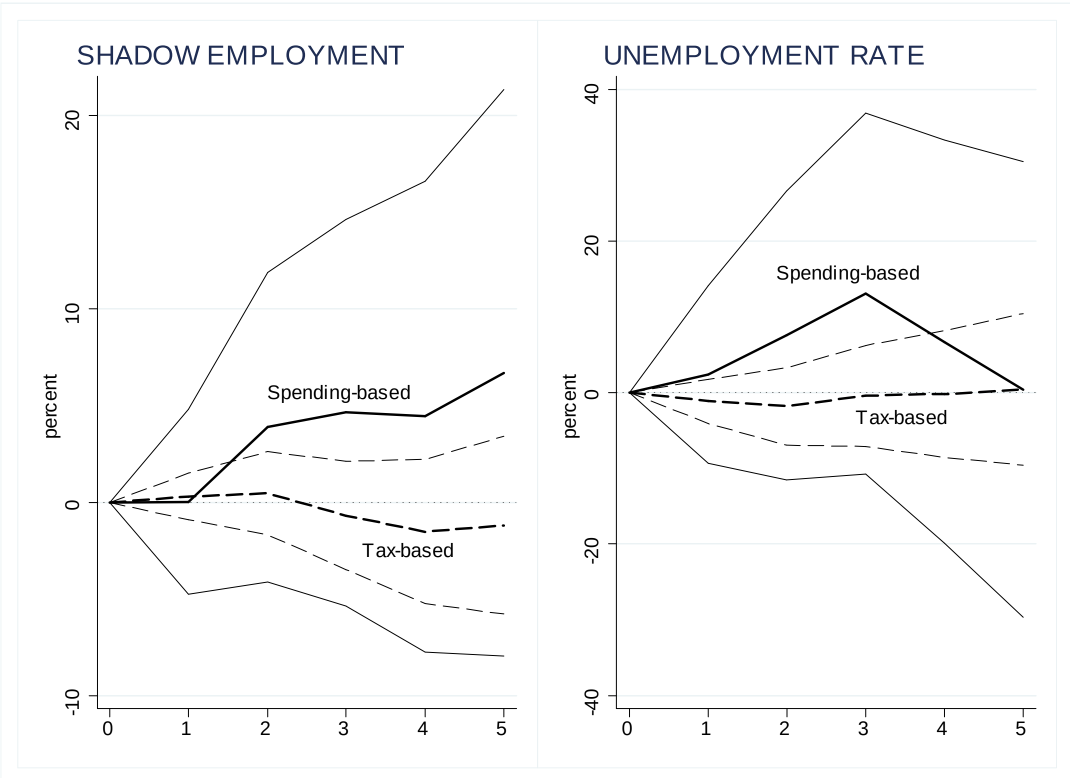


Figure 8: Empirical IRFs - Narrative Fiscal Consolidation Episodes - with Unemployment Rate

Table 3: Anticipated Shocks

Dependent Variable: VAR Expenditure Shocks

REGRESSOR	1	2
'Raw' Professional Forecast Errors	0.006 (0.005)	
'Purified' Professional Forecast Errors		-.001 (0.005)
Constant	0.001 (0.005)	0.002 (0.004)
R-squared	0.091	0.002

Robust standard errors in parentheses
$^{***}p \leq 0.01$, $^{**}p \leq 0.05$, $^{*}p \leq 0.1$

B.3 Anticipated Shocks

An important problem that may arise when using sign restrictions to identify shocks is the issue of anticipated shocks. This problem is particularly pertinent to fiscal shocks due to the way in which fiscal policy is carried out, with news about future policy changes released to the public ahead of time, and lags between policy decisions and their implementation. As discussed in Perotti (2005) and Ramey (2011), this can have significant implications for the results of VAR estimation. Dealing comprehensively with this issue is not straightforward, and is beyond the scope of this paper. As a first pass at ascertaining whether the shocks we have identified are truly unanticipated, we follow Perotti (2005) and regress the spending shocks on professional forecasts of government expenditure, taken from the ECB's survey of professional forecasts. We also repeat the exercise first regressing the forecast errors on the lag of the 4 variables in the VAR, and then regressing the VAR shocks on these "purified" forecast errors. The results of these regressions are shown in Table 3. We see that the forecasts are uncorrelated to our shocks, suggesting that VAR shocks are not predictable.

C Derivations

C.1 Household's maximisation problem

We can write in full the Lagrangean for the representative household's maximisation problem. Firstly, we can incorporate the composition of the household, as well as the definition of the total effective consumption bundle, directly into the utility function of the household. Then, we can plug the definition of the matches $m_t^j = \psi_t^{hj} u_t^j$ into the law of motion of employment in each sector, and also replace i_t in the budget constraint using the law of motion of private capital. Then we are left with 3 constraints, and the following Lagrangean:

$$\begin{aligned}\mathcal{L} = E_0 \quad & \sum_{t=0}^{\infty} \beta^t \Bigg\{ \frac{\left[\alpha_1 (c_t)^{\alpha_2} + (1-\alpha_1)(g_t)^{\alpha_2}\right]^{\frac{1-\eta}{\alpha_2}}}{1-\eta} + \Phi \frac{\left[1 - u_t - n_t^F - n_t^I\right]^{1-\varphi}}{1-\varphi} \\ & -\lambda_{ct}\Big[(1+\tau_t^c)c_t + k_{t+1} - (1-\delta)k_t + \frac{\omega}{2}\left(\frac{k_{t+1}}{k_t} - 1\right)^2 k_t + \frac{B_{t+1}\pi_{t+1}}{R_t} - r_t k_t \\ & -(1-\tau_t^n)w_t^F n_t^F - w_t^I n_t^I - \varpi(1-s_t)u_t - B_t - \Pi_t^p + T_t\Big] \\ & -\lambda_{n^F t}\Big[n_{t+1}^F - (1-\sigma^F)n_t^F - \psi_t^{hF}(1-s_t)u_t\Big] \\ & -\lambda_{n^I t}\Big[n_{t+1}^I - (1-\rho-\sigma^I)n_t^I - \psi_t^{hI} s_t u_t\Big] \Bigg\} \end{aligned} \quad (1)$$

The controls are c_t, k_{t+1}, B_{t+1}, n_{t+1}^F, n_{t+1}^I, u_t and s_t. The first order conditions are:
[wrt c_t]

$$cc_t^{(1-\eta-\alpha_2)} \alpha_1 c_t^{(\alpha_2 - 1)} - \lambda_{ct}(1+\tau_t^c) = 0 \quad (2)$$

[wrt k_{t+1}]

$$\lambda_{ct}\left[1 + \omega\left(\frac{k_{t+1}}{k_t} - 1\right)\right] - \beta E_t \lambda_{ct+1}\left[1 - \delta + r_{t+1} + \frac{\omega}{2}\left(\left(\frac{k_{t+2}}{k_{t+1}}\right)^2 - 1\right)\right] = 0 \quad (3)$$

[wrt B_{t+1}]

$$-\lambda_{ct}\frac{1}{R_t} + \beta E_t \lambda_{ct+1}\frac{1}{\pi_{t+1}} = 0 \quad (4)$$

[wrt n_{t+1}^F]

$$-\lambda_{n^F t} - \beta E_t\left[\Phi l_{t+1}^{-\varphi} - \lambda_{ct+1}(1-\tau_{t+1}^n)w_{t+1}^F - \lambda_{n^F t+1}(1-\sigma^F)\right] = 0 \quad (5)$$

[wrt n^I_{t+1}]

$$-\lambda_{n^It} - \beta E_t[\Phi l_{t+1}^{-\varphi} - \lambda_{ct+1} w^I_{t+1} - \lambda_{n^It+1}(1-\rho-\sigma^I)] = 0 \quad (6)$$

[wrt u_t]

$$-\Phi l_t^{-\varphi} + \lambda_{ct}\varpi + \lambda_{n^Ft}\psi_t^{hF}(1-s_t) + \lambda_{n^It}\psi_t^{hI}s_t = 0 \quad (7)$$

[wrt s_t]

$$-\lambda_{n^Ft}\psi_t^{hF}u_t + \lambda_{n^It}\psi_t^{hI}u_t - \lambda_{ct}\varpi = 0 \quad (8)$$

Equations (2)-(4) are the arbitrage conditions for the returns to consumption, private capital and bonds. Equations (5) and (6) relate the expected marginal value from being employed in the each sector to the wage, accounting for the income tax in the regular sector, the utility loss from the reduction in leisure, and the continuation value, which depends on the separation probability. Equation (7) states that the value of being unemployed (rather than enjoying leisure), $\lambda_{ct}\varpi$, should equal the marginal utility from leisure minus the expected marginal values of being employed in each sector, weighted by the respective job finding probabilities and shares of jobseekers. Equation (8) is an arbitrage condition according to which the choice of the share, s_t, is such that the expected marginal values of being employed, weighted by the job finding probabilities, are equal across the two sectors.

We can define the marginal value to the household of having an additional member employed in the two sectors, as follows:

$$\begin{aligned} V^h_{n^Ft} &\equiv \frac{\partial \mathcal{L}}{\partial n^F_t} = \lambda_{ct}w^F_t(1-\tau^n_t) - \Phi l_t^{-\varphi} + (1-\sigma^F)\lambda_{n^Ft} \\ &= \lambda_{ct}w^F_t(1-\tau^n_t) - \Phi l_t^{-\varphi} + (1-\sigma^F)\beta E_t(V^h_{n^Ft+1}) \end{aligned} \quad (9)$$

$$\begin{aligned} V^h_{n^It} &\equiv \frac{\partial \mathcal{L}}{\partial n^I_t} = \lambda_{ct}w^I_t - \Phi l_t^{-\varphi} + (1-\rho-\sigma^I)\lambda_{n^It} \\ &= \lambda_{ct}w^I_t - \Phi l_t^{-\varphi} + (1-\rho-\sigma^I)\beta E_t(V^h_{n^It+1}) \end{aligned} \quad (10)$$

where the second equalities come from equations (5) and (6) respectively.

C.2 Derivation of the resource constraint

Consider the household's budget constraint:

$$(1+\tau^c_t)c_t + i_t + \frac{B_{t+1}\pi_{t+1}}{R_t} \le r_t k_t + (1-\tau^n_t)w^F_t n^F_t + w^I_t n^I_t + \varpi u^F_t + B_t + \Pi^p_t - T_t \quad (11)$$

Recall the government's budget constraint:

$$\frac{B_{t+1}\pi_{t+1}}{R_t} - B_t = DF_t$$

Plugging this into (11):

$$(1+\tau_t^c)c_t + i_t + DF_t \leq r_t k_t + (1-\tau_t^n)w_t^F n_t^F + w_t^I n_t^I + \varpi u_t^F + \Pi_t^p - T_t \tag{12}$$

Recall also the definition of the deficit:

$$DF_t = g_t + \varpi u_t^F - (1-\xi^{TR})\left[(\tau_t^n + \tau_t^s)w_t^F n_t^F + \tau_t^c c_t + T_t\right] - \rho\gamma p_t^x x_t$$

Plugging this directly into equation (12):

$$\begin{aligned}(1+\tau_t^c)c_t + i_t + g_t + \varpi u_t^F - (1-\xi^{TR})\left[\tau_t^c c_t + (\tau_t^n + \tau_t^s)w_t^F n_t^F + T_t\right] - \rho\gamma p_t^x x_t = \\ r_t k_t + (1-\tau_t^n)w_t^F n_t^F + w_t^I n_t^I + \varpi u_t^F + \Pi_t^p - T_t\end{aligned}$$

Cancelling out the taxes and unemployment benefits, we have:

$$c_t + i_t + g_t - \rho\gamma p_t^x x_t = r_t k_t + (1 + (1-\xi^{TR})\tau_t^s - \xi^{TR}\tau_t^n)w_t^F n_t^F - \xi^{TR}(\tau_t^c c_t + T_t) + w_t^I n_t^I + \Pi_t^p \tag{13}$$

Recall now that (i) the price of the final good is normalised to 1, (ii) the retail firms turn x_t units of the intermediate good into y_t units of the final good, and (iii) the differentiated retail goods are costlessly aggregated into the final consumption good. Then by definition, the profit from the retail firm can be written as:

$$\Pi_t^p = y_t - p_t^x x_t \tag{14}$$

Substituting this into equation (13), we obtain:

$$c_t + i_t + g_t = r_t k_t + (1 + (1-\xi^{TR})\tau_t^s - \xi^{TR}\tau_t^n)w_t^F n_t^F - \xi^{TR}(\tau_t^c c_t + T_t) + w_t^I n_t^I + y_t - (1-\rho\gamma)p_t^x x_t \tag{15}$$

The price of the intermediate good, p_t^x, is determined by the zero-profit condition of the intermediate goods producing firm. That is, it satisfies:

$$\underbrace{(1-\rho\gamma)\,p_t^x x_t}_{\text{Revenue of intermediate firms}} - \underbrace{\left[(1+\tau_t^s)w_t^F n_t^F + w_t^I n_t^I + r_t k_t + \kappa^F \upsilon_t^F + \kappa^I \upsilon_t^I\right]}_{\text{Costs of intermediate firms}} = 0$$

Plugging this into equation (15):

$$\begin{aligned} c_t + i_t + g_t &= r_t k_t + (1 + (1-\xi^{TR})\tau^s_t - \xi^{TR}\tau^n_t) w^F_t n^F_t - \xi^{TR}\left(\tau^c_t c_t + T_t\right) \\ &\quad + w^I_t n^I_t + y_t - \left[(1+\tau^s_t) w^F_t n^F_t + w^I_t n^I_t + r_t k_t + \kappa^F \upsilon^F_t + \kappa^I \upsilon^I_t\right] \end{aligned} \tag{16}$$

Cancelling terms we have:

$$c_t + i_t + g_t = y_t - \left(\kappa^F \upsilon^F_t + \kappa^I \upsilon^I_t\right) - \xi^{TR}\left(\tau^c_t c_t + T_t + (\tau^s_t + \tau^n_t)\, w^F_t n^F_t\right) \tag{17}$$

Rearranging terms we get the final expression:

$$y_t = c_t + i_t + g_t + \kappa^F \upsilon^F_t + \kappa^I \upsilon^I_t + \xi^{TR} TR_t$$

C.3 Derivation of the wages

For each sector $j = F, I$ the Nash bargaining problem is to maximize the weighted sum of log surpluses:

$$\max_{w^j_t} \left\{(1-\vartheta^j)\ln V^h_{n^j t} + \vartheta^j \ln V^f_{n^j t}\right\}$$

where $V^h_{n^j t}$ and $V^f_{n^j t}$ are defined as:

$$V^h_{n^F t} = \lambda_{ct} w^F_t (1-\tau^n_t) - \Phi l_t^{-\varphi} + (1-\sigma^F)\lambda_{n^F t} \tag{18}$$

$$V^h_{n^I t} = \lambda_{ct} w^I_t - \Phi l_t^{-\varphi} + (1-\rho-\sigma^I)\lambda_{n^I t} \tag{19}$$

$$V^f_{n^F t} \equiv \frac{\partial Q}{\partial n^F_t} = (1-\rho\gamma)\, p^x_t (1-\alpha^F)\frac{x^F_t}{n^F_t} - (1+\tau^s_t) w^F_t + \frac{(1-\sigma^F)\kappa^F}{\psi^{fF}_t} \tag{20}$$

$$V^f_{n^I t} \equiv \frac{\partial Q}{\partial n^I_t} = (1-\rho\gamma)\, p^x_t (1-\alpha^I)\frac{x^I_t}{n^I_t} - w^I_t + \frac{(1-\rho-\sigma^I)\kappa^I}{\psi^{fI}_t} \tag{21}$$

The first order conditions of these optimization problems are:

$$\vartheta^F (1+\tau^s_t) V^h_{n^F t} = (1-\vartheta^F)\lambda_{ct}(1-\tau^n_t) V^f_{n^F t} \tag{22}$$

$$\vartheta^I V^h_{n^I t} = (1-\vartheta^I)\lambda_{ct} V^f_{n^I t} \tag{23}$$

Plugging the expressions for the value functions into these FOCs, we can rearrange to find expressions for w^F_t and w^I_t. Using (18), (20) and (22), we can solve for w^F_t, which yields:

$$w^F_t = \frac{(1-\vartheta^F)}{(1+\tau^s_t)}\left((1-\rho\gamma)\, p^x_t (1-\alpha^F)\frac{x^F_t}{n^F_t} + \frac{(1-\sigma^F)\kappa^F}{\psi^{fF}_t}\right) + \frac{\vartheta^F}{\lambda_{ct}(1-\tau^n_t)}\left(\Phi l_t^{-\varphi} - (1-\sigma^F)\lambda_{n^F t}\right)$$

$$(24)$$

Similarly using (19), (21) and (23), we can solve for w_t^I, which yields:

$$w_t^I = (1-\vartheta^I)\left((1-\rho\gamma)\,p_t^x(1-\alpha^I)\frac{x_t^I}{n_t^I} + \frac{(1-\rho-\sigma^I)\kappa^I}{\psi_t^{fI}}\right) + \frac{\vartheta^I}{\lambda_{ct}}\left(\Phi l_t^{-\varphi} - (1-\rho-\sigma^I)\lambda_{n^I t}\right) \quad (25)$$

D Calibration strategy

We calibrate the model using annual data on the Italian economy over the period 1982-2006.

D.1 Formal Labor market

We calibrate the labor-force participation and the unemployment rates that are related to the formal market to match the observed average values from the data. We set $lf \equiv n^F + u^F = 60\%$ and $\frac{u^F}{lf} = 10\%$. Then using definitions we can get:

$$u^F = \frac{u^F}{lf} lf$$

$$n^F = lf - u^F$$

We fix the separation rate, σ^F, equal to 0.07 and we can derive:

$$m^F = \sigma^F n^F$$

and

$$\psi^{hF} = \frac{m^F}{u^F}$$

Since there is no exact estimate for the value of the formal vacancy-filling probability, ψ^{fF}, in the literature, we use what is considered as standard by setting it equal to 0.96. Hence, we can also derive:

$$\upsilon^F = \frac{m^F}{\psi^{fF}}$$

We set the matching elasticity with respect to vacancies, μ_2, equal to 0.7, close to the estimate for Italy in Peracchi and Viviano (2004). Then the matching efficiency parameter for the formal sector can be set to satisfy:

$$\mu_1^F = \frac{m^F}{(\upsilon^F)^{\mu_2}\left(u^F\right)^{1-\mu_2}}$$

D.2 Formal Production

We set the capital depreciation rate, δ, equal to 0.088. Then we derive $\frac{i}{k}$:

$$\frac{i}{k} = \delta$$

Following the literature, we set the discount factor, β, equal to 0.96. Next, we get R:

$$R = \frac{1}{\beta}$$

and

$$r = R - 1 + \delta$$

The elasticity of demand for intermediate goods, ϵ, is set such that the gross steady-state markup, $\frac{\epsilon}{\epsilon-1}$, is equal to 1.25, and the price of the final good is normalized to one. Then p^x is determined by:

$$p^x = \frac{\epsilon - 1}{\epsilon}$$

We set the TFP parameter in this sector $A^F = 1$ and the capital share $\alpha^F = 0.36$. We set the probability of audit and the fraction of total profits paid as a fine in the event of an audit as follows: $\rho = 0.02$, which is close to the value used in Boeri and Garibaldi (2007), and $\gamma = 0.3$. Then we can obtain from the firms' FOC with respect to capital:

$$\frac{y^F}{k} = \frac{r}{(1 - \rho\gamma)\, p^x \alpha^F}$$

From the production function in the regular sector we have:

$$\frac{n^F}{k} = \frac{1}{A^F} \left(\frac{y^F}{k} \right)^{\frac{1}{1-\alpha^F}}$$

Using definitions we can then obtain:

$$k = n^F \left(\frac{n^F}{k} \right)^{-1}, \; y^F = \frac{y^F}{k} k, \; i = \frac{i}{k} k$$

We set the vacancy costs in the formal sector $\kappa^F = 0.14$ and the payroll tax rate $\tau^s = 0.16$ close to the value used in Orsi et al. (2014). Then we have:

$$w^F = \left[(1 - \rho\gamma)\, p^x (1 - \alpha^F) \frac{y^F}{n^F} - (R - 1 + \sigma^F) \frac{\kappa^F}{\psi^{fF}} \right] / (1 + \tau^s)$$

D.3 Informal Production

We set the TFP in the informal sector $A^I = 0.6$ and $\alpha^I = 0.4$. Using Istat data we set $\frac{n^I}{n} = 0.13$ and we can derive:

$$n^I = \frac{\frac{n^I}{n}}{1 - \frac{n^I}{n}} n^F$$

Then by definition we have:

$$y^I = (A^I n^I)^{1-\alpha^I}, \; y = y^F + y^I$$

D.4 Informal Labor Market

We set the exogenous job destruction rate in the informal sector $\sigma^I = 0.0545$. We denote by $\tilde{\sigma}^I$ the total steady state separation rate in the underground sector, that is:

$$\tilde{\sigma}^I \equiv \sigma^I + \rho$$

Then we have

$$m^I = \tilde{\sigma}^I n^I$$

Then we set $\psi^{fI} = 0.05$ and get:

$$v^I = \frac{m^I}{\psi^{fI}}$$

We set the vacancy cost in the informal sector $\kappa^I = 0.13$ and derive

$$w^I = (1 - \rho\gamma)\, p^x (1 - \alpha^I) \frac{y^I}{n^I} - (R - 1 + \tilde{\sigma}^I) \frac{\kappa^I}{\psi^{fI}}$$

D.5 Fiscal Variables

Next, we set the replacement rate, $\frac{\varpi}{w^F}$, equal to 0.35 close to the estimates in Martin (1996), also used by Fugazza and Jacques (2004). Then by definition:

$$\varpi = \frac{\varpi}{w^F} w^F$$

We set government spending and the tax rates as follows: $\frac{g}{y} = 11\%$, $\tau^n = 0.4$, in line with Orsi et al. (2014), and $\tau^c = 0.18$. Then by definition:

$$g = \frac{g}{y} y$$

We set the steady state debt-to-GDP ratio from the data, $b = 103\%$ and using the law of motion of debt-to-GDP we derive

$$\frac{DF}{y} = (\beta - 1)b$$

and by definition

$$DF = \frac{DF}{y} y$$

We set the corruption parameter $\xi^{TR} = 0.2$. Then using the definition of the deficit we derive

$$TR = \frac{g + \varpi u^F - \rho\gamma p^x y - DF}{1 - \xi^{TR}}$$

Then using the resource constraint we have:

$$c = y - i - g - \kappa^F \upsilon^F - \kappa^I \upsilon^I - \xi^{TR} TR$$

and from the definition of tax revenues we have

$$T = TR - (\tau^n + \tau^s)\, w^F n^F - \tau^c c$$

D.6 Household

We set the intertemporal elasticity of substitution, $\frac{1}{\eta}$, equal to 0.5 and the weight of private consumption in effective consumption, $\alpha_1 = 1$ for the case of wasteful government spending. For the case of utility-enhancing spending we set $\alpha_1 = 0.85$ and $\alpha_2 = -0.25$, so that private and public spending are complements. This gives us the consumption bundle by definition:

$$cc = [\alpha_1 (c)^{\alpha_2} + (1 - \alpha_1)(g)^{\alpha_2}]^{\frac{1}{\alpha_2}}$$

and also:

$$\lambda_c = \frac{cc^{(1-\eta-\alpha_2)} \alpha_1 c^{(\alpha_2 - 1)}}{1 + \tau^c}$$

We then use the following three equations:

$$[1 - \beta(1 - \sigma^F) + \beta\psi^{hF}]\lambda_{n^F} = \beta\lambda_c \left[(1 - \tau^n) w^F - \frac{u^F}{u^F + u^I}\varpi\right]$$

$$[1 - \beta(1 - \tilde{\sigma}^I) + \beta\frac{m^I}{u^I}]\lambda_{n^I} = \beta\lambda_c \left[w^I - \frac{u^F}{u^F + u^I}\varpi\right]$$

$$\lambda_{n^I}\frac{m^I}{u^I} = \lambda_{n^F}\psi^{hF} + \lambda_c\varpi$$

to solve for the three unknowns λ_{n^F}, λ_{n^I} and u^I. This gives us, by defintion:

$$\psi^{hI} = \frac{m^I}{u^I}$$

$$l = 1 - lf - n^I - u^I$$

$$u = u^F + u^I$$

$$s = \frac{u^I}{u}$$

$$\mu_1^I = \frac{m^I}{(\upsilon^I)^{\mu_2}\,(u^I)^{1-\mu_2}}$$

We set the value of leisure in the utility function, φ, equal to 2. Then we can derive Φ to satisfy:

$$\Phi = \left(\lambda_c\varpi + \lambda_{n^F}\psi^{hF}\right) l^{\varphi}$$

We set the bargaining power parameters in the two sectors to satisfy:

$$\vartheta^F = \frac{\Omega_1^F - w^F}{\Omega_1^F - \Omega_2^F}$$

$$\vartheta^I = \frac{\Omega_1^I - w^I}{\Omega_1^I - \Omega_2^I}$$

where $\Omega_1^F \equiv \left[(1-\rho\gamma)\, p^x(1-\alpha^F)\frac{y^F}{n^F} + \frac{(1-\sigma^F)\kappa^F}{\psi^{fF}}\right]/(1+\tau^s)$, $\Omega_1^I \equiv \left[(1-\rho\gamma)\, p^x(1-\alpha^I)\frac{y^I}{nI} + \frac{(1-\tilde{\sigma}^I)\kappa^I}{\psi^{fI}}\right]$, $\Omega_2^F \equiv \left[\Phi l^{-\varphi} - (1-\sigma^F)\lambda_{n^F}\right]/\left(\lambda_c\left(1-\tau^n\right)\right)$, $\Omega_2^I \equiv \left[\Phi l^{-\varphi} - (1-\tilde{\sigma}^I)\lambda_{n^I}\right]/\lambda_c$.

D.7 Other Parameters

The steady state debt-to-GDP target is set equal to the actual debt-to-GDP ratio, $b^* = b = 103\%$. In order to achieve a 5% drop in the debt-to-GDP target 10 periods after a shock, we set $\rho_1 = 0.85$ and $\rho_2 = 0.0001$. We set the inflation targeting parameter in the Taylor rule, $\zeta_\pi = 1.5$, the capital adjustment costs $\omega = 0.5$ and the price-stickiness parameter $\chi = 0.25$. Finally, we set the parameters of the fiscal policy rule in each case to ensure that we meet the target after 10 periods.

E Additional Figures

Figure 9: Comparison of Benchmark and Full Model - Expenditure Cut

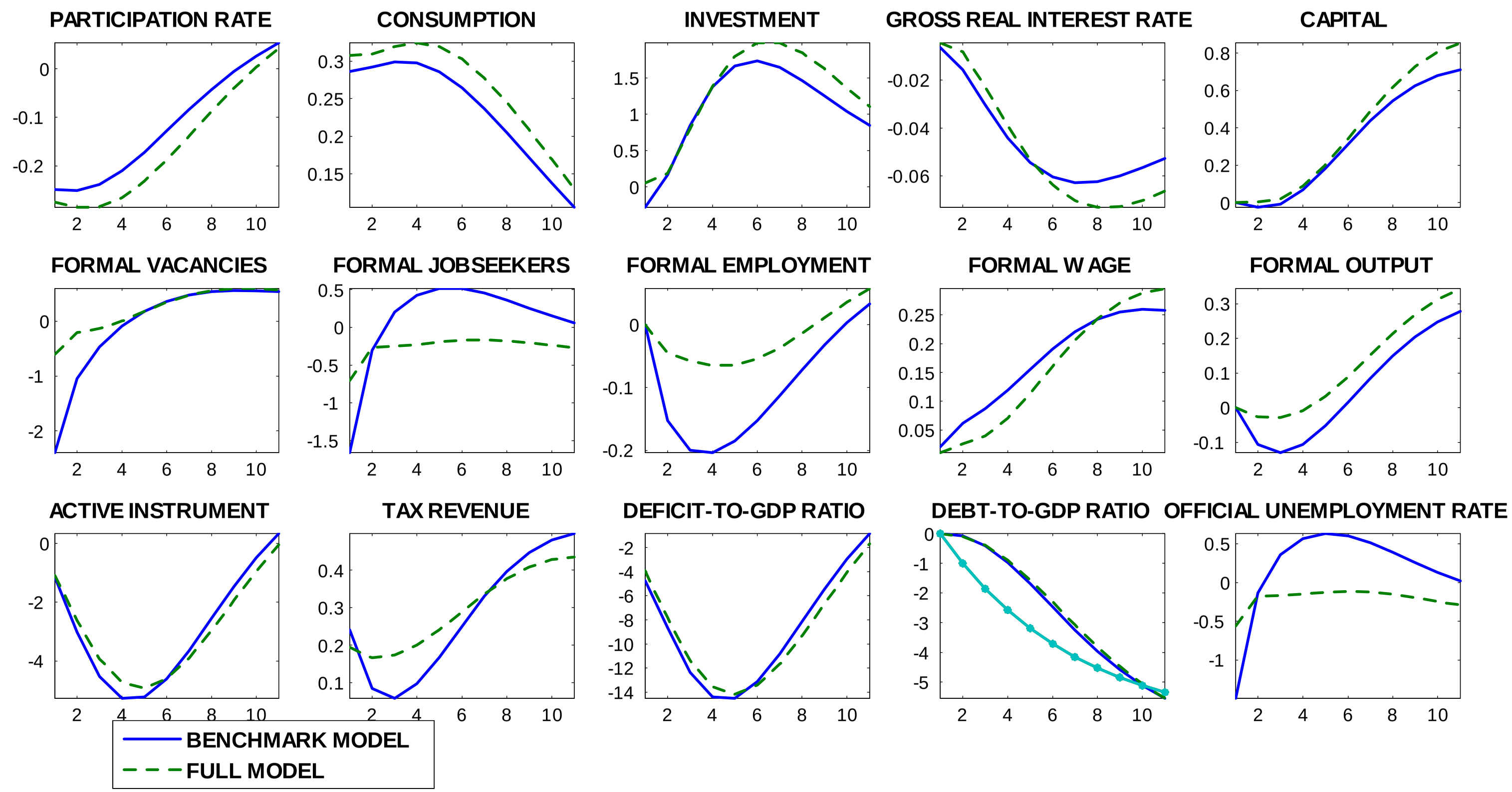


Figure 10: Comparison of Benchmark and Full Model - Labor Tax Hike

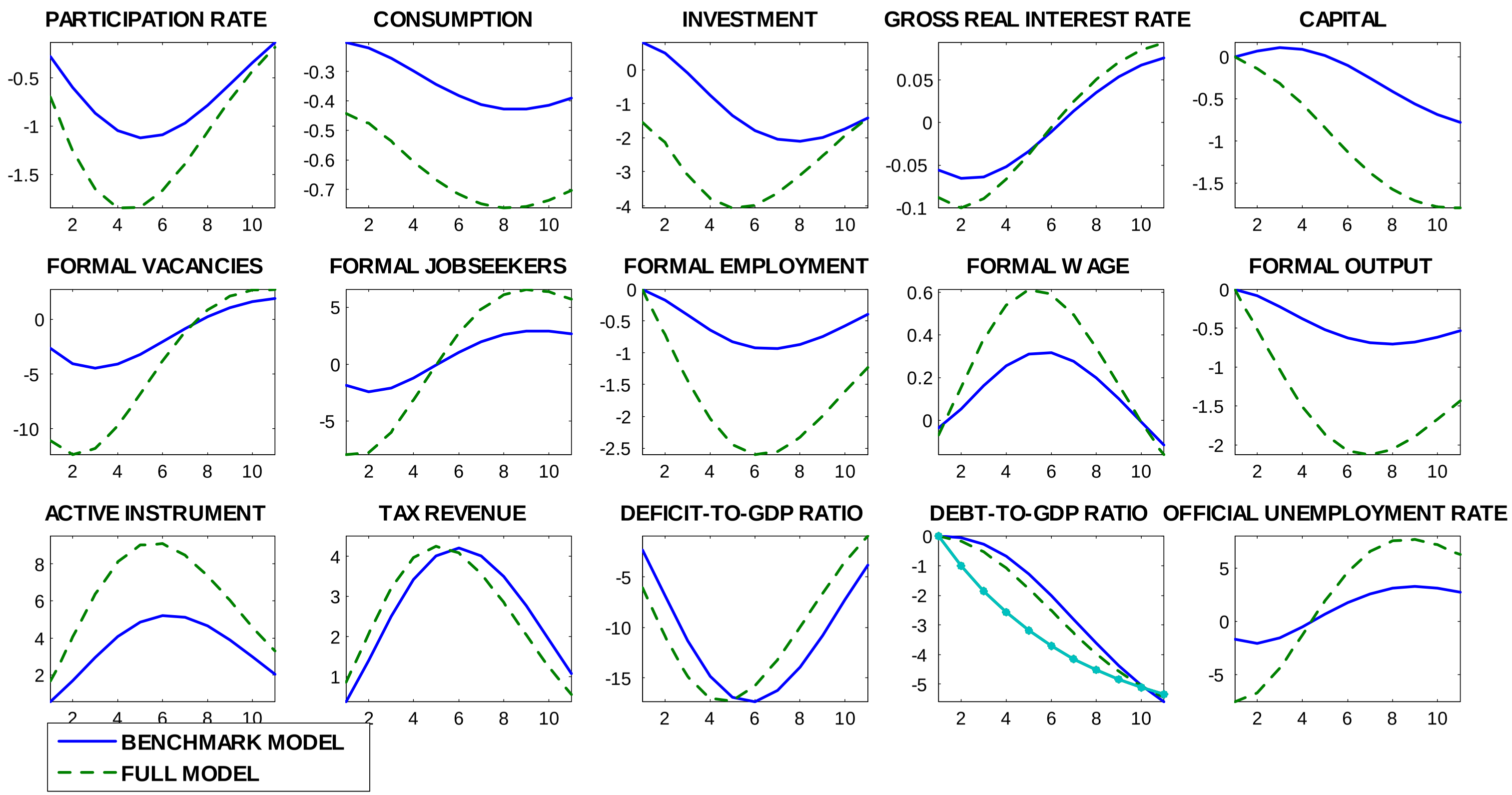


Figure 11: Comparison of Benchmark and Full Model - Mixed Consolidation