The macroeconomics of fiscal consolidations in a monetary union: the case of Italy

L. Forni, A. Gerali, M. Pisani

Bank of Italy

Tesoro (MEF), Dec 2, 2009
Research agenda: use of DSGE model for fiscal policy analysis
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...in a general equilibrium setting

Disavantages: tipically representative agent (no redistribution), strong modeling assumptions
We started from an estimated closed economy model for the Euro Area (JPubE 2009)
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Find papers on www.lforni.it
Goals of this paper

We build a medium scale dynamic general equilibrium currency-union model of the Italian and rest of the euro area economy

Quantitatively assess the macroeconomic and welfare implications of different Italian ... consolidation scenarios

We introduce distortionary taxes on labor income, capital income and consumption

Distinguish between public spending on final goods and services produced by the private sector, public employment and transfer to families

Assume also that public expenditure is welfare-enhancing

Focus on efficiency considerations; no redistribution (representative agent)

We ask the following questions:
1. Can it be welfare improving to reduce the public debt in Italy?
2. We evaluate different consolidation scenarios in terms of composition (expenditures and revenues)
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- We build on Forni-Monteforte-Sessa (2009).
Brief description of the model (fiscal)
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Calibration
Rest of the talk outline

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- Conclusions
The model

Standard medium scale 2 areas (Italy and rest of EA) monetary union DSGE model (same currency):

- Monopolistic competition in goods and labor market
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- Monopolistic competition in goods and labor market
- Traded and non traded goods
- Nominal and real rigidities
- Incomplete international asset markets: government and private bonds are traded internationally
- There is an area-wide central bank that sets short-term nominal interest rate according to a Taylor rule
The model: fiscal policy

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

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

Total government revenues \( T_t \) are given by the following identity:

\[
T_t = \tau_w W_t L_t^g + \tau_c \left[ P_t C_t^g + P_t C_t^g \right] + \tau_k \left[ R_k + D_t \right]
\]

The government produces public goods:

\[
Y_g = \left( \gamma G \right)^{1/\alpha} C^{\alpha} + \left( 1 - \gamma G \right)^{1/\alpha} L^{\alpha}
\]

The model is closed by a …scal rule that use a single instrument \((i)\) to bring the debt to the target level \((b)\):

\[
i_t = \left( \phi b_t \right)
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\[
Y^g = \left( (1 - \gamma_G)^{\frac{1}{\alpha}} C^\frac{\alpha - 1}{\alpha} + (1 - \gamma_G)^{\frac{1}{\alpha}} L^\frac{\alpha - 1}{\alpha} \right)^{\frac{\alpha}{\alpha - 1}}
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\]

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\[
Y_g = \left( (\gamma_G) \frac{1}{\alpha} C_g^{\frac{\alpha-1}{\alpha}} + (1-\gamma_G) \frac{1}{\alpha} L_g^{\frac{\alpha-1}{\alpha}} \right)^{\frac{\alpha}{\alpha-1}}
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The model is closed by a fiscal rule that uses a single instrument \((i)\) to bring the debt to the target level \((b^*)\):

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\frac{i_t}{i_{t-1}} = \left( \frac{b_t}{b^*} \right)^{\phi_1}
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Simple log-linear but approximately optimal (Smitt-Groe’ e Uribe 2006)
The model: agents

- The expected value of household $j$ lifetime utility is given by:

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

$$\tilde{C}_t(j) = \left[ \omega \frac{1}{\theta} C_t(j)^{\frac{\theta-1}{\theta}} + (1 - \omega) \frac{1}{\theta} Y_t^g \frac{\theta-1}{\theta} \right]^{\frac{\theta}{\theta-1}}$$
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- The nominal flow budget constraint for Ricardian agent $i$ is given by

$$(1-\tau^w_t) W_t(i) L_t(i) + (1-\tau^k_t) [R^k_t K_t(i) + D_t(i)] + B_t(i) + Tr(i) + \frac{\tau^c_t}{1+\tau^c_t} P_t I_t(i)$$

$$= P_t C_t(i) + P_t I_t(i) + \frac{B_t(i) + 1}{R_t} + \frac{\psi}{2} \left( \frac{I_t(i)}{K_t(i-1)} - \delta \right) P_t k_{t-1} + \frac{\phi}{2} \left( \frac{W_t(i)}{W_{t-1}(i)} - \pi \right)^2 W_t L_t$$
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- Definition of GDP

$$GDP = C + C_g + I + EXP - IMP + wL^g$$
Basic ingredients

1. Forward looking agents (wealth effect on consumption and hours)
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2. Public expenditures are not pure waste (public goods in the utility function)
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1. Forward looking agents (wealth effect on consumption and hours)
2. Public expenditures are not pure waste (public goods in the utility function)
3. Distortionary taxation (on labor, capital and consumption)
### Table 4. Steady-state National Accounts Decomposition
(Base-Case Parameters)

<table>
<thead>
<tr>
<th></th>
<th>Italy</th>
<th>Rest of the Euro Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ratio of GDP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private consumption</td>
<td>59.7</td>
<td>56.8</td>
</tr>
<tr>
<td>Private Investment</td>
<td>20.7</td>
<td>14.2</td>
</tr>
<tr>
<td>Export</td>
<td>25.8</td>
<td>23.6</td>
</tr>
<tr>
<td>Imports</td>
<td>25.9</td>
<td>23.6</td>
</tr>
<tr>
<td><strong>MACRO VARIABLES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public purchases $C_g$</td>
<td>9.3</td>
<td>9.3</td>
</tr>
<tr>
<td>Transfer to households</td>
<td>17.1</td>
<td>16.7</td>
</tr>
<tr>
<td>Wage bill ($wl_g$)</td>
<td>11.0</td>
<td>11.9</td>
</tr>
<tr>
<td>Public Investment $I_g$</td>
<td>2.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Primary total expenditures</td>
<td>39.7</td>
<td>40.2</td>
</tr>
<tr>
<td>Interests</td>
<td>4.6</td>
<td>5.3</td>
</tr>
<tr>
<td>Total expenditures</td>
<td>44.3</td>
<td>45.6</td>
</tr>
<tr>
<td><strong>FISCAL VARIABLES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor income revenues</td>
<td>20.4</td>
<td>23.1</td>
</tr>
<tr>
<td>Capital income revenues</td>
<td>10.1</td>
<td>13.0</td>
</tr>
<tr>
<td>Consumption revenues</td>
<td>10.1</td>
<td>9.6</td>
</tr>
<tr>
<td>Sum of the above revenues</td>
<td>40.6</td>
<td>45.7</td>
</tr>
</tbody>
</table>

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

For the fiscal variables: expenditure figures are from AMECO database for 2006 (Ban of Italy 2007); revenues data are from Eurostat (2007) and refer to 2005.
Optimal policy in these models

- Optimal policy would prescribe:
  1. Distortionary taxes should be zero; all revenues levied through lump-sum taxes (if allowed).
  2. If lump-sum taxes not allowed, move to negative debt level.

Policy makers would find these prescriptions unpalatable.
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We borrow consolidation scenarios from official documents (DPEF)
Fiscal consolidation scenarios

- The *target* level for the debt decreases by 10 points of GDP in 5 years
Fiscal consolidation scenarios

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- We keep the path for the target level of debt unchanged across scenarios
Fiscal consolidation scenarios

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- We keep the path for the target level of debt unchanged across scenarios.
- We consider scenarios that differ in the composition of tax rates and expenditure levels.
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- We consider fully credible and fully anticipated scenarios and run perfect-foresight simulations
Fiscal consolidation scenarios

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- We consider scenarios that differ in the composition of tax rates and expenditure levels
- We consider fully credible and fully anticipated scenarios and run perfect-foresight simulations
- Two measures of welfare in consumption equivalents: steady state comparison and *welfare with transition x*

\[ x \ s.t. \quad \sum_{i=1}^{\infty} \beta^i U(xC_{ss1}, L_{ss1}) = \sum_{i=1}^{\infty} \beta^i U(C_i, L_i) \]
### Table 7. Steady state comparisons (% changes)

<table>
<thead>
<tr>
<th></th>
<th>No change in expenditures</th>
<th>No change in tax rates</th>
<th>Reduction in labor tax rate</th>
<th>Reduction in capital tax rate</th>
<th>Reduction in both tax rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B,\pi$</td>
<td>$B,\tau_k$</td>
<td>$B,C^g$</td>
<td>$B,L^g$</td>
<td>$B,Tr$</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP</td>
<td>1.1</td>
<td>0.4</td>
<td>2.8</td>
<td>2.7</td>
<td>5.2</td>
</tr>
<tr>
<td>Private consumption</td>
<td>1.4</td>
<td>0.7</td>
<td>5.8</td>
<td>5.5</td>
<td>8.6</td>
</tr>
<tr>
<td>Public good ($V_g$)</td>
<td>0.1</td>
<td>0.1</td>
<td>0.8</td>
<td>1.9</td>
<td>0.5</td>
</tr>
<tr>
<td>Investment</td>
<td>1.5</td>
<td>2.7</td>
<td>3.7</td>
<td>5.6</td>
<td>8.6</td>
</tr>
<tr>
<td>Export</td>
<td>0.2</td>
<td>0.2</td>
<td>0.4</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Import</td>
<td>1.8</td>
<td>1.6</td>
<td>4.6</td>
<td>5.9</td>
<td>4.4</td>
</tr>
<tr>
<td>Hours worked ($L$)</td>
<td>1.4</td>
<td>0.3</td>
<td>3.6</td>
<td>4.7</td>
<td>4.0</td>
</tr>
<tr>
<td>Real wage ($w$)</td>
<td>-0.6</td>
<td>0.8</td>
<td>-1.5</td>
<td>-2.2</td>
<td>-1.9</td>
</tr>
<tr>
<td>After-tax real wage</td>
<td>2.0</td>
<td>0.8</td>
<td>7.2</td>
<td>6.4</td>
<td>3.4</td>
</tr>
<tr>
<td>Terms of trade</td>
<td>1.2</td>
<td>1.1</td>
<td>3.0</td>
<td>4.4</td>
<td>2.8</td>
</tr>
<tr>
<td>Welfare</td>
<td>0.0</td>
<td>0.5</td>
<td>0.4</td>
<td>-0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Rest of the Euro area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP</td>
<td>0.4</td>
<td>0.3</td>
<td>1.0</td>
<td>1.4</td>
<td>0.9</td>
</tr>
<tr>
<td>Private Consumption</td>
<td>0.4</td>
<td>0.4</td>
<td>1.0</td>
<td>1.4</td>
<td>0.9</td>
</tr>
</tbody>
</table>

L. Forni, A. Gerlai, M. Pisani (Bank of Italy)  
Fiscal consolidation  
Tesoro (MEF), Dec 2, 2009  
Page 14 / 25
Lessons

1. Consolidating only through tax rates implies increasing taxes in the short run and bringing them to a new lower level in the new ss (after the debt and interest expenditure has been reduced).

2. Acting only on expenditures - leaving taxes unchanged - implies cutting them in the short run but having them above the initial ss in the long run.

3. 1 and 2 have similar level of welfare (zero). Consolidation through taxes has bigger effects on macro variables.

4. When cutting taxes and expenditures at the same time high and positive welfare gains.

5. The scenarios entailing the highest levels of welfare are those where expenditures cuts are concentrated on purchases of goods and services and public employment (Ricardian agents).
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We consider robustness w.r.t.:

- Frish elasticity of labor supply $1/(\tau - 1)$: 2 in the baseline $\rightarrow$ 0.5
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- 35% share of credit constrained agents
### Table 9. Robustness, steady state comparisons (% changes)

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>$\tau = 3$</th>
<th>$\omega = 0.5$</th>
<th>$\theta = 0.8$</th>
<th>$\lambda = 0.35$</th>
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<tbody>
<tr>
<td></td>
<td>$[B, C^o]$</td>
<td>$[B, C^p]$</td>
<td>$[B, L^o]$</td>
<td>$[B, L^p]$</td>
<td>$[B, T^r]$</td>
</tr>
<tr>
<td><strong>Italy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP</td>
<td>5.2</td>
<td>5.1</td>
<td>7.4</td>
<td>4.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Private consumption ($C^*$)</td>
<td>10.2</td>
<td>9.6</td>
<td>7.1</td>
<td>8.7</td>
<td>9.1</td>
</tr>
<tr>
<td>Public good ($Y^g$)</td>
<td>-5.5</td>
<td>-12.9</td>
<td>0.9</td>
<td>-5.6</td>
<td>-23.3</td>
</tr>
<tr>
<td>Non Ricardian consumption ($C^{NR}$)</td>
<td>12.2</td>
<td>17.4</td>
<td>15.3</td>
<td>10.4</td>
<td>17.0</td>
</tr>
<tr>
<td>Investment</td>
<td>0.8</td>
<td>1.3</td>
<td>1.1</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Export</td>
<td>8.6</td>
<td>14.9</td>
<td>12.4</td>
<td>6.6</td>
<td>14.4</td>
</tr>
<tr>
<td>Import</td>
<td>3.1</td>
<td>1.1</td>
<td>5.9</td>
<td>1.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Hours worked ($L^*$)</td>
<td>2.1</td>
<td>0.1</td>
<td>1.0</td>
<td>2.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Real wage ($w^*$)</td>
<td>11.0</td>
<td>8.9</td>
<td>9.8</td>
<td>11.7</td>
<td>9.1</td>
</tr>
<tr>
<td>After-tax real wage ($(1 - \tau^t)w^*$)</td>
<td>5.5</td>
<td>9.4</td>
<td>7.9</td>
<td>4.3</td>
<td>9.0</td>
</tr>
<tr>
<td>Terms of trade</td>
<td>6.5</td>
<td>5.3</td>
<td>4.1</td>
<td>6.0</td>
<td>3.8</td>
</tr>
<tr>
<td>Welfare: steady state</td>
<td>4.7</td>
<td>3.1</td>
<td>2.2</td>
<td>4.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Welfare: with transition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rest of the Euro area</td>
<td></td>
<td></td>
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<td>1.8</td>
<td>3.0</td>
<td>2.5</td>
<td>1.3</td>
<td>2.8</td>
</tr>
<tr>
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<td>1.8</td>
<td>3.0</td>
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<td>1.3</td>
<td>2.8</td>
</tr>
</tbody>
</table>
How about the transition? Fiscal variables

Figure 2. Baseline scenario: fiscal variables
How about the transition? Macro variables

Figure 3. Baseline scenario: macroeconomic variables

- Private consumption, %dev from ss
- Public goods, %dev from ss
- Investment, %dev from ss
- Total employment, %dev from ss
- Real wage, %dev from ss

Scenario Tr, Scenario Lg, Scenario Cg
Conclusion: main messages

- 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.

- In all scenarios considered we assumed a reduction of the target debt to GDP ratio of 10 percentage points over five years.
- The assumed fiscal consolidation can be welfare improving if:
  1. cut taxes and expenditures at the same time
  2. cut purchases of goods and services or public employment rather than transfers to households (wealth effect on Ricardian agents)
  3. results seem robust to parameter changes
  4. transition is not costly
  5. the spillover effects are sizable

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Results seem robust to parameter changes and the transition is not costly.
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- The assumed fiscal consolidation can be welfare improving if:
  1. cut taxes and expenditures at the same time
  2. cut purchases of good and services or public employment rather than transfers to households (wealth effect on Ricardian agents)
  3. results seem robust to parameter changes
  4. transition is not costly
Conclusion: main messages

- 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.

- In all scenarios considered we assumed a reduction of the *target* debt to GDP ratio of 10 percentage points over five years.

- The assumed fiscal consolidation can be welfare improving if:
  1. **cut taxes and expenditures at the same time**
  2. **cut purchases of good and services or public employment rather than transfers to households (wealth effect on Ricardian agents)**
  3. **results seem robust to parameter changes**
  4. **transition is not costly**
  5. **the spillover effects are sizable**
THE END
Labor income wedge ($\tau^w = 43\%, \tau^c = 17\%$ in the case of Italy):

$$\frac{U'_L}{U'_C} = w \left( \frac{1 - \tau^w}{1 + \tau^c} \right) \left( \frac{1 - \vartheta}{\vartheta} \right)$$
The model: tax wedges in steady state

- Labor income wedge ($\tau^w = 43\%$, $\tau^c = 17\%$ in the case of Italy):

$$\frac{U'_L}{U'_C} = W \left( \frac{1 - \tau^w}{1 + \tau^c} \right) \left( \frac{1 - \vartheta}{\vartheta} \right)$$

- Capital income wedge ($\tau^k = 29\%$ in the case of Italy):

$$r^k = \frac{1 - \beta(1 - \delta)}{\beta(1 - \tau^k)}$$
### Table 5. Steady state comparisons: reduction in tax and expenditure distortions

<table>
<thead>
<tr>
<th></th>
<th>Tax distortions (1% of GDP)</th>
<th>Expenditure distortions (1% of GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>([Tr, \tau_w])</td>
<td>([Tr, \tau_k])</td>
</tr>
<tr>
<td><strong>Italy</strong></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Output</td>
<td>1.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Consumption</td>
<td>2.3</td>
<td>1.1</td>
</tr>
<tr>
<td>Investment</td>
<td>2.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Export</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Import</td>
<td>3.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Hours worked</td>
<td>2.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Effective labour cost</td>
<td>-1.0</td>
<td>1.4</td>
</tr>
<tr>
<td>After-tax real wage</td>
<td>3.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Terms of trade</td>
<td>2.0</td>
<td>1.8</td>
</tr>
<tr>
<td>Welfare: steady state</td>
<td>1.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Welfare: with transition</td>
<td>1.0</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Rest of the Euro area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Consumption</td>
<td>0.7</td>
<td>0.6</td>
</tr>
</tbody>
</table>
Where are the trade-offs

Figure 1. Welfare (% deviation from steady state), compensating the tax cuts with different expenditure items
Latest generation of DSGE model very popular among CB (ECB, NCB, Bank of Canada, Bank of Sweden...) and International Institutions (IMF, EC...)

- Robust to the Lucas critique for policy analysis
- Good for both the US and EA (Smets and Wouters JEEA 2003, AER 2007)
- Bayesian estimation outperform other methods (Fernandez-Villaverde and Rubio-Ramirez, JE 2004)
- Can take into account agents' expectations, various transmission channels of fiscal policy, interaction with monetary policy, international spillovers
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