The Macroeconometric model for Italy - MeMo-It

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Workshop - Settore reale e finanziario nei modelli dell’economia italiana
Outline

1. Institutional framework

2. MeMo-It
   - Theoretical background
   - MeMo-It multiplier

3. Investments: details
Econometric studies + R. Golinelli Building the core of the Istat system of models for forecasting the Italian economy: MeMo-It, 2013


In 2011 - Isae (Public Institute for Economic Analysis) became part of Istat

Isae funtions (forecasting and policy analysis moved to Istat

- EZEO;
- prices (IPCA);
- industrial production index
- Italy’s economic outlook
- Monthly report

In Europe only Insee and Statistics Norway release projections
Key point in forecasting activity

- continue the previous collaboration and release
- revising methodology
- develop a new macroeconometric model for the Italian economy
- New macroeconometric model (MeMo-It) - 22 May 2012
Principal dissemination area
New area
New area

Economic forecasts and microsimulations

On January 1, 2011 some of the functions performed by Isae were handed over to Istat which expanded its competence and strengthened its role in relation to policy makers and the community.

In particular, they include forecasting and short-, medium- and long-term economic analysis and the development of microsimulation models of the effects of fiscal policies on households, businesses and institutions.

The results of forecast activities are disseminated through different products.

- **Italy’s Economic Outlook** provides estimates of GDP and its main components, calculated twice a year – in May and November – for the current and the two subsequent years. The processing is based on the forecasting model MeMo-It (Macroeconomic Model for Italy) developed by Istat (please, see Rivista di statistica ufficiale n.1/2013).

- **Euro Zone Economic Outlook** is a quarterly estimate of the trend of key Euro indicators. The note is prepared jointly by the IFO for Germany, INSEE for France and Istat for Italy.

- The **Monthly report** provides an update of the progress of the Italian economy along with quarterly forecasts of the Italian GDP growth and some analysis of the leading economic indicators. The note is published within the first week of the following month, while the update of the quarterly forecasts is made available only in the months of February, May, August and November.

The results of the development of **microsimulation models** for policy assessment are made available through different products.

- **Effects of tax provisions on enterprises**: this note analyzes the effects of the main provisions on enterprise income taxation. The analysis is carried out by means of the new microsimulation model ISTAT-Matis (Model for the Analysis of Taxation and Incentives on Corporations).
theory comes first versus facts come first

Frontier that reflects different optimal composition between economic theory and data (Pagan, 2003)
Optimal composition

- at the top we have models (such as RBCs and DSGEs) that aim to interpret the data
- at the bottom we have models (such as VARs) that aim to summarize the data
- data coherence pays more than theory coherence in terms of models’ forecasting ability
Institutional interpretation

- the thin line might represent the academic situation: it has a flat slope on the hypothesis that academic MM target publishers (and referees) pay more attention to the theoretical aspects of the empirical work, rather than data coherence.
- the thick line shows the Istat modeling choice for its new MM.
- the systematic use of the latest available (and continuously updated) statistical information to feed MeMo-It, integrating the best available data with both theoretical and institutional knowledge.
MeMo-It modeling is a mixture of both LSE and Fair-updated Cowles Commission approaches and techniques: in order to merge theory and data at point B, MeMo-It uses cointegration methods on dynamic sub-systems to estimate theory-interpretable and identified steady state relationships, imposed in the form of equilibrium-correction models.

In absence of weak exogeneity property single equations are preliminarily inspected by estimating parameters with 2SLS. When the whole model is assembled, all MeMo-It parameters are simultaneously estimated with 3SLS. Note that the use of conventional formulae for computing the asymptotic covariance of the 2SLS/3SLS estimators and the Wald-type test statistics remain good approximations despite the fact that model variables may be integrated; see Hsiao (1997a and 1997b)
Statistical agencies are constantly revising data, both to incorporate further information and to update their definitions to reflect advances in economic theory and measurement. The issue faced by all macro modelers is how to incorporate those changes in a consistent way. Fernandez-Villaverde (2008)

Annual data entail two NA data releases per year (in March and October), just in the eve of each the two releases of the MeMo.It forecast scenarios in May and November.

The annual periodicity makes easier the modeling of medium-long term features of the economy which helps longer range forecasts (five years ahead and beyond) because, from annual data, medium-term business cycles may better emerge (see Comin and Gertler (2006))
new-keynesian inspiration; economic growth is driven from demand side in the short-run
in the long-run potential output is the equilibrium
in the short-run disequilibrium from potential output are related to movements on prices
MEMo-It

econometric approach

- identification of the main blocks: supply side (potential output), consumption, price, foreign sector, government, labour markets, Phillips curve
- preliminary estimation of the single block (2 stages)
- final estimation of the model (3 stages) looking at the quality of the forecast in the sample
- The dynamic features of the model have been evaluated both by means of ad hoc exercises that shock exogenous variables compared to the solution pattern and by forecast accuracy in the sample
MeMo-It

variables

- 53 endogene related to behavioral equation
- 78 identity
- 65 exogenous
- 9 scenario (exchange rate, oil-price, world growth)
Multiplier

- Multipliers are the way to better understand the consistency of the full empirical system with the underlying economic theories (Fair).
- Multiplier exercises consist of looking at the effects on a number of endogenous variables such as GDP and inflation of permanent changes in some exogenous variables, such as the fiscal instruments. To do so, for each endogenous variable of interest we will compute and report the deviations (in percentage points for the variables in flows, in absolute differences for variables representing ratios or rates) between the shocked solution and a baseline scenario of MeMo-It model over the period 2012 to 2018 (over an horizon of 7 years).
we will report the results of four alternative fiscal stimuli

- an increase (Hp1) in Government spending (GS)
- an increase (Hp2) in Government transfers to households (TRH);
- a reduction in (Hp3) households income tax (ITH)
- a reduction in (Hp4) in consumption tax (CT).
multiplier results

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hp 1:</td>
<td>0.7</td>
<td>0.5</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Hp 2:</td>
<td>0.2</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Hp 3:</td>
<td>0.2</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Hp 4:</td>
<td>0.1</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
</tr>
</tbody>
</table>
### Table 2: The effect of multipliers on HP 1 for relevant variables

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>0.7</td>
<td>0.5</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Unemployment</td>
<td>-0.2</td>
<td>-0.2</td>
<td>-0.3</td>
<td>-0.3</td>
<td>-0.3</td>
<td>-0.2</td>
<td>-0.1</td>
</tr>
<tr>
<td>Consumer price</td>
<td>0.3</td>
<td>0.7</td>
<td>1</td>
<td>1.4</td>
<td>1.6</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Trade balance (% GDP)</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.4</td>
</tr>
</tbody>
</table>
multiplier comments

- The increase in public spending (Hp 1) directly affects the domestic demand in real terms, while the increase in transfers to households (Hp 2) and the reduction in households income tax (Hp 3) both affect the households disposable income in nominal terms and, in this way, affect consumption, which is another component - as direct public spending - of the total domestic demand. Finally, the reduction in consumption tax (Hp 4) is implemented through a decrease in the VAT tax rate which leads to the reduction in consumption prices and, for this way, an increase in households income in real terms that, in turn, affect consumption spending.
the fiscal multipliers in Table 1 are overall in line with the new-Keynesian models and much smaller than those in Keynesian models (similar results are in Cogan et al., 2010), because the effect on GDP diminishes as non government components are crowded out by higher inflation due to demand pressures on the supply.

if we compare our multiplier outcomes with those obtained by Coenen et al. (2012) using various DSGE models, we note that the time profile is quite similar.

despite very different methodological approaches and unequal degree of coherence with data, MeMo-It neo-Keynesian theoretical roots clearly emerge.
FIGURA 5. INVESTIMENTI IN PRODOTTI DELLA PROPRIETÀ INTELLETTUALE NEI PAESI EUROPEI
Anni 1995-2015, numeri indice 2007=100, valori concatenati
Aggregate investment is a key variable in the macroeconomic debate especially in the on-going economic situation characterized by severe recessions and slowing economic growth. More generally the design of sound policy measures to stimulate investment expenditure over the short and medium term run is a fundamental purpose of macroeconomic policy.

At the macro level, in particular, little is known about the role of financial constraints and uncertainty in explaining investment dynamics and about long and short run properties of asset specific business expenditure.
In Memo-It we propose a VECM model augmented to include liquidity and uncertainty measures. The VECM framework, allows us to estimate long and short run relationships and to test for the weak exogeneity of a subset of variables in a multivariate framework, where all the variables of interest are a priori endogenous.

Through our model we aim also to provide an answer to the following questions: How much financial constraints and uncertainty hamper business investment? Do they produce only short-run effects? Are these effects asset specific?
We model Italian business investment over the period 1980-2012, distinguishing between Total Business capital stock, Non Residential buildings, Machinery and Equipment and Information and Communication Technology (ICT).

Liquidity and uncertainty are key determinants of investment behaviour, especially in the short run and for ICT. In simulation exercises ICT emerges as a key policy variable to foster the Italian economic recovery.
The accelerator model of Clark (1917) and the neoclassical intertemporal optimisation model of Jorgenson (1963) have been the first benchmark models to explain investment behaviour. As both models descend from theories of investment conditional on the level of output, following Caballero (1999) we can see them as nested in the definition of the flexible accelerator (Clark, 1944, and Koyck, 1954):

\[ I_t = \sum_{k=1}^{n} \beta_k \Delta K^*_t - k \]

where \( I \) is the investment, \( K^* \) is the desired stock of capital, and \( \beta \)'s are parameters.
Given that $K^*$ is unobservable, we can define it, in the spirit of Eisner (1969), as a function of income ($Y$) and substitution effects, the latter measured by the neoclassical cost of capital ($uc$), without any theoretical parameters’ restriction:

$$k^*_t = a_0 + \alpha_1 y_t + \alpha_2 uc_t$$

- $\alpha_1 = 1$ and $\alpha_2 = 0$ then accelerator model
- $\alpha_1 = 1$ and $\alpha_2 = -1$ then flexible neoclassical model
- $k^*_t$ is not observable but we might model $k_t$ as trying to keep pace with it
Micro evidence

- Micro empirical evidence suggests that the short-run fluctuation of capital accumulation might be substantially related to the effects of uncertainty and changes in liquidity constraints (Hubbard, 1998, Bloom et al. 2007)

- The measure of financial condition is from Istat’s monthly business survey, where firms are asked 'how do you judge the current level of liquidity (quite good, normal, bad). Low level of the index implies difficult financial conditions.

- The index of uncertainty is gathered from Bloom’s Economic Policy Uncertainty Index site (high levels of the index refers to significant levels of uncertainty)
Investments by asset

Total capital stock ($k_{tot}$) is distinguished into the following assets: machinery and equipment ($k_{me}$), non-residential ($k_{nres}$) and information and communication technologies ($k_{ict}$). To get the sense of the differences across the assets notice that in 2010 the capital share of each asset is equal to 40.8%, 55.4% and 3.8% respectively.
Liquidity and uncertainty might be estimated in a macro environment in 2 steps:

- first the traditional cointegration relationships are evaluated and then the residuals are regressed against liq and unc
- This strategy assumes that each variable exerts its effects or in the long or in the short-run.
- However, this hypothesis might be too strong to hold since there can be variables affecting capital accumulation both at low and high frequencies. The cost of capital is a good example in this respect
- To explore all these options in a comprehensive framework we adopt a Vector Error Correction Model (VECM) (Johansen, 1995).
- The vector of variables for the aggregate representation is

\[ Z^{agg} = (k^{agg}, y, uc^{agg}, liq, unc) \]

- while that for the three representations by asset becomes

\[ Z^j = (k^j, y, uc^j, liq, unc) \]

with \( j = me, nres \) and \( ict \)
The results show that the desired level of capital stock is related to the output $y$ and to the specific user costs $UC$.

In particular, the desired level of aggregate capital stock strongly reacts to changes in output together with a smaller negative influence of the user cost; although the negative sign is coherent with the theory, the estimated intensity is always significantly lower than 1.

ICT follows flow adjustment instead of stock adjustment.
the price of uncertainty

<table>
<thead>
<tr>
<th></th>
<th>uncertainty</th>
<th>liquidity</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GDP</strong></td>
<td>0.2</td>
<td>0.2</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Business investments</strong></td>
<td>2.1</td>
<td>2.5</td>
<td>4.8</td>
</tr>
<tr>
<td>- ICT</td>
<td>15.0</td>
<td>9.3</td>
<td>25.7</td>
</tr>
<tr>
<td>- Machinery &amp; equipments</td>
<td>0.5</td>
<td>1.8</td>
<td>2.3</td>
</tr>
<tr>
<td>- Non-residential buildings</td>
<td>0.5</td>
<td>1.2</td>
<td>1.7</td>
</tr>
<tr>
<td><strong>Capital stock</strong></td>
<td>0.6</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Full time equivalent employees</strong></td>
<td>0.1</td>
<td>0.1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

(a) % changes in 2013 with respect to the actual levels.
###Prospetto 3. Elasticità di breve e lungo periodo del modello degli investimenti

<table>
<thead>
<tr>
<th></th>
<th>Totale investimenti</th>
<th>Non residenziale</th>
<th>Macchinari e attrezzature</th>
<th>Proprietà intellettuale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elasticità all'output</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>breve</td>
<td>2,4</td>
<td>4,8</td>
<td>1,8</td>
<td>1,1</td>
</tr>
<tr>
<td>lungo</td>
<td>1,2</td>
<td>1,0</td>
<td>1,6</td>
<td>1,0</td>
</tr>
<tr>
<td><strong>Elasticità all'incertezza</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>breve</td>
<td>-0,1</td>
<td>0,0</td>
<td>-0,1</td>
<td>-0,2</td>
</tr>
<tr>
<td>lungo</td>
<td>-0,3</td>
<td>0,0</td>
<td>0,0</td>
<td>-0,9</td>
</tr>
<tr>
<td><strong>Var. % di un aumento di 100 punti base del tasso di interesse</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>breve</td>
<td>-0,8</td>
<td>-0,5</td>
<td>-1,0</td>
<td>-0,8</td>
</tr>
<tr>
<td>lungo</td>
<td>-2,8</td>
<td>-0,4</td>
<td>-1,5</td>
<td>-6,2</td>
</tr>
<tr>
<td><strong>Elasticità complessiva al risultato lordo di gestione</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>breve</td>
<td>0,4</td>
<td>0,2</td>
<td>0,6</td>
<td>0,2</td>
</tr>
<tr>
<td>lungo</td>
<td>0,3</td>
<td>0,0</td>
<td>0,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>
next steps

- long run properties
- relation between short-run model and annual model (Midas approach)
- how to manage for some features of well-being