# THE MACROECONOMETRIC MODELS FOR ITALY (MEMO-IT): POLICY EVALUATION AND FUTURE CHALLANGES

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## 1. Introduction

In May 2012, Istat released its first macroeconomic forecasts for 2012-2013 based on MeMo-It, the new Macroeconometric Model of the Italian economy (Istat, 2012). The development of MeMo-it was the result of the transfer of the forecasting duties from Isae to Istat. The driving principles of the new model are the transparency and the best fit to the available information set and to a lesser extent the adeherece to a theoretical economic paradigm.

The research activity to develop MeMo-It follows two main lines: the first is devoted to extend the capabilities of the model for policy evaluations and aims at increase its ability to perform real time analysis of policy measures; the other is focused on the improvements of the methodological features of the model.

MeMo-it is currently used to accomplish Istat institutional commitments (the so called Audizioni) and at the same time, it is subject to continuous developments to incorporate to the energy sector and to improve its long-run properties.

After a short presentation of the main features of MeMo-It in section 2, section 3 discusses some evidence on its capabilities for policy evaluation. Section 4 illustrates the state of the art of the ongoing research activity to develop the model and section 5 concludes.

## 2. MeMo-It characteristics[1]

MeMo-It is an annual model for the Italian economy that requires two sets of external (exogenous) information over the forecasting period. First, consistent assumptions about the developments of the international scenario (such as trade growth, exchange rates, ECB interest rates, and the oil price). Second, an annual estimate of key GDP components obtained from short-term models based on monthly and quarterly data available at the time of forecast (SMeMo-It). Thus the

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[1] For a detailed description of the model's characteristics see Bacchini et al. 2013

final annual projections are based on the full information set available at the time forecasts are released according to SMeMo-It for the first simulation year. For example, the forecast exercise in November is based on SMeMo-It that uses the quarterly information on National Accounts (NA) about the first two quarters of the year and thus provides a preliminary picture of the current annual values of the main NA aggregates . This information is introduced in MeMo-It by means of add factors and intercept corrections, interpreted as a fine-tuning of statistical information rather than a form of combined or judgmental forecasts (Stekler, 2007).

**Figure 1 –** *Outline of MeMo-It block relationships*
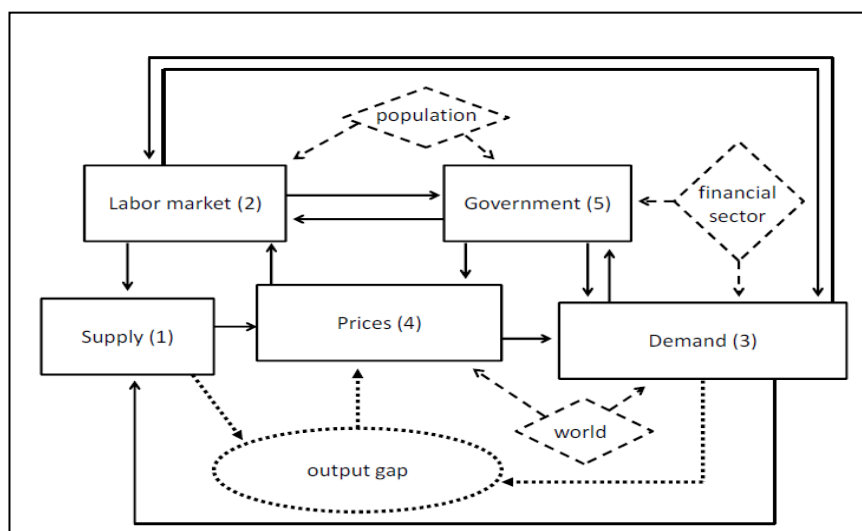


The theoretical modeling background of MeMo-It is a mixture of both the approach of the London School of Economics and the techniques of the Fair-updated Cowles Commission: in order to merge theory and data, MeMo-It uses cointegration methods on dynamic sub-systems to estimate theory-interpretable and identified steady state relationships, imposed in the form of equilibrium-correction models. However, in absence of weak exogeneity property (see Pesaran et al., 2001), single equations are preliminarily inspected by estimating parameters with two-stage least squares (2SLS). When the whole model is assembled, all MeMo-It parameters are simultaneously estimated with three-stage least squares (3SLS). Note that the use of conventional formulae for computing the asymptotic covariance of the 2SLS/3SLS estimators and the Wald-type test statistics are good approximations despite the fact that the variables of the model might be integrated

(Hsiao, 1997a and 1997b). The diagram in Figure 1 outlines the main relationships that characterize MeMo-It.

In particular, the five rectangles represent the model's basic blocks that are progressively numbered from 1 to 5. In addition, three rhombuses denote the main sources of external information for the age- and gender-structure of the population, the ECB policy interest rate (in the financial sector) and global variables, such as world demand, exchange rates, oil price and other import prices. Arrows identify the causal structure of the MeMo-It relationships across blocks.

MeMo-It is substantially based on the New-Keynesian approach where the supply side of the economy plays a central role. Accordingly, the underlying key assumption is that, in the short-run the economic activity is mainly driven by the demand side, while in the long run the economic system converges to potential output given by the supply side. Prices react to the output gap and, in this way, they accounts for the disequilibrium of supply and demand.

The dotted arrows in the lower portion of Figure 1 represent the interactions arising from such disequilibrium (between the supply and demand rectangles) and the output gap (in the oval circle) that, in turn, affects the prices rectangle. At the moment of the first press release in May 2012, MeMo-It was composed by 53 stochastic equations and 78 identities.


## 3. The evaluation of the fiscal policy using MeMo-It

Istat currently provides economic analysis and policy evaluations of government fiscal policy measures. Recent examples are the evaluations of 'Legge di stabilità' or 'Documento di programmazione economica e finanziaria'. The macroeconomic impact of policy reforms is simulated  by means of multiplier analysis. The analysis can be defined as an impulse-response summary of the model's parameters in a reduced form summarizing the performance of the model as a whole. This analysis is also very informative about the main transmission mechanisms embodied in the model (see for example Coenen et al. 2012). If, as an example, we would like to evaluate the macroeconomic impact of an increase in Government spending (equal ex ante to 1 percent of baseline GDP in the initial year (i.e. 2013)[2], we see, from Figure 1, that there is a positive effect on GDP that influences the prices through the output gap. Then, there are also slight positive effects on unemployment and negative effects on the trade balance due to the larger domestic demand and to the negative competitiveness effect. Precisely GDP will expect to grow in the period 2013-2015 (0.7, 0.5 and 0.4 respectively) and unemployment to decrease (-0.2, -0.2 and -0.3 respectively).

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[2] See Bacchini et al. 2013 for further analysis on multiplier

Table 1 below shows the results of a simulation exercise performed[3] in June 2013, to evaluate the impact of a reduction of the tax wedge paid by enterprises (table 1)[4].

**Table 1** – *Effect of a reduction on the tax wedge paid by enterprises*

|                        | 2013 | 2014 | 2015 |
|------------------------|------|------|------|
| GDP                    | 0.0  | 0.2  | 0.2  |
| Consumption            | 0.1  | 0.4  | 0.5  |
| Investment             | 0.3  | 0.6  | 0.9  |
| Employees              | 0.7  | 1.2  | 1.6  |
| Real disposable income | 0.6  | 0.7  | 0.9  |

## 4. Future challenges for MeMo-It

New questions to solve, better fit to the data are the main advancements for a macroeconometric model. The extension of MeMo-it to the energy and environment domain is at the top of the research agenda for this year. This is followed by the reinforcement of the long-run properties of the model. In this section we briefly account for the developments in these areas[5].

*The extension to energy*

MeMo-It is currently being extended to model energy and environmental features in order to become a relevant tool to evaluate the impact of related policy measures on the Italian economy. The development strategy is organized in two main steps: first, MeMo-It will be extended to account for demand and supply of energy (2E-MeMo-It-S1); then it will include an environmental module starting from the carbon emissions (see for example Reynes et al. 2011) (2E-MeMo-It-S2).

In a first stage the model will include in the supply side a KLEM production function to account for the use of energy inputs in the production process. The energy and intermediate inputs used in the production process are demanded by the business sector of the economy. Therefore it is necessary to explicitly model both demand functions of E (energy) and M (intermediates inputs) and add them to the supply side KLEM block represented in figure 2. The demand for energy and

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[3] See Istat 2013, Audizione Commissione Lavoro Pubblico e Privato

[4] Reduction is equal to 1 p.p. of GDP (ex-ante). Results are illustrated in terms of deviation from the standard scenario without the tax wedge reduction.

[5] The research agenda includes an intensive activity for the methodological improvements in the short-run models. A new proposal for the forecast of the Eurozone GDP has been presented at international conference on July 2013 and a new methodological proposal for the foresight of the Italian industrial index of production will be presented at the end of the year together with the evolution of SMeMo-It.

intermediates will be modelled through behavioral equations able to explain both short and long run dynamics. Energy prices will be modeled accordingly. The above structure allows to evaluate the effects of energy policies on the business sector through their impact on the demand of production inputs. At the same time, we include the household energy consumption in the demand block.

First, energy consumption will be modelled without distinguishing among the energy assets but referring to an energy aggregate including gas, oil, electricity and renewable sources. Then the analysis will be focused on the extension of 2E-MeMo-It to the environment. Figure 2 shows the block structure of the economy-energy-environment model and illustrates the main transmission channels between the supply and demand side of the economy and the environment (blue lines). The explicit inclusion of the environment will lead to the inclusion of a module for the evaluation of the emissions.

**Figure 2** – *Developing 2E-MeMo-It*
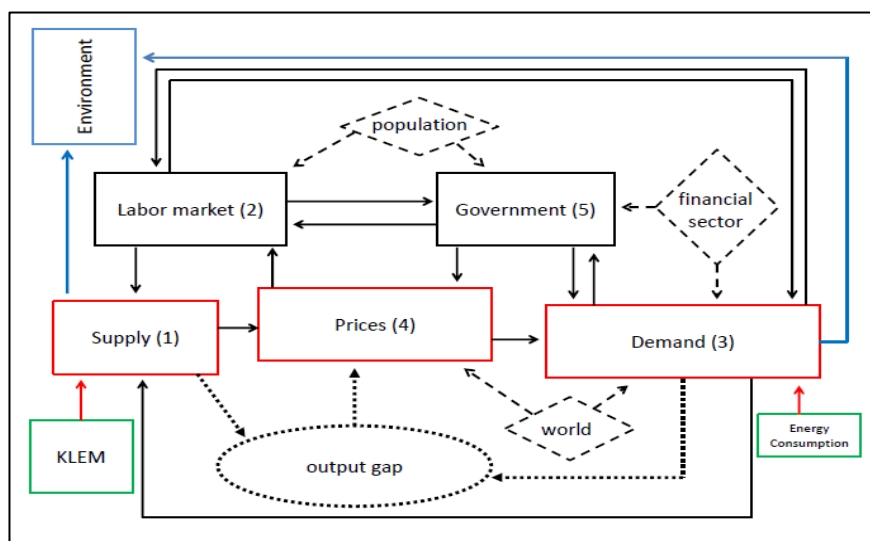


A preliminary version of the 2E-MeMo-It will be presented at the end of 2013.

*The long-run features[6].*

The classical Pagan (2003)'s representation, reported in Figure 3 below, introduces the frontier concept, also recalled in Bacchini et al (2013): models along this frontier all belong to the category of "best practice" models, even though they reflect different tastes and preferences that, in turn, are due to the motivations of the institution to which modellers belong. MeMo-It could be upgraded from type I to the "best practice" models or the type II hybrid models (with explicit long-run equilibrium) by paying more attention to its long-run properties and by including the modelling of stocks. In fact type II hybrid models meet other three requirements:

- their equilibrium path must descend from an a priori theoretical view that, in turn, requires some parameters restrictions (e.g. RBC type small model for the UK of Garratt et al, 2003);
- some decisions may be influenced by expectations about the future;
- they must provide a consistent treatment of stocks and flows.

**Figure 3 –** *Where MeMo-It is and where it could be*
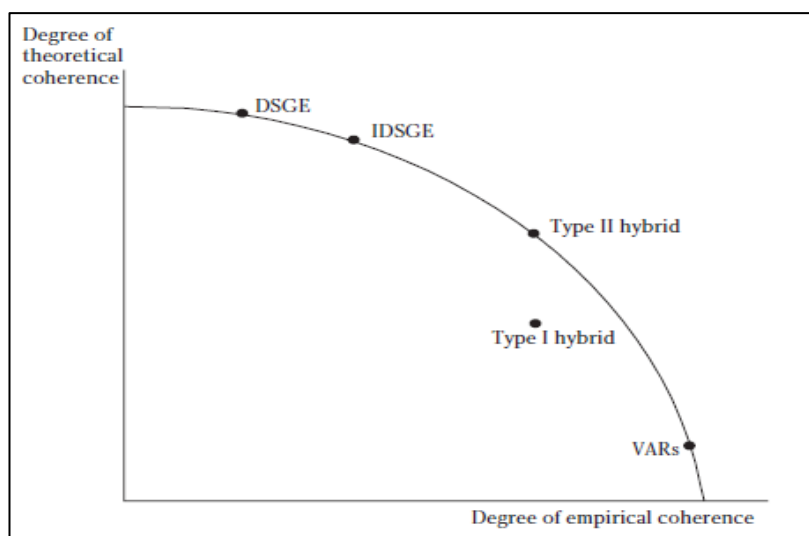


MeMo-It attainment of an explicit long-run equilibrium path (steady-state growth) would not only allow a better understanding of its theoretical structure, but it would also provide terminal conditions for dynamic solutions of models

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[6] A more comprehensive discussion on the limits of MeMo-It is illustrated in Bontempi 2013

consistent expectations. In order to achieve this aim, it has to improve the degree of theoretical coherence while maintaining the same degree of empirical evidence. Rather than imposing restrictions to the data ex-ante, the actual data (in this case, the estimated parameters) are used to interpret and to constrain the long-run relationships. The proposed steps can be easily implemented since the block-structure of the model can be formally represented by a number of long-run/steady-state relationships. The suggested steps are the following:

s1) Start from the latest version of the estimated model, produce a plausible long-run (40 or 50 years) scenario for the exogenous variables of the model by also investigating their persistence properties, then use this scenario in order to simulate the long-run steady-state solution.

s2) If the model converges, analyse the main features of the long range simulation; if not, investigate what trends - hidden in some intercept, in some missing long-run homogeneity restriction, or in some exogenous variables assumption - prevent the model from stabilizing.
These two preliminary steps accomplish the "clean-the-model" phase, where many iterations may be needed.

s3) When a long-range solution is reached, compare its main features with the main stylized facts of mainstream DSGE or RBC models

s4) Test for cross-equation parameters' restrictions needed to reach long-run micro-founded relationships.

s5) Finally, perform a number of key multipliers' exercises in order to assess - in the light of alternative theoretical explanations - where the model converges and through which pattern.

All the steps that have been described are currently under investigation.


## 5. Conclusion

This paper provides a snapshot of the main features of MeMo-It, the macroeconometric model developed by Istat in 2012 together with the current research activities for its implementation.
Further developments will be focused on modeling Investment behavior across assets types and on the integration of micro models on households and firms in MeMo-It.

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**SUMMARY**

In May 2012 Istat released for the first time its macroeconomic forecasts for 2012-2013 based on MeMo-It, the new Macroeconometric Model of the Italian economy. Following its presentation, the model has been used also for policy evaluation in the institutional documents presented by Istat.

This paper illustrates both the model results for policy evaluation and the research activities that are ongoing to extend the domain of analysis of the model to the energy sector. At the same time the features concerning the long-run properties and the relation between MeMo-It and the short-run models and the microeconometric models are also illustrated.

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