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The Istat Macroeconometric
Model (MeMo-It)

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The new Istat Macroeconometric Model: improvements in statistical information availability and labour force projection

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Abstract

After some introductory comments devoted to the presentation of Istat new Macroeconometric Model MeMo-It at the LII Annual Scientific Meeting of Sie, the second section of this foreword spells out the main possible areas of cooperation between Istat and Sie, in an effort to implement a more open access to and improve the quality of statistical data-bases for research purposes. The third section considers some of the key issues relevant when dealing with labour markets and the theoretical approach chosen by the model. I will argue that in the contemporary framework new needs for labour force projection and job requirements should be considered and connected to the drive shaft of the econometric model.

Keywords: data-base availability and quality, labour markets, microdata, human capital, manpower forecasting.

1. Introductory comments

The assignment to the Italian National Institute of Statistics (Istat), since January 2011, of the responsibility of macroeconomic forecasting activities represents, first of all, an important shift in the very role and functions of Istat. It fosters, moreover, a switch of mind and a new attention and investment by scientific associations and particularly by the Italian Economic Association (Sie).

It is precisely in order to mark this shift that Sie decided to invite the team of experts sharing the responsibility for the MeMo-It model to present it in a parallel session devoted to the modelling of Italian economy in the LII Annual Scientific Meeting of Sie, held last year at the University of Matera. The presentation was carried out by Fabio Bacchini, with the contribution of Roberto Golinelli, while the discussion was introduced by Maria Elena Bontempi and Ottavio Ricchi, with the active contribution of several scholars attending the session.

The works presented in that session are now published in this issue of Istat quarterly journal, after a revision allowing the different authors to take advantage of the fruitful discussion held on that occasion.

This novel responsibility of developing a new macroeconometric model represents, in fact, a further step in the actual acknowledgment that Istat is a public research organisation,

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a core independent producer and a guarantor authority of official statistics to the service of citizens and policy-makers.

A parallel recent institutional change should be also mentioned, since it can lead to a significant improvement in the capability of interaction between Istat and the academic and scientific communities, as well as with the other stakeholders in civil society. In December 2011 the *Commission for the Users of the Statistical Information* (Cuis) was established and Sie is actively taking part in its activities.

These changes foster a switch of mind and require a new awareness and investment by scientific associations because, through closer cooperation with Istat, they can help to solve frictional problems as well as strategic issues in the field of statistical information availability and quality. The *Commission for University and Research* (Cur) established by Sie did start to work and make proposals on both trajectories.

The second section of this foreword is therefore devoted to clarify the main proposals made in this spirit by Cur and Sie.

The third section deals with some of the key issues that can be raised while reasoning on the theoretical approach selected for dealing with labour markets in the model. I will also argue that in the contemporary framework new needs for labour force projection and job requirements should be considered and connected to the drive shaft of the econometric model.

2. Institutional changes and new cooperation opportunities between Istat and Sie

As suggested before, recent institutional changes in Istat foster a new attitude by scientific associations, in general, and by Sie, in particular. The new cooperation framework can help to improve the array and quality of the statistics made available to the public, solving also frictional problems. Moreover, and more important, it can help to face new strategic issues, with better chances to find sustainable solutions to them.

Cur has intensely worked in the last three years with the aim of setting up proposals of cooperation on both trajectories.

In the first place, it has produced a wide-ranging document, circulated through Cuis, in which several suggestions have been advanced for improving, in the short-medium term, the availability and quality of data-bases for academic and non-academic research. In our proposal, these should be obtained also trough the merging of existing different sources[2] in order to make better applied studies and policy assessment in different fields possible.

The proposed baseline, which builds on the research practice adopted in the different fields of applied economics, refers to a multi-layer perspective. The main layers refer to:

a) the collection of new data-bases which are needed in research topics relevant for crucial policy actions;[3]

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[2] Internal, but also external to Istat.
[3] For instance, the effects of financialization of the economy and global crisis on firm networks and value chains; the procedures through which firms are redesigning their job openings, organization of knowledge, sectorial specialization and value creation in the new international division of labour; the new problems of interaction between labour demand and supply, from skill mismatch to over/under education, over/under skilling, over/under qualification, over/under utilization.

b) the need of new approaches for the measurement of immaterial activities, human capital, social capital and migration;

c) the need for new arrangements allowing for a timely and effective quality assessment of the enlarging base of administrative and managerial statistical sources;

d) the need to develop the longitudinal or diachronic dimension of socio-economic statistics;

e) the improvement of the modes employed in collecting and processing data on microeconomic variables[4] and mesoeconomic variables;[5]

f) the need to generally improve the procedures for accessing statistical data-bases.

In the second place, Cur worked with the aim of focusing Cuis and Istat attention on a strategic issue accrued in a more tangible way rather recently in the world of economic research. A quantum leap in microdata utilization has occurred in the last twenty years or so. The two main interconnected drivers of change have been: (a) the technological and scientific progress in processing, elaboration and estimate of statistical information, through statistical and econometric techniques; (b) the need to employ new assessment methods in the evaluation of social and economic impact of public policies at the local national and supra-national level. Dataset panels[6] and geographical units are the core requirements in the survey of heterogeneous behaviour.

Available microdata bases, also due to the new procedures recently implemented by Istat, allow for quite a few applications, but severe limitations[7] still persist and independent researchers are not yet able to find their way in an uneven quasi-market environment.

If this is true for fully available microdata sources, I should add that we are under-exploiting also the "statistical oilfields" that are available at Istat or could be nurtured at the SISTAN level, through the merging of administrative data-archives of different authorities.

This issue has strong implications both on the career prospect of applied researchers and on the quality of statistical information available at the central and local level to public bodies, business organization and the media, at large. Together, these two implications make evident that the basic principle at stake is the guarantee of democratic access to microdata bases.

In this perspective a lot could still be done and Sie is ready to collaborate in the best suited ways to improve the availability of microdata for applied research in Italy. Among the suggestions made, I consider very relevant, also for its concrete co-financing side, the idea to cooperate with Istat in launching a two-stage program aiming at favouring the access to new and improved microdata bases. The main purpose of the programme is to recover and enhance the value of well defined "statistical oilfields" which, after a phase of appropriate cleaning up and maintenance, would be used for research activities jointly

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[4] For instance, prices, physical capital stock, households wealth, labour markets and human capital circulation, real estate markets, R&D and innovation.

[5] The need for a new system of territorial statistics, both for improving the quality of applied research and for planning appropriate policy actions, is evident. E.g., in Italy, there will be room to improve information on territorial accounts, cyclical data at a local level, and the production of data on spatial consumer behaviour, environmental indicators, commodities circulation, firm localization and mobility, local labour markets, material flows and transport infrastructures, immaterial flows and communication infrastructures.

[6] That is, longitudinal data on single individuals and household and, even more, on single firms, agencies and other organizations.

[7] The main reasons which could explain this deadlock are linked to privacy regulation, cultural habits, budget restraints and also to a still prevailing rent-seeking attitude.

by Istat researchers and academic researchers and then made freely accessible to the public for research purposes. After a selection of the best suited statistical oilfields, in the first stage a "call for ideas" concerning their "exploring potential" could be issued with the support of Sie and other scientific associations. In the second stage, a "call for projects", again with the support of Sie and other scientific associations, could be launched, on the basis of the ideas developed in the first phase, and the best projects for each oilfield selected.

No new structure or consortium would be required and the main aim is to foster, even in a recession phase, an effective and efficient cooperation between Istat/SISTAN and academic researchers, giving full recognition to the principle of democratic access to microdata.

In the same spirit, I find the proposal made by Maria Elena Bontempi in her paper highly valuable. Her wish that "MeMo-It shall become open source, publicly available and fully documented" (Bontempi, 2013, pp. 48-49) is strongly supported by Sie for all the reasons made clear in her work, but also for the motives stirring Sie proposals.

3. Key issues and new needs for forecasting activities

For several and sometimes contrasting reasons, that would require a specific paper on the topic, labour market functioning became crucial for the generality of economic profession only after the take off of the New Classical Macroeconomics.[8]

Given the important and complex role played by labour markets in the overall economy and the increasing weight of the highly educated and skilled labour force in them, I would suggest to reconsider the choice to stick to assumptions like: homogeneous labour force, perfect competition equilibrium; absence of segmentation between generations. Moreover, there is an evident strong need to anticipate the flows and stocks among the different regions in the different sections of jobs and manpower. An open econometric model supporting these projections would be highly valuable.

In my view, we can find good reasons for this reappraisal if we first consider the requirements of the European 2020 strategy in the Euro-Mediterranean perspective, and if we look at the main facts referring to the labour markets for highly educated people in Italy, comparing them with those characterizing the United States situation. This is why I will devote this section to this exam.

3.1. Smart growth in Europe and Italy inside the Euro-Mediterranean area

While the economic and financial crisis is still deeply affecting labour markets, especially in Italy and Europe, and depressing in particular both occupational opportunities and earnings capacity of highly qualified young people, the capability of carrying out the education of competent graduates, to employ them and to foster life-long education is more and more crucial in order to increase people's employability, productivity and firms' competitiveness.

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[8] For instance, this is rather amazing that, as Addison and Siebert (1979, p. 1) remember us, Paul Samuelson (1954, p. 380) suggested that economists horrified by the mathematical and formal directions taken by their discipline might "sublimate their feelings" and "transfer from economic theory" in to a safe haven such as labour economics.

In this general context, the economic prospects of the Euro-Mediterranean Countries (EMCs) are uncertain, not only due to the long-lasting effects of the global economic crisis, social turbulence and political unrest, but also because of the impact of long term structural changes in the international division of labour and the shortage of political and institutional tools pre-arranged by the EU and the international community at large.

Furthermore, the post 2011 events in the Southern shore of the Mediterranean Sea ask us to reconsider the European integration process taking into account the new challenges and the deep interactions between the Northern and the Southern shores, as well as to implement new priorities and regional economic unions.

We may even say that, after all, at least some of the many determinants of the "Arab spring" were not unpredictable. For sure, what has been called the "fever under the skin" of the Arab world heads to a brand new stage of development.

The main research question we should focus on is the following: after at least six years of global crisis, is it realistic to conceive a European strategy for promoting employment based on smart, sustainable and inclusive growth? And, if the answer is positive, is it desirable and realistic to implement such a strategy by adopting an outward-oriented approach with positive scale effects?

As it has been the case with the transformation of the Eastern-Central Europe Countries (ECECs) after the fall of the Berlin wall, the puzzle of the present crisis reflects many of the factors acting at a global scale: the impact of long-term fragmentation in trade and production; the emergence of new economic powers; the changing composition of population and labour force.

In fact, if we take into account the proper time lag, we may note clear similarities between the ongoing transition of the ECEC and the potential transformation of the Arab League Countries (ALCs). For instance, the number of countries in each group is similar (27 countries and 22 respectively); the two groups of countries are similar in the size of projected population in 2030 (384.7 and 412.8 million), even if the latter exhibits a higher speed of growth and the median age is much lower.

Of course strong differences are also present: while the EU first comers countries are all included in the group with a very high HDI, the ECEC are concentrated in the group with high HDI and the ALC are mostly distributed between the high HDI group and the low HDI group. But this can be also consistent with the assimilation of the present events to a new transition process.

However, the subsequent key question is: how a new transition is likely to take place if the EU, in competition/cooperation with the US, will not invest enough in it?

Structural and behavioural changes are now taking an accelerated speed, following a long-run trend pre-existent to the global crisis: scale effects in many spheres of economic life;[9] diversification in the models of capitalism;[10] variety in economic leadership;[11] supply of new financial sources.[12]

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[9] E.g., availability of broad production factors, manufacturing and trade.

[10] E.g., the supposed strengthening of the Turkish model in the version of Islamic liberalism and democratic governance or in its pre- Erdoğan version.

[11] E.g., China, with its 38,800 workers in Libya in 2011 evacuated very quickly, and also Brazil, as observer state in the Arab League, are very influent in the Mediterranean area.

[12] E.g., sovereign funds from Saudi Arabia and other Arab states.

Deep changes are taking place in labour markets on multi layer basis:

a)   in the level and composition of the labour force by age groups and generations;
b)   in the level and composition of the labour force by gender;
c)   in the level and composition of the labour force by educational qualifications;
d)   in the level and composition of the labour force by geographical origin;
e)   in the level and characterization of inequality which is high and increasing.

Higher education graduates do not seem to represent anymore the main tool for shifting the production frontier. They are becoming, together with upper higher education diploma holders, bulk of the labour force in the most advanced countries, and in developing countries as well. The economic, but also the social and political role of education is changing over time.

This brings about additional key research questions. Are labour market adjustments to be still conceived as the residual to economic integration processes? Which role is played by mismatch, over-education, under-utilization of qualified manpower? Do we experience complementarities or substitution between the labour force of the two shores? To what extent labour market governance can be one of the main determinants in regional integration processes?

All these questions have to be properly explored, but I could add some analytical comments in order to start this exploration. The complexity of the present setting helps to explain why very divergent views are shaping the present debate. Three are the main views, at least among the economists.

In the human capital model education is essentially treated as an investment good for which the returns are decreasing as the years of education increase. Therefore, education is a key to economic success, but tertiary education cannot overcome the boundaries set by the Smithian compensating differentials and, if this happens, inefficiency occurs, with excess supply/over-education or excess demand/under-education as the most visible outcomes. This view is often suggesting, with a short-term attitude, that mismatch is dominant when Italian labour markets are considered, but also when the determinants of "Arab spring" are investigated.

In a second view, which I would call post-Ricardian, skill formation and development are processes inherently linked to firm activities. The match between labour demand and supply is always mediated by the expected dynamics of skill formation and development, which adapts employees' characteristics to the firm's technology and organization of knowledge and work. Skill formation and development allow the establishment of complementary relationships between the techno-organizational framework of the firm and the skills of the individual employee. Skill mismatch may depend on: (i) a 'pathological disconnection' between the educational system and the economic system in the demand and supply of knowledge and skills (like in the human capital model); (ii) a 'physiological' division of labour between the two systems in the process of skill formation.

By devoting time and funds to the development of human resources, individuals and households, firms and governments undertake activities which are not only finalised to present benefits (consumption, availability of required skills), but also to future pecuniary returns (investment) and non pecuniary advantages (risk aversion and precautionary behaviour). This second view suggests that underutilization, more than over-education, can often be the problem, especially in transition phases.

In the third view, which I would call the "offshorability" view, the basic idea is that computers can quickly and cheaply perform tasks that used to require highly qualified manpower: technological progress is reducing the demand for highly educated workers (lawyers, paralegal, but also engineers). "Conversely, jobs that can't be carried out by following explicit rules – a category that includes many kinds of manual labour, from truck drivers to janitors – will tend to grow even in the face of technological progress." (Krugman, 2011, p. 1-2) According to this view, since the 90s the US job market has not been characterized "by a general rise in the demand for skill, but by "hollowing out": both high-wage and low-wage employment have grown rapidly, but medium-wage jobs – the kinds of jobs we count on to support a strong middle class – have lagged behind." International trade in services will reinforce this trend making high-wage jobs performed by highly educated workers more "offshorable" than jobs done by low-paid, less-educated workers. The third, is certainly the most sceptical and deterministic view.

However, in all these views long-term prospects should be distinguished from short-term ones, but this distinction is not done very often.

In any case, if we observe present and past evidence a systematic fact occurs: lower unemployment rates and higher employment rates are strongly associated with tertiary education both for males and females. This is true both for OECD and EU19 Countries. A relative advantage in labour markets seems to persist even in recession times.

Moreover, the supply side of the markets for goods and services cannot be forgotten. However, recent developments in the study of firm organization emphasize an increasing role played by firms in the enhancement of manpower skill endowments. In a dynamic world training is an essential joint production activity needed to organize knowledge within firms. It is not only a simple matter of on-the-job training. The problem is that firms cannot implement this consistency of the internal and external organization of knowledge by themselves, because they are too focused on short-term dynamics, especially in periods of high instability in markets. The consistency should be favoured by industrial and innovation policies.

This seems to be the case also for many of the ECEC. The picture is more complex and the data are often missing with reference to ALC.

In the Middle East and North Africa (MENA) region labour markets are characterized by:
a) strong segmentation between public and private sector;
b) high unemployment rates;
c) shifts from the formal to the informal sector.

Labour force growth rates of are higher than population growth rate in most Arab countries , with an average growth rate of 3 percent annually.

In 2000 regional economies had to absorb 30 million entrants into the labour market, and they will have to absorb another 160 million by 2025 (Williamson, Yousef, 2002).

We are told that in the Arab countries, at least 20 percent of the total population is between 15 and 24 years old. Unemployment is concentrated in the age group of youth (15-24 years). This is so for 80 percent of unemployment in Egypt as well as in Jordan. The informal sector employs 61 percent of Arab workforces on average. It is characterized by small-scale establishments, moderate investments, and production of family nature. Employees lack legal protection, social insurance and protection against professional injuries and diseases. Rigidity is dominant in the Arab labour markets for elder workers, while high turnover prevails for young entrants.

The inability to transform the different educational and labour market institutions (labour code, universal admission in higher education, low profile of training institutions) is often considered as one of the determinants of the existing imbalances.

Youth is concentrated in the informal sector and is generally vulnerable for lack of access to resources, including land, skills, knowledge, capital and social connections. Hence young people are particularly vulnerable to poverty. Gender and regional differences exist as unemployment rates are in general higher among females than among males. Urban unemployment is higher than the rural one due to internal migration.

Within this framework, worsened by war, the implementation of economic policies combining economic, environmental and social sustainability is crucially based on forecasts of international flows and stocks of manpower correlated with the structural and cyclical evolution of the different regions.

3.2. Comparing stylized facts for labour markets in the United States and Italy

As already stressed, the global economic crisis is enduring and the sequences of booms and slumps characterizing it add to prospective risk and uncertainty, especially for younger generations and women.

In economic and social systems in which the organization of knowledge and innovation are continuously transforming the international division of labour, life expectancy significantly increases and the majority share of manpower goes to graduates from higher-secondary and post-secondary education, the relevance of the integration between study curricula and on-the-job experience over the life cycle increases. All the stages included between study, internship and permanent employment contract gain strategic meaning and constrain the different steps and career progressions.

Long before the crisis, changes took place which deeply affected the role and functions of the higher education systems at the international level. Among these an overriding role was played by: the growth of a service economy based on knowledge which is presently reshaping the boundaries between the production sectors; the expansion of an international trade in which firms' competitiveness rests on their capacity to contribute to the global production through definite roles in sound value chains rather than in the exchange of finite goods; the establishment of an international division of labour granting new and relevant tasks to emerging economic powers.

Within this framework the capability of individuals to interconnect their education with their professional experience and work career is crucial for their employability and their economic and social success. Indeed the global economic crisis is accelerating changes under way and the need to programme education and professional careers with appropriate tools in the different scenarios. However, in spite of its crucial role, the capability to link together educational projects and job opportunities is not enough developed at the individual and collective level yet. Deeper technical skills are required to handle the growing share of non-repetitive tasks and a set of broader skills are required to move from one customized task to another. In addition, the automation of repetitive tasks leaves workers with overlapping assignments and increased interaction with each other. This increases in turn the demand for soft skills such as general interpersonal skills and teamwork. In broad form, these effects, referred to by economists as "skill-biased technology change" are reinforced by a related change in the mix of industries and occupations from an industrial economy to a post-industrial service economy. Finally, the

pace of technological and economic change itself accelerates. As a result, workers need to be armed with more general preparation in order to adapt to changes in labour markets.

Simplifying in a radical way the puzzle, we may try to obtain better signals on future perspectives taking into account a continuum with two polar edges: the United States and Italy. Even if the former are extremely different from Italy and Europe in many respects, starting from the baseline, push and pulls in change and policy actions, the evolution under way and the forecasts on the setting after the crisis in this country could anticipate trends with which others countries shall confront themselves. By the way, the United States came first into the global crisis and probably they will be among the first to come out of it.[13] Leaving aside extreme, even if possible, scenarios of stationary state and degrowth, the most definite trends observed for this Country are the following.

a) *Employment polarization*. Observing the pattern of change in employment shares by wage terciles in the last fifteen years, the employment growth is polarized with job opportunities increasingly concentrated, on the one side, in high-wage and probably high-skill jobs, on the other, in low-wage and probably low-skill jobs. A decline is detected for traditional middle-wage and probably middle-skill jobs (Autor, Katz, 2010);

b) *Educational gender reversal*. In the United States female educational attainment rose substantially in the last twenty years.[14] This is true when considering the female college education attainment rates and the ratio of the female college attainment rate to the male one (around 1.3 in 2009). However, this positive result is late in determining an adequate economic and social success, and, in the case of United States, has a counterpoint in the weak increase for males with post-secondary education (Autor, Katz, 2010);

c) *Inequality increase*. Empirical evidence for the United States highlights a rather high level of inequality in disposable income. In the last thirty years we have observed a strong and increasing income inequality, a process of strong élites concentration and, even if starting from relatively low levels, a strong rise in long-term unemployment, especially for the age class 15-24 years.[15]

Of course in this comparison we need to be very careful. In particular, the clear-cut account of these trends clashes with at least three limits. The first is due to the awareness that in statistics relating to this field of analysis several measurement and comparison problems persist. The second is based on the acknowledgement that we do not have a satisfactory theory for interpreting the social structure evolution at our disposal. The third consists in the uncertainty which surrounds post-crisis outcomes and the possible confirmation or inversion of observed trends.

Italy is located at the opposite edge. We can make a distinction with respect to other European Countries for the fact that it was the first to start the Bologna Process. In fact, the *Bologna Declaration* in 1999 had a strong impact on the willingness to reform the Italian

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[13] Evidence seems to show a continuous decline in unemployment every month, slow but steady job growth, and stronger quarterly GDP growth.

[14] The US recession has also been called the "mancession" due to the disproportionate job loss for males and increased labour force participation of females.

[15] Almost half of the unemployed have been so for over 6 months. This is unusual and highly biased by race, class and education.

university system in order to support an overall convergence at the European level. In Italy the main steps of a complex, and sometimes cumbersome, reform process aiming at saving rather than investing resources, have been the following. The reform act (MD 509/99) established a generalized 3+2 system, implemented starting from academic year 2000-01. Further adjustment regulations (MD 270/04) were implemented in academic year 2008-09 (apart from the Faculty of Law, for which it already started in 2006-07) aiming at reducing the number of new degree courses and the resources involved. Law 240/10 substantially reformed the governance of the university system and is now under implementation.

We should indeed remember that we are reasoning on a much smaller dimension of the university system than that of the United States, taking into account both the share of population holding a university degree and the share of demand for workers holding a university degree.[16] The scale problem can be addressed at two levels. The first one (at the European scale) can be tackled and solved through the European Space of Higher Education (ESHE). The second (at the national scale) can be tackled and solved doing what is needed at the national level.

Even if the cumulative effect of the strong institutional change and the global crisis make it difficult to completely assess the transition, the observed outcomes of the reform – when focusing on the share of students that fully developed their study experience under the new system - are largely positive. The most definite trends observed for Italy are the following:

a) *Detrimental convergence.* Observing the pattern of change in employment shares by wage terciles in the last fifteen years, the employment growth concentrates only on job opportunities in high-wage and probably high-skill jobs. Job opportunities both in low-wage and probably low-skill jobs and in traditional middle-wage and probably middle-skill jobs have decreased (Autor and Katz, 2010). These last two trends in Italy can be likely explained respectively by the reduction in job creation by the public administration and the strong expansion of immigrant labour force.[17] AlmaLaurea (2012) shows how this long term trend is coupled in Italy with a decrease of employment in the most qualified professions from 2004 to 2010, contrary to what happens in other European countries, including Spain;

b) *Under the educational threshold.* A crucial prerequisite for Italy is to achieve the educational threshold needed to compete with the most dynamic economies. The expenditure in education and research is much lower proportionally than that in the United States and in the leading European Countries. Unfortunately Italian inadequate commitment in this sector goes back in the years. One of the most relevant consequences lies in the fact that, in spite of the increase experienced in the last decade, in 2008 (OECD, 2010) the share of graduated population was rather low, both in the age class 55-64 (10 percent vs 40 percent in the United States and 20 percent in OECD Countries) and in the age class 25-34 (20 percent vs 42 percent in

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[16] The Obama administration put more emphasis on middle skills – post-secondary vocational certificates and 2-year associate's degrees of value in the labour force.

[17] It is more difficult to say the same for the United States. The data that the Author uses largely reflects the precipitous decline in US manufacturing and of middle-wage jobs. We should also be concerned with what middle wage jobs replaced them. In US healthcare jobs did a lot of that and biased towards female employment. Moreover, 11 million illegal workers in a 300 million population (160 million labour force) is often a political gimmick to blame unemployment on cheaper foreign labour.

the United States and 35 percent in OECD Countries). This imbalance is worsened by low investment in work-based training. All this brings about an Italian historical delay, with crucial feedbacks on the low education of the ruling class, both public and private, and on its low propensity to understand the strategic role of human capital;

c) *Educational gender success and occupational failure.* Also in Italy female educational attainment has risen substantially in the last twenty years, so as to generate one of the highest observed ratios between female and male college attainment rate (around 1,6 in 2009) (Autor and Katz, 2010). Such a positive result not only is late in determining adequate economic and social success, but it also coexists with a situation in which female graduates experience more difficulties in finding jobs and, when they get them, these are often less stable and pay lower wages (AlmaLaurea, 2012).[18] Moreover, gender inequalities tend to increase at some distance from the graduation year. Lastly, in Italy the increase of the female graduates component has not a counterpartt in the weak increase of the male graduates component, as in the case of the United States, also due to low starting levels for both;

d) *Inequality increase.* Empirical evidence for Italy highlights a rather high level of inequality in disposable income. However in the last thirty years, after a sharp increase till the middle of the 1990s, we can observe a decrease in income inequality. The increase in long-term unemployment is rather strong, especially for the age class 15-24 years. Moreover, AlmaLaurea (2012) stresses how strongly the graduates' occupational condition is influenced by the great variability in family and social background, as well as by the strong differentiation of the local systems of production in which they live. Also gender inequalities depend, apart from individual determinants, on the stage of development of the local economic context.

In any case intuition and investigation suggest that in the present global context the majority of traditional activities carried out in higher education systems tend to acquire a new role. This is why it is important to face complex and new questions.

In general, the interaction between cycle and structure is neglected because "In economics, the long run is seen as a logical time period where all adjustments are automatic, so the question of how and when adjustment processes take place can be ignored." (Bianchi, Labory, 2012, p. 4). In contrast, the present crisis is strengthening the link between cycle and structure, and one of the transformations which underlines this fact is the individual need to plan education and professional ladder more carefully than in the past. However, in spite of its importance, the tuning of educational and training projects with job opportunities does not attract enough attention and the available information and capabilities in vocational guidance are lacking both at the individual and social level.

My suggestion is that the United States experience, both in the case of forecasts made by the Bureau of Labor Statistics (Sommers, Franklin, 2012), and in that of the projections proposed by the Center on Education and the Workforce (Carnevale, Smith, Strohl, 2010), can be highly relevant in order to comply with the new needs of manpower forecasting in Italy and Europe. Therefore, it would be important if the future work on Istat's econometric model were also oriented in this direction.

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[18] As it is often suggested, a female needs one extra degree to earn the wages of a male with a lower level of degree. Some of that is due to occupational choices.

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Building the core of the Istat system of models for forecasting the Italian economy: MeMo-It

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Abstract

This paper provides a description of Istat's new Macroeconometric Model MeMo-It. This is the tool used by Istat to produce bi-annual medium-term forecasts of the Italian economy since May 2012.
The key model's features are illustrated and compared with other modeling approaches used in the literature. The paper describes the theoretical foundations of the model along with the set of equations and their estimation. It also presents an assessment of model's performance by focusing on the key multipliers.

Keywords: macroeconometric models, econometric forecasts, theory-first vs data-first models, model specification, fiscal policy multipliers.

1. Introduction

Since January 2011, Istat has been assigned responsibility on macroeconomic forecasting activities.[1] This is not a novel function for National Statistical Institutes (NSIs) since other statistical agencies in Europe are responsible for economic forecasting activities along with statistical data production.[2] In fact, economic modeling in NSIs can benefit from the availability of the wide range of raw and validated statistical data as well as in-house expertise on data management, integration and quality. To implement these tasks Istat created in 2011 the Econometric Studies and Economic Forecasting (SEP) Division that has responsibilities to carry out modeling and research activities, including macroeconomic short-term and medium-term forecasts. In order to ensure that appropriate Chinese walls are in place between economic modeling and statistical production functions, the SEP Division reports directly to the Department head in charge of data integration, quality and corporate innovation.

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[1] Before 2011 Isae was responsabile for macroeconomic forecasting under the Ministry of finance supervision. As a result of the decision to close down Isae, these activities have been moved to Istat.

[2] In this respect, Insee for France and Eurostat are good examples.

This led to the construction of the new macroeconometric model of the Italian economy (MeMo-It) that is presented in this paper.[3]

MeMo-It modeling approach is a mixture of both the London School of Economics (LSE) methodology, related to work on integrated and cointegrated systems, and the Cowles Commission approach referring to the specification and testing of structural macroeconometric models (Hendry et al., 1984, Fair 1974, 1976; 1984; 1994; and 2004). 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.

MeMo-It's structure relies on two basic features: first, it should be simple and easy to communicate to the users; second, it uses annual data, in order to allow for updates twice a year (i.e. as soon as a new vintage of National Accounts, NA, is released in March and October). In this way, the model can be fully updated (both data and parameters' estimates) in the eve of each release of the forecasts.[4]

The first results of Istat's macroeconomic forecasts for 2012-2013 based on MeMo-It have been released in May2012, (http://www.istat.it/it/archivio/62667).

MeMo-It is composed by 53 stochastic equations and 78 identities, and represents an economic system including households, firms, public administration, and foreign sector.

The rest of this paper will focus on the model's characteristics and properties and it is organized as follows. Istat's macroeconomic modeling is outlined in section 2, while section 3 discusses alternative modeling approaches used in the literature and provides arguments in favor of the modeling strategy used by Istat. Section 4 summarizes the main features of MeMo-It and section 5 provides details on its block structure, along with a formal description of the key behavioral equations. Section 6 outlines the model's performance, focusing on multipliers, and section 7 concludes.

2. MeMo-It and Istat economic modeling suite

There is a general consensus in the literature on the relevance of economic forecasting but not on the methods used to perform it (Budd,1999). Naive methods link the latest information on economic activity using a judgmental approach based on the sensibility of the researcher. On the contrary, the econometric approach requires an explicit representation of the economic system through a formal model, whose quality can be tested through statistical data. Using this approach analysts can disentangle ex post the reasons for forecast's success or failure. In other terms, econometric models' outcomes - as opposed to the judgmental approach - can be formally assessed and, hopefully, improved in light of past errors. Reproducibility of outcomes is therefore the main reason supporting the Istat decision to follow formal modeling approach to carry out macroeconomic forecasts.

However, models are deliberate simplifications of the economy and, as such, are prone to errors and misinterpretations due to their high level of aggregation and to the potential

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[3] The model was developed during 2012 by an Istat project team led by Fabio Bacchini. The team was provided scientific advice by prof. Roberto Golinelli.

[4] Along with MeMo-It, Istat's forecast framework includes a set of bridge equations and VAR models to forecast short-run development in the economy (SMeMo-It).

risk of omitted information. As a result, it is unlikely that a single overriding model could cover all relevant aspects of the economy: no model is perfect by definition.

In order to be transparent (i.e. the economic relationships underlying the model must be easy to understand for users), the macroeconomic model has to be of small-scale and use a limited (parsimonious) number of variables and behavioural equations. Therefore, the strength of the modeler lies in the ability to use a potentially vast range of variables of different nature coming from alternative sources, and to appropriately combine their relevant information into a single model (or a suite of models) able to operate in different contexts, over different cyclical phases, or in different periods of the year (Bank of England, 1999, Don and Verbruggen, 2006, and Pagan and Robertson, 2007).

MeMo-It is part of a suite of economic forecasting models developed by Istat, and its role in the modeling framework is prominent, as MeMo-It is the core tool that has to ensure the overall consistency in the system.

MeMo-It is an annual model for the Italian economy that requires two sets of external (exogenous) information over the forecast period. First, consistent assumptions about the developments in 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.

As shown in the left side of figure 1, the information listed above is exogenously provided through, (i) results based on simulations carried out using the Oxford Global Economic model (OGEM, see Oxford Economics, 2011), and (ii) results from bridge and VAR models (SMeMo-It). In SMeMo-It, selected monthly economic indicators are used to forecast the relevant quarterly National Accounts (NA) variables up to four quarters ahead (Isae, 2003). Conditional on the variables projected using the international scenario based on OGEM, MeMo-It's first simulation year is driven by the SMeMo-It results that use the available information up to the time in the year when the forecasting exercise is conducted (see figure 1). For example, for the forecasts exercise in November, SMeMo-It use the quarterly information on National Account and MeMo-It the annual data updated to the last revision available.

Figure 1 - Istat economic forecasting and policy analysis models framework
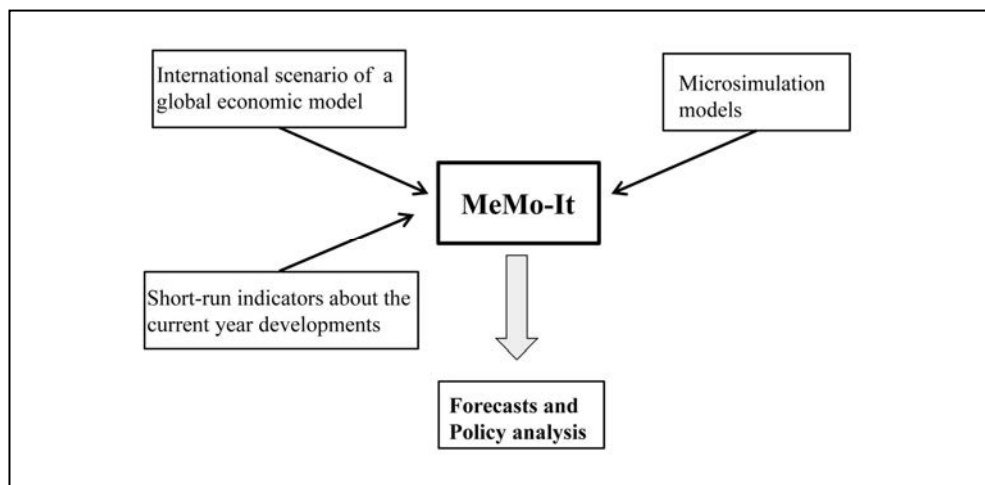
The use of quarterly data estimated via SMeMo-It improves MeMo-It forecasting ability of the current year: the benefit of incorporating into annual models information stemming from short-term indicators to forecast NA variables has been highlighted by a number of studies (for example, Borin et al., 2012, and Kapetanios et al., 2007a).[5]

The comparison of the output of the two auxiliary models in figure 1, with MeMo-It unadjusted forecasts (i.e. before any add factor is used) provides an assessment of the magnitude of potential errors due to the partial information set that can be used at the time the forecast exercise is carried out. The discrepancies in the forecast of the main aggregate among the models should be evidence for either temporary changes or emerging structural shifts in some relation. In the latter case, location shift warnings emerge and motivate the use of corrections in some MeMo-It equations (Clements and Hendry, 2008).

These corrections are introduced in MeMo-It through add factors and intercept corrections, interpreted as a fine-tuning of statistical information rather than a form of combined or judgmental forecasts (Stekler, 2007).

It is well known that for the analysis of policy decision, such as changes in the tax system, introduction of heterogeneity in the model's agents (i.e. households, firms, etc.) would be relevant for the performance of the model (Cogan et al., 2010). This may lead to the need of using micro-level information which cannot be modeled at aggregate level. Therefore, as shown in figure 1, microsimulation models for households and firms could be used to generate additional results to integrate the macroeconomic dataset and enhance model performance. The link between MeMo-It and microsimulation models supports more comprehensive policy analysis (Golinelli and Mantovani, 1992) given that microeconomic models try to be exhaustive representations of particular forms of economic activity, without necessarily ensuring that variables not explained are strictly exogenous (Higson and Holly, 1990). The description of these microeconomic tools along and the corresponding micro-macro links with MeMo-It which are still in progress will be presented in future papers.

3. MeMo-It and the macroeconometric modeling literature

3.1 Theory *versus* data

In introducing their paper about model-building strategies, Kapetanios et al. (2007b) note that "a persistent question in the development of models for macroeconomic policy analysis has been the relative role of economic theory and evidence in their construction". (p. 565). Since the 1960s, following the strand of research at the Cowles Commission (Klein, 1950), when first macroeconometric models were introduced, three methods of quantitative research have emerged over time (Pagan, 1994).

At the beginning, theory - or perhaps better "theoretical reasoning" - suggested a model's specification one equation at a time: the random error was then attached. The "failure" of these models in explaining stagflation in the mid-1970s (Lucas, 1976, and Sims, 1980) produced a paradigm change emphasizing the role of statistical relationships.

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[5] The exact measure of the forecast gain obtained using SMeMo-It together with MeMo-It is part of the research agenda.

Data were regarded as realizations of a multivariate data generation process (DGP) from which the empirical model had to be reduced with the help of theoretical ideas. In this second strand of research (often referred to as London School of Economics (LSE) approach), economic theory lost its "dominance" over model specification.

Further developments (Kydland and Prescott, 1982) refer to micro-founded models based on *a priori* theory such as Real Business Cycle (RBC), or new Keynesian Dynamic Stochastic General Equilibrium models (DSGE) which gives exact micro-foundations to the macro structure, assuming representative agents who solve intertemporal optimization problems under rational expectations. In this context, theory not only is more important than data, but also reaches the highest dominance ever, as the relationships between model and empirical evidence suggest *ad hoc* errors aiming to reconcile theory and available data (see for example Smets and Wouters, 2003).

As brilliantly summarized in Pagan (2003a and 2003b), and Fukac and Pagan (2009), the three modeling approaches listed above entail a sort of dichotomy between two methodological approaches: "theory comes first" *versus* "facts come first". The dichotomy is represented by alternative optimal compositions on the curve plotted in figure 2.

In general, economics has primacy for those modeling strategies located at the top left hand corner while statistics is dominant at the bottom right hand end. Put it in another way at the top we have models (such as RBCs and DSGEs) that aim to interpret the data, while at the bottom we have models (such as VARs) that aim to summarize the data.

The position on the curve can be related to the institutional framework in which modelers operate. The total effort to be spent in the modeling activity leads to the "budget constraint" line. Its slope reflects the relative "price" based on theoretical vs. data management expertise. Figure 2 reports two alternative lines (cases).

Figure 2 - Two alternative models (points) along the "best practice" frontier
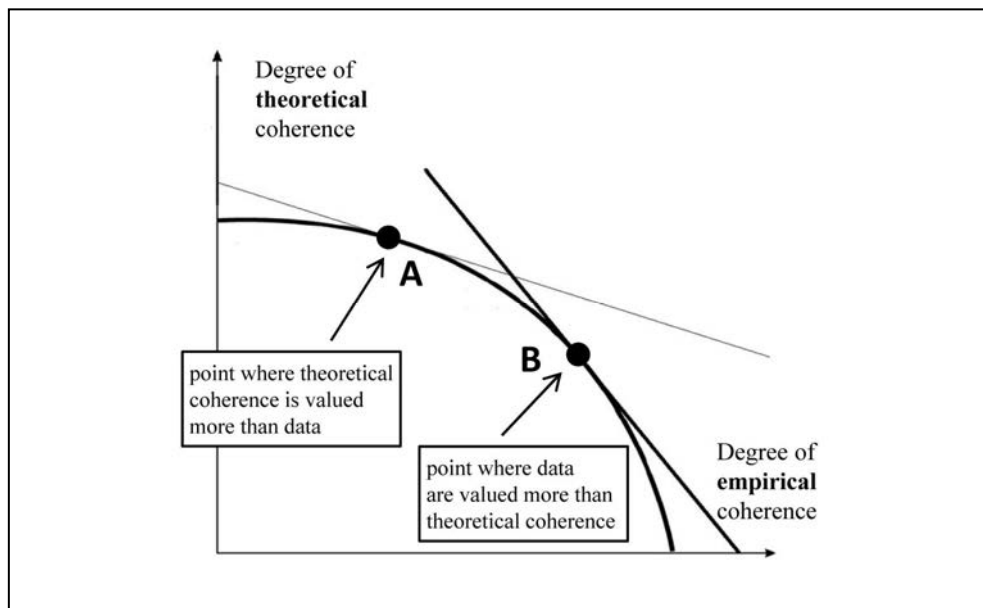
The thin line might represent the academic situation: it has a flat slope on the hypothesis that academic models pay more attention to the theoretical aspects rather than data coherence. As a result, the flat line put the "academic model" in the top-left point A of figure 2. The thick line represents the Istat modeling choice for its new model. In order to understand why Istat found its optimal point in B instead of A, we remark that Istat's "relative price" of using theory-intensive frameworks is higher, resulting in a steeper slope of the budget constraint line: this reflects the institutional tasks which are to be accomplished by Istat are: (1) to provide macroeconomic forecasts two- and five-years ahead (respectively for the macroeconomic scenario and for inflation only); (2) to produce, model and to interpret statistical data for the Italian economy. Therefore, Istat's relative price emphasizes the systematic use of the latest available (and continuously updated) statistical information to feed MeMo-It, and the integration of these best available measures with both theoretical and institutional (e.g. chain accounting identities) knowledge.

3.2 Data-based models *versus* DSGE approach

Models that follow a DSGE framework are guided by the idea of steady states (i.e., that ratios of certain variables are constants, Fukac and Pagan, 2006, and Morley, 2010). This assumption is inconsistent with the results that emerge from an assessment of most economic time series. Therefore, it is quite awkward to use parameters' estimators in models which potentially suffer from this sort of misspecification. In the DSGE context, model parameters' calibration is better motivated than estimation.[6] On the other hand, the pragmatism evoked above (and its adoption by MeMo-It philosophy) needs formal statistic inferences on the ability of the theory to explain actual data, and this requirement makes parameters' calibration techniques less attractive than their statistical estimation.

The relative prominence of data coherency depicted in point B of figure 2 is also admissible on the theoretical ground, as it reflects the epistemological pragmatism advocated in Colander et al. (2008), Hoover et al (2008), and Morley (2010). Following this approach, the idea of optimizing agents in micro-founded models stands for a metaphor, because of the insurmountable problems in aggregating behaviors across actual individuals (Hoover, 2006).[7] Belonging to this methodological strand, MeMo-It makes explicit reference to the empirical information in order to assess the data-admissibility of the theoretical constructs, and does not assume explicit micro-foundations of weak-form.[8] In doing so, MeMo-It deals with the "fallacy of composition" problem to which representative agents' models can be prone (Howitt, 2006), as the aggregation of heterogeneous micro-decisions invariably leads to macro-relations with very different dynamic properties. In general, no simple transition from micro- to macro-behavior seems possible (Pesaran and Smith, 2011).

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[6] However, recently Bayesian estimation methods have been introduced to estimate DSGE parameters, but their statistical properties are unclear. More importantly, for the advocates of "point B" models, very little specification testing is carried out.

[7] Besides the representative agent critique, Driffil (2011) quotes a full paragraph of papers arguing against DSGE by pointing out that they are burdened with far too much economic theory (much of it of dubious value); illuminated by far too little examination of data, facts and history.

[8] A model has weak-form micro-foundations if decisions by agents are governed by explicit dynamic optimization problems. Strong-form micro-foundations require that the formulation of the optimization problem is consistent with the microeconomic evidence; see Faust (2009, p. 53). In other terms, strong-form micro-foundations require that the theoretical model is supported by data.

Another practice in modeling micro-founded models (both RBC and DSGE) is that of filtering out the permanent components from original data. Besides the risk of using wrong filters to extract the cyclical components (Harvey and Jaeger, 1993, and Catão and Pagan, 2011), the use of filtered data implies more attention to dynamics, and leads to the issue of linking the (modeled) filtered series with the actual ones. The Bank of England proposed a "hybrid" route (Harrison et al, 2005) to account for this problem, which however does not seem particularly attractive for MeMo-It. In fact, the combination of core variables (i.e. those filtered and modeled under pure theoretical guidance) and non-core variables (i.e. those not filtered and not included in the core relationships) by additional short-term equations (explaining the non-core variables as a function of the dynamic path of the core variables) is not viable in our context, as MeMo-It aims to interpret and describe the original data.[9]

Finally, Fair (2012a) lists a number of additional examples in which the micro-founded approach makes a problematic use of official statistics.

3.3 MeMo-It theory background

Sims (1980) proposed the VAR approach as a better alternative strategy for empirical macromodeling because he thought the challenging research program to improve traditional macromodeling was impossible to carry out, at least in the short run. However, after more than 30 years (i.e., well beyond Sims's paper "short run") in which also some limitations of VAR and Computable General Equilibrium (CGE) paradigms have been discovered, a range of new formal econometric tools are available to test for wrong specification.

In fact, starting from Sims's critique, there has been an increasing use of statistical integration-cointegration techniques (see the milestone works of Dickey and Fuller, 1979, Engle and Granger, 1987 and Johansen, 1995) to formally test long-run relationships suggested by the economic theory. In other terms, the cointegration property checks whether the theoretical model is a valid approximation of a steady-state situation which, in turn, can be used as an attractor in the specification of dynamic empirical models in equilibrium correction (EqC) form (see the seminal "LSE approach" paper of Hendry et al., 1984). In the same way, Kozicki (2012) suggests that time-series advances, allowing for improvements in the joint modeling of long-run relationships derived from economic theory and short-run dynamics, have led to the development of macroeconometric models that fall between the classical Cowles Commission and the New Keynesian DSGE approaches.

As the cointegration property is invariant to widening the dataset, cointegration analysis is usually accomplished within blocks (subsystems) of strongly interrelated variables in order to make as much use as possible of theory in the blocks' specification (Jansen, 2002). In this way, the modeler can: (i) test whether the theory is relevant in the specification of an empirical model which *also* accommodates institutional features; (ii) try to account for heterogeneity among agents; and (iii) explore in an appropriate way the time dimension of the dataset (Hall, 1995, Granger, 1999, Bardsen et al., 2006, and Bardsen and Nymonen, 2009).

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[9] Further, again from the point of view of the modeller who is oriented towards "point B models", it is particularly worrying that - as it is often the case - the dynamics between core and non-core variables deliver estimates of the speed of adjustment which are very slow.

Therefore, a model's ability to fit the data is an essential quality of empirical models as, given the absence of theoretical truisms, the implications of economic theory have to be confronted with the data in a systematic way. The work of Juselius and Johansen (2005) summarizes this methodological approach (derived from the LSE approach) that is accomplished within the modeling frame of stochastic difference equation in EqC form (Juselius 2009).[10] While the use of cointegration techniques requires a lot of realism about the difficulties in the measurement of the long run relationship and in the assessment of economic theories, in modeling MeMo-It we rather prefer to face these problems instead of assuming *a priori* the knowledge of the answers, as theorists and calibrators are prone to do (Pesaran, 1997, and Smith, 2006).

Garratt et al. (2003) is a good example of an emerging class of medium-small scale models to which MeMo-It aims to belong. In these models, theoretical steady state properties are estimated as cointegrating (long-run) level-relationships, while theory-based short-run cross-equation restrictions are either ignored or, at best, tested in their data congruency before entering the system.[11]

Overall, the statistical assessment of the cointegration properties and, more generally, of the dynamic relationships inside blocks of variables is one possible way to account for the economic theory in "point B" models, i.e., where the data adequacy of the model is more valued. Pesaran and Smith (2011) refer to "avoiding the straitjacket", and give explicit support to the methodology that we can broadly label as the LSE approach in the following way: "[this approach] uses the long-run cointegrating information in the data, but allows more flexible short-run dynamics; recognizes the interconnectedness of large systems and develops methods to estimate high-dimensional systems that help identify certain types of shocks" (p. 15).

Another pragmatic way to react to Sims-Lucas arguments against the early empirical models is their direct improvement by introducing other (both new and revised) techniques (but not explicitly cointegration) to better estimate, test, and analyze them. This wide line of research has been conducted (almost alone, over the last 40 years) by Ray Fair, who can be seen as the most prominent advocate of the "improved" Cowles Commission modeling approach. Since early 1970s, every ten years, Fair (1974 and 1976; 1984; 1994; and 2004) has published a book which can be seen as the update of the best-practice to implement the Cowles Commission simultaneous macro-modeling framework. In each book, Fair updates his *US model* (for the US economy)[12] to analyze several important empirical questions, such as "testing for a New Economy in the 1990s" (Fair, 2004, chapter 6).

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[10] Juselius and Franchi (2007) use this LSE approach and reject the basic hypotheses underlying the theoretical DSGE/RBC models. However, Favero (2009), with reference to models of monetary policy, is slightly less pessimistic: even though he acknowledges the usefulness of the advances due to the LSE approach, he still sees potential improvements in the use of DSGE models approximated by restricted VARs; for forecasting purposes see also Del Negro and Schorfheide (2003). Again on the forecasting side, but in the cointegration field, Anderson et al. (2002) introduce a vector EqC model anchored to long-run relationships suggested by economic theory which delivers forecasts of comparable quality as those made by government agencies and private forecasters.

[11] The recent versions of OECD and Oxford Economics global models are based on this modelling approach too (Hervé et al., 2011, and Oxford Economics, 2011).

[12] Since the 1984 book, the MC model, i.e., his multi-country model, is also described and used in empirical analyses.

Fair (1993) lists six different improvements[13] to the old-fashioned models which have been introduced to answer the mid/end-1970s critiques and to keep "point B" modeling activity on the frontier:[14] (i) parameters of large scale and possibly non-linear models can be estimated with instrumental-variables methods in order to account for possible endogenous regressors (i.e., two-stage and three-stage least squares, 2SLS and 3SLS, and generalized method of moments, GMM); (ii) stochastic simulations of models can be used in order to evaluate the degree of uncertainty surrounding model's; (iii) model-consistent expectations (since the seminal paper by Fair, 1979) can be introduced (if needed by the theory and if relevant for data analysis) in order to handle the issue of rational expectations;[15] (iv) a number of diagnostic tests are available to analyze the residuals of single and/or systems of equations (with both asymptotic and simulated test distributions;[16] (v) forecast encompassing tests of model predictions against those of purely statistical uni- and multivariate models (such as AR and VAR); (vi) the analysis of the model "multipliers" is the way to better understand the consistency of the full empirical system with the underlying economic theories. In this context, one or more exogenous variables of the multipliers are changed, and the effects on endogenous variables due to these changes are computed from either deterministic or stochastic solutions of the model.

As noted in Hendry and Chong (1986), since system's characteristics are the prime concern of macroeconometric models, it might be the case that the validity of every individual component does not guarantee an acceptable overall performance. Therefore, it is understandable why the six Fair techniques listed above produce outcomes which usually refer to the performance and behavior of the whole model rather than to its single elements.

4. Summary of MeMo-It settings

MeMo-It modeling approach is a mixture of both London School of Economics approach and Fair-updated Cowles Commission techniques: 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

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[13] Improvements made possible also thanks to the advances in computer techniques and in hardware power.

[14] Of course, the advocates of the "point A" DSGE models do not fully agree with Fair's claim that models obtained thanks to improvements in the Cowles Commission approach are the better way to macro modelling. Fernandez-Villaverde (2008).

[15] In models adopting "consistent expectations (CE)" technique, all expectations in the model are formed using the future simulated values from the model itself. Intuitively, CE implementation requires an iterative search across alternative solutions to find the one in which variable values expected through the simulation period are indeed generated by the simulation; see Dungan and Wilson (1988).

[16] The aim of these tests is to prevent models from mis-specified dynamics, and to assess the persistence over time (inertia) of variables' fluctuations. Pesaran and Chudik (2011) show that the aggregation across heterogeneous agents with simple micro dynamics can lead to considerably more complicated macro dynamics if micro units are related (i.e., random micro shocks do not cancel out). Therefore, modelling macro dynamics may require more flexible dynamics for adequately represent aggregated data across heterogeneous individuals.

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 (Hsiao, 1997a and 1997b).

MeMo-It periodicity is annual. This choice has two main advantages. First, from the data coherence point of view it must be noted that, despite very different theoretical views, Fernandez-Villaverde (2008) strongly agrees with the Fair ideas of keeping the model's database as updated as possible: "Statistical agencies are constantly revising data, both to incorporate further information and to update their definitions to reflect advances in economic theory and measurement (p. 699). The issue faced by all macro modelers is how to incorporate those changes in a consistent way. One possibility, followed by Fair (the most reasonable one from our point of view), is to always use the most recent vintage of data. This amounts to asking the model to account for what we currently think actually happened, As seen, annual data entail two NA data releases per year (in March and October), just in the eve of the two releases of the MeMo-It forecast scenarios in May and November. Therefore, as soon as new data are released, MeMo-It database is updated and the whole model is re-estimated with the new (revised) statistical evidence, in order to look for the occurrence of relevant location shifts in the most recent part of the sample to be accounted for with intercept corrections (see Clements and Hendry, 2008);[17] occasionally, some equations may also be revised.

Second, the annual periodicity makes it easier to model 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 be easier to detect (Comin and Gertler, 2006).

In this section we have tried to answer questions such as: "Why Istat decided to build its model by following a mixture of LSE-type data-driven modeling and of Fair-updated Cowles Commission approach instead of adhering to the current strong *vogue* of the DSGE models?". As a bottom line, we can quote Faust (2009, p. 47) to answer the previous question:

> "In bringing new technologies we often see the following pattern: a new idea is adopted *and experiences some initial success; inflated optimism arises among experts regarding what has been achieved; traditional cautions are neglected; catastrophe follows; after a period of recovery, the new idea settles into its more modest but rightful productive place.*"

We hope that the traditional critiques to the macro-modeling strategy can be emended in order to make past errors avoidable: nowadays, it could be that the cautious MeMo-It approach is able to give useful empirical outcomes. More explicitly, "the new humility is not symptomatic of failure, just as the bravado of the 1960s was not symptomatic of success", Diebold (1998, p. 188).

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[17] In looking for location shifts, we can also benefit of the comparison of MeMo-It current-year forecast with those of OGEM and SMeMo-It models, as described in Section 2.

5. The block-structure of MeMo-It

The diagram in figure 3 outlines MeMo-It main relationships. In particular, the five rectangles represent the model's basic blocks which are progressively numbered from 1 to 5 to refer to the subsections where their details are given: supply side (5.1), labor market (5.2), demand side (5.3), prices (5.4), and Government (5.5). 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.

Figure 3 - Outline of MeMo-It block relationships
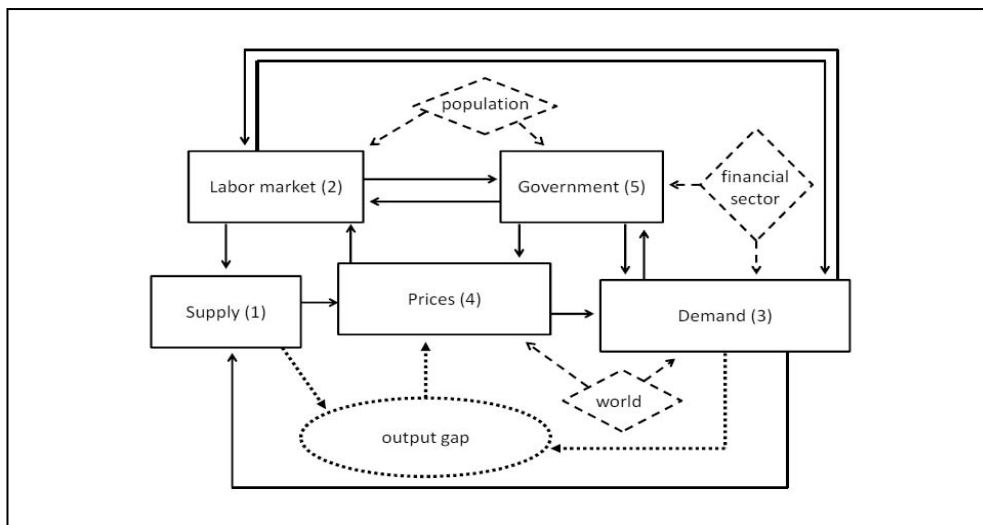
MeMo-It is substantially based on the New-Keynesian approach where the supply side of the economy plays a central role. Accordingly, the underlying key assumption is that in the short-run the economic activity is mainly driven by the demand side, while in the long run the economic system converges to 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 4 represent the interactions arising from such disequilibrium (between the supply and demand rectangles) with the output gap (in the oval circle) which, in turn, affects the prices rectangle.

In turn, price changes feedback into demand variables' rectangle and into wages in the labor sector rectangle. Real wages and employment affect income distribution and households consumption (in the demand rectangle).

Consumption and incomes in the demand rectangle are the tax bases which, combined with (exogenous) rates, define different form of taxation in the Government rectangle. Direct taxation and public transfers generate income redistribution that impacts demand, while indirect tax and social security contribution rates affect prices and labor cost.

Finally, investments and output in the demand rectangle respectively contribute to supply rectangle through capital stock formation (lower arrow), and employment in the labor market rectangle (upper arrow).

In the following five subsections (numbered as, in brackets, the rectangles of Figure 3) we introduce main features of each block, together with the most relevant equations.[18]

5.1 The supply side

Potential output is modeled as a constant returns to scale Cobb-Douglas production function with two productive inputs, labor and capital stock, assuming a Harrod-neutral technical progress (Beffy et al, 2006; D'Auria et al, 2010), and is defined as:

$$logYpot_t \equiv HTFP + 0.64 \, log \, Ldpot_t + 0.36 \, log \, K_t \qquad (1)$$

where potential labor input (*Ldpot*), expressed in terms of total hours worked, is given by trend labor force participation, working age population, trend hours worked and the NAIRU rate of unemployment (in turn, modeled as a function of lags of the output gap, *GAP*, and the unemployment rate, *UR_T*, plus other structural variables). The left-hand side of figure 4 gives a complete view of these relationships, together with the related parts of the labor market which will be discussed below.

Figure 4 - MeMo-It supply block (left) and the related parts of the labor market
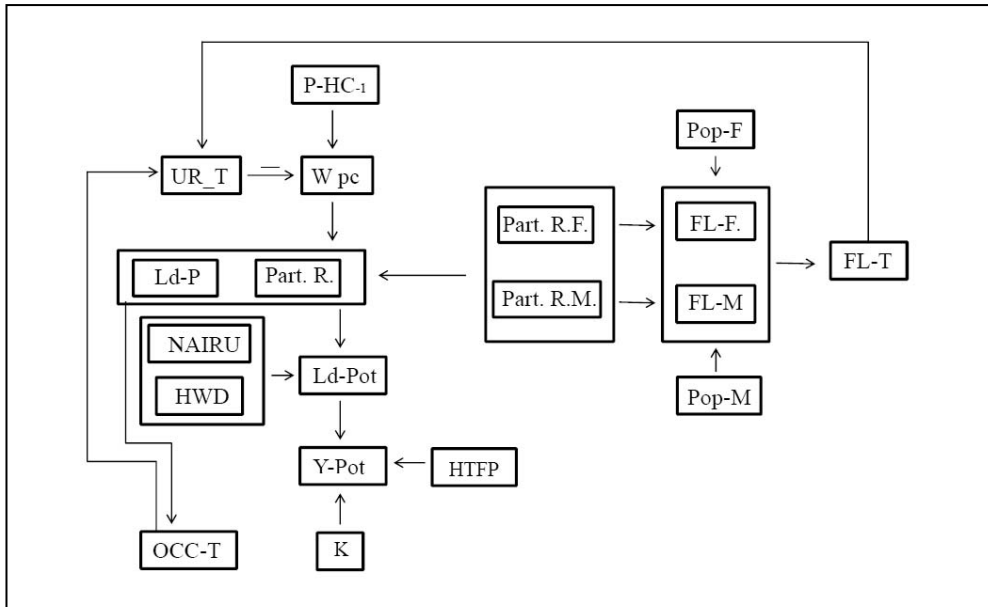
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Potential capital stock (K)[19] is given by the full utilization of the existing capital stock, which is by definition an index of the overall capacity. *HTFP* is the trend component of the Solow residual (total factor productivity). Note that the parameter 0.64 in equation (1) is calibrated on the basis of the average labor share over the historical period.

Finally, as depicted in figure 3, short-run fluctuations are represented by the output gap, which is defined as the deviation of actual (*Yact*) from potential (*Ypot*) GDP:

$$GAP_t \equiv 100 \times \frac{Yact_t - Ypot_t}{Ypot_t} \tag{2}$$

5.2 The labor market

The labor market is represented by three sets of equations that define labor demand, labor supply, and wages. The relationships of these variables with the supply side of MeMo-It are depicted in figure 4.

Labor demand is consistent with the Cobb Douglas production function (Hamermesh 1996, 1999) estimated. Under perfect competition, labor is paid on the basis of its marginal product: labor demand depends on output, and negatively on real wages.

Labor demand is specified according to two behavioral equations and one identity. Labor input is measured in terms of full time equivalent units. The labor demand of the private sector (*LDP*) refers to both employees and self-employed and is specified as follows:

$$\Delta logLDP_t = + 0.49 \; \Delta log \; \frac{YO_t * PY_t}{WPC_t * (1 + TSSC_t)} + 0.39 \; \Delta logLDP_{t\text{-}1} - 0.05 \; logLDP_{t\text{-}1}$$

$$+ 0.06 \; logYO_{t\text{-}1} - 0.09 \; log \; \frac{WPC_{t-1} * (1 + TSSC_{t-1})}{PY_{t-1}} \tag{3}$$

where *YO* is the value added in real terms, *PY* is the GDP deflator, *WPC**(1+*TSSC*) represents compensation of employees per-capita at current prices (*WPC*) augmented with effective payroll tax rate (*TSSC*). Labor demand in the economy is obtained by adding to *LDP* the labor input in the public sector, which is assumed to be exogenous. The corresponding figures in terms of total employment in the economy is defined by *OCCT*.

The labor supply accounts for the diverging patterns of the long-run development of participation rates for both men and women and of business cycle (Lucas and Rapping, 1969). The labor supply equation for females, expressed in terms of participation rates, is specified as follows:

---

[19] Capital stock is calculated using a perpetual inventory method approach on the basis of investment spending; see Goldsmith (1951).

$$\Delta logPART\_RF_t = 0.12\, \Delta log\; \frac{WPC_{t-1}}{PCH_{t-1}} + 0.55\, \Delta log\; \frac{OCCT_t}{POP\_F_t} * SHARE\_F_t\; -$$

$$0.03\, \Delta log\; \frac{HWDW_{t-1}}{PCH_{t-1}} - 0.37\, \Delta logPART\_RM_{t-1} + 0.27\, \Delta logPART\_RF_{t-1} \qquad (4)$$

where *PART_RF* is the female participation rate, *WPC* are per capita earnings, *PCH* is the private consumption deflator, *OCCT* is total employment in the economy, *SHARE_F* is incidence of female employment in total employment, *POP_F* is the female population aged 15 to 64 years. As a result, $\dfrac{OCCT_t}{POP\_F_t} * SHARE\_F$ is the employment rate (Bodo and Visco, 1987). *HWDW* is an indicator of the nominal wealth of households (Fair, 2004). This specification implies that female labor supply responds to real wage movements as well as to observed variation in real wealth. Finally, *PART_RM* is the male participation rate, which is included in the female equation consistent with households labor supply models (Lundberg, 1988).

The equation for male participation rate is expressed as follows:

$$\Delta logPART\_RM_t = 0.11\, \Delta log\; \frac{WPC_t}{PCH_t} + 0.23\, \Delta log\; \frac{OCCT_t}{POP\_M_t} * (1 - SHARE\_F)\; -0.12$$

$$\Delta logPART\_RF_{t-2} \qquad (5)$$

where *POP_M* is the male population aged 15 to 64 years. As a result

$$\frac{OCCT_t}{POP\_M_t} * (1 - SHARE\_F_t) \text{ is the male employment rate.}$$

Total labor force (*LFT*) is then obtained from the estimates of participation rates by gender. Finally, the unemployment rate (*URT*) is specified as an identity in terms of the ratio between the amount of unemployed persons (*FLT-OCCT*) and the labor force.

5.3 The demand side

The demand side is focused on the behavior of economic agents (households, firms), of the public sector and of the rest of the world. Households purchase consumption goods and services, perform residential investments, and accumulate real and financial wealth. Firms invest in other (non-residential) assets, such as machineries and equipment. The public sector affects directly the final demand through its consumption and investment plans, and the rest of the world determines the foreign component of final demand. Main relationships are depicted in figure 5.

Figure 5 - MeMo-It demand block
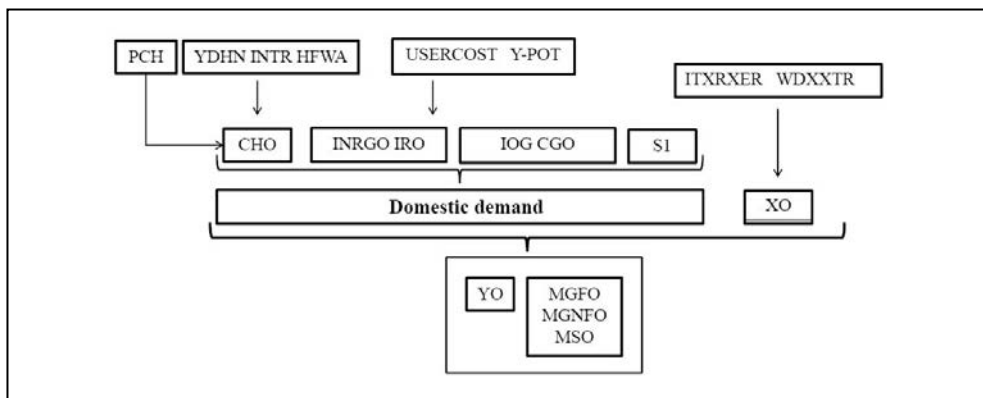
Private consumption and the household sector

Private consumption is modeled according to the permanent income hypothesis (Friedman, 1957), and consistently with Rossi and Visco (1995) and Bassanetti and Zollino (2008), who adopted a similar approach to model the behavior of the Italian consumers.

Real private consumption (*CHO*) is represented by the following relationship between disposable income, financial wealth and interest rate.

$$\Delta log CHO_t = 0.01 + 1.16\,\Delta log\,\frac{YDHN_t}{PCH_t} + 0.35\,\Delta log\,\frac{YDHN_{t-1}}{PCH_{t-1}} - 0.11$$

$$log\,\frac{CHO_{t-1}\times PCH_{t-1}}{YDHN_{t-1}} - 0.15\,\Delta log(\frac{1+INTR_{t-1}}{100}) + 0.14\,\Delta log\,\frac{HWFA_{t-1}}{YDHN_{t-1}} \qquad (6)$$

Where $YDHN$ is the disposable income (net of interests) at current prices, $HWFA$ is the financial wealth at current prices, PCH is the consumption deflator and $INTR$ is the short-term nominal interest rate.

The share of disposable income, which is not consumed by the households, increases their real and financial wealth stocks. These two stocks (measured at market prices) are modeled following the perpetual inventory method. The equation for residential investment (IRO) is the following:

$$\Delta log IRO_t = -0.30 + \Delta log\,\frac{YDHN_t}{PIR_t} - 0.45\,[\,log(1+\frac{IRN_t}{100}) - \Delta log PIR_t\,] - 0.12$$

$$log\,\frac{IRO_{t-1}\times PIR_{t-1}}{YDHN_{t-1}} + 0.46\,\Delta log PIR_{t-1} \qquad (7)$$

where PIR is the residential investment deflator and IRN is the long-term nominal interest rate.

Investments and the firms sector

Firms purchase machineries, equipment and other goods. These investments are driven by the share of potential output (Y_POT), a persistence factor (investments' dynamics), the user cost of capital ($USERCOST$), the gross operating surplus (GOS) as a proxy for retained earnings, and the uncertainty ($UNCERT$), measured as the conditional volatility of business cycle shocks. The user cost of capital measures the price of capital services and it is expressed as a function of borrowing cost, depreciation and capital gains on the asset price. The estimated equation for private investment (excluding dwellings, $INRNGO$) is:

$$
\frac{INRNGO_t}{Y\_POT_{t-1}} = 0.62 \ \frac{INRNGO_{t-1}}{Y\_POT_{t-2}} \ -0.14 \ \frac{INRNGO_{t-2}}{Y\_POT_{t-3}} \ - \ 0.07
$$

$$
(USERCOST_{t-1} + \frac{2 \times USERCOST_{t-2}}{3 \times PINRNG_{t-3}}) - 0.01 \ (\ UNCERT_{t-2} + UNCERT_{t-1}\ ) +
$$

$$
0.04 \ (\frac{GOS_t + GOS_{t-1} + GOS_{t-2} + GOS_{t-3}}{PY_{t-1} \times Y\_POT_{t-1}}\ ) \tag{8}
$$

where $PINRNG$ is the deflator for private investment (excluding dwellings). In MeMo-It, the $UNCERT$ variable is modeled as a first-order AR process with parameter equal to 0.35.

Imports, exports and the foreign sector

The foreign sector equation specification is based on an identity accounting for all the transactions between the country and the rest of the world $ROWSALDO$ as follows:

$$
ROWSALDO = (XO_t \times PX_t - MO_t \times PM_t) + (WB_t - WBH_t) + (APETIND_t - APUCP_t - TINDN_t) \\
+ ROWDT_t + ROWID_t + ROWSB_t + ROWOTH_t \tag{9}
$$

where $(XO \times PX - MO \times PM)$ is the trade balance in value XO and MO are exports and imports in volume and PX and PM are the export and import deflators; $(WB - WBH)$ are the net foreign incomes; $(APETIND - APUCP - TINDN)$ are the net indirect taxes; $ROWDT$ are current taxes on income and wealth; $ROWID$ are net capital incomes; $ROWSB$ are social benefits; $ROWOTH$ are other unilateral transfers.

The theoretical approach followed to model the foreign sector behavior refers to the most recent literature, such as Milesi-Ferretti and Lane (2011), and Obstfeld and Rogoff, (2010).

The foreign sector is represented by four equations: one for real exports of goods and services, and the others for real imports of goods and services (i.e. imports of non-fuel goods, imports of fuel goods, and imports of services).

Real exports are expressed as follows:

$\Delta logXO_t = 1.70 + 1.16 \ \Delta logWDXXTR_t + 0.30 \ \Delta logWDXXTR_{t-1} -0.55 \ \Delta logITXRXER_t - 0.26 \ logXO_{t-1} + 0.16 \ logWDXXTR_{t-1} -0.22 \ logITXRXER_{t-1}$ $\tag{10}$

where $WDXXTR$ represents the world exports in value and $ITXRXER$ the effective real exchange rate.

Real imports of non-fuel goods are specified as follows:

$$\Delta \log \frac{MGNFO_t}{DDO_t} = 1.74 - 0.37 \log \frac{MGNFO_{t-1}}{DDO_{t-1}} - 0.51 \log \frac{PMGNF_{t-1}}{PDD_{t-1}} \qquad (11)$$

where DDO is the domestic demand in real terms, $PMNFG$ is the deflator of non-fuel goods imports.

Real imports of fuel goods are modeled as:

$$\Delta \log \frac{MGFO_t}{DDO_t} = -0.16 + 0.66 \,\Delta \log PETROL_{t-1} - 0.08 \log \frac{MGFO_{t-1}}{DDO_{t-1}} - 0.05 \log \frac{PMGF_{t-1}}{PDD_{t-1}} \quad (12)$$

where $PETROL$ is the total consumption of oil and $PMFG$ is the deflator of fuel goods imports.

Finally, real imports of services are specified as:

$$\Delta \log \frac{MSO_t}{DDO_t} = -2.27 - 0.59 \,(\Delta \log PMS_{t-1} - \Delta \log PDD_{t-1}) - 0.30 \log \frac{MGFO_{t-1}}{DDO_{t-1}} + 1.85 \frac{QR_{t-1}}{100} \quad (13)$$

where PMS is the deflator of imported services and QR is the capacity utilization rate.

The net capital income, that mainly includes profits and dividends, is derived by an account relationship and it is explained by the public sector balance. The inclusion of this variable allows to control for the impact of an improvement of the public sector balance that is expected to reduce the risk premium (Caporale and Williams, 2002). The reduction of the risk premium should improve the capital income mainly through the reduction of interest's component. Finally the equation of other unilateral transfers - which includes current, capital, public and private unilateral transfers - expresses a negative correlation between world exports and inflows of transfers.

5.4 Prices and wages

The theoretical framework of the pivot equation for the block of the prices is inspired by a general formulation of the Gordon (1981)'s triangle model, revised and reintroduced in Gordon (1988), where the value added deflator (measured as log levels in first differences, $\Delta \log PV_t$) is explained by three basic determinants: dynamics,[20] demand shocks (excess demand, GAP_t), and supply shocks, which are in turn measured by cost pushing foreign-prices shocks, by labor productivity shocks and by random and uncorrelated stochastic disturbances.

Formally, the pivot equation of MeMo-It block of prices is represented as:

$$\Delta \log PV_t = -0.28 + 0.50 \frac{GAP_t}{100} + 0.51 \,\Delta \log PV_{t-1} + 0.10 \,\Delta \log PM_{t-1} - 0.09 \log \frac{Ypot_{t-1}}{Ldpot_{t-1}} \qquad (14)$$

---

[20] As in Gordon's papers and in accordance with the traditional Keynesian approach, here we assume backward looking expectations, that lead to explanatory inflation inertia in the triangle model. Put differently, MeMo-It pivotal inflation equation might be interpreted as a New-Keynesian Phillips curve (Galì and Gertler, 1999) where expectation are backward- and not forward-looking; see Gordon (2011).

where $\Delta logPV_{t-1}$ measures inflation inertia, GAP_t is the output gap, and the last two explanatory variables are proxies for supply shocks.

Although it belongs to the labor market block, for analogy with the topic tackled in this section, we also report below the estimation results of a traditional Phillips (1958) curve for the log-levels in differences in per capita nominal wage, $\Delta logWIpct$, as it has been developed in the field of cointegration approach by Golinelli (1998). Specifically, MeMo-It wage inflation is modeled as:

$$\Delta logWIpc_t = -0.22 + 0.63\,\Delta logPCH_{t-1} - 0.04\,log\frac{UR\_T_t}{100} + 0.55\,log\frac{Yact_{t-1}}{ULA_{t-1}} + 0.016\,logCONF_t \quad (15)$$

where $\Delta logPCH_{t-1}$ is the lagged household consumption inflation, UR_T is the unemployment rate, $\frac{Yact_{t-1}}{ULA_{t-1}}$ measures labor productivity, and $CONF$ is a proxy measure of the tension on the labor market.

The two equations listed above respectively represent the main sources of income distribution, i.e. the pivot relationship for the domestic prices before taxes (more precisely, the valued added deflator at factor costs), and the nominal per capita domestic wage income. Regarding the sources of price fluctuation coming from abroad, we modeled the total imports' inflation (i.e. the change in log-levels of total imports deflator, $\Delta logPM_t$) as the weighted average of three imported inflation categories:

$$\Delta logPM_t = 0.004 + 0.15\,\Delta logPMGF + 0.81\,\Delta logPMGNF + 0.04\,\Delta logPMS \quad (16)$$

where: $\Delta logPMGF$, $\Delta logPMGNF$, and $\Delta logPMS$ are the inflation rates of energy goods, non-energy goods, and services respectively. In turn, each of these rates is modeled by a different equation, starting from a general autoregressive-distributed lags (ARDL) model of the first order for: oil price inflation in Dollars ($\Delta logOIL$), log of the relative price of import in non energy goods with respect to world manufactured export ($log\frac{PMGNF}{MANEXPRI}$), and the nominal exchange rate of US Dollar against Euro ($\Delta logDOLL\_EUR$). The three retained equations are those which are both congruent with data and have significant parameters.

Given the domestic and foreign pivot prices (PV and PM) all log-differenced deflators of the components of the domestic demand (i.e. households consumption, PCH, Public spending, PCG, non-residential investments, $PINR$, and residential investments PIR) are modeled as estimation-based averages of $\Delta logPV$ and $\Delta logPM$, and of TIVA, TINDR, TCPR, i.e. the effective rates of VAT, other indirect taxes, and subsidies to production respectively. Finally, export price inflation is modeled in a similar way as that of domestic demand components, except for the fact that it is assumed a priori that indirect taxation does not contribute to export prices. As for disaggregate import inflation equations above, models of domestic demand components and exports come from a general-to-specific reduction procedure starting from a general ARDL model.

5.5 - The public sector

The public sector in MeMo-It is represented according to an institutional approach. The endogenous variables are broadly defined by accounting identities and algebraic relations that describe in a stylized way the accounting and normative rules governing the most relevant items of the general government balance sheet account. This allows for the evaluation of both direct and indirect effects of fiscal policies, and to assess the impact of macroeconomic changes on government accounts.

The general representation of the public sector is reported in table 1 where relative independent variables are indicated in brackets and highlighted in bold if exogenous,

On the expenditure side, we break down spending by purchases of good and services, compensation of employees, investments, private production subsidies, contribution to private investments, interest payments, and social benefits.

Good and services net purchases in value (E2) are exogenous and represent a policy instrument. The other outlays (except for the residual item) are endogenously determined in other blocks of the model. Public investment (E6) is set exogenously in real terms and shaped by inflation in nominal terms. Compensation of employees (E1) depends on the average per-capita wage rate for civil servant, in turn related to the private wages estimated in the labor sector of the model, and the number of public employees, that is assumed to be exogenous. Subsidies on private production (E3) and investment (E7) are exogenous. Interest payments (E4) are obtained by multiplying the average cost of the debt, estimated as a function of a lags structure of short- and long-term interest rates and the debt stock. Social benefits in nominal terms (E5) are linked to population age structure and a price indicator.

On the revenue side, social contributions and indirect and direct taxes are modeled explicitly. Social contributions are the sum of those paid by employers (R1) and those paid by employees and by self-employed (R2). Among direct taxes, we model separately taxes on households income (R8), on firm profits (R9) and on capital yields (R10). Indirect taxes are decomposed in value added tax (R3), local tax on productive activities (R5) and excise duties on mineral oils (R4). These outlays are calculated by multiplying the corresponding base (endogenous in the model) by the specific implicit average rate (policy instrument). Excise duties on mineral oils in particular depend on oil barrels consumption (in turn, a function of GDP, energy intensity and oil price in euro) and the tax rate. The property tax (R6) is set exogenously as other residual revenue items.

In MeMo-It the endogenous items of the public sector balance sheet are defined by the product of exogenous policy rates times the corresponding tax bases which in turn are endogenously determined in other blocks of the model.

Therefore, for previous years, such implicit rates are defined by the ratios of specific tax items to the corresponding macroeconomic aggregates which proxy their bases. For the forecast period, the pattern of the policy variables is assumed in order to reflect the fiscal stance. This activity is carried out along 3 steps.

In the first step a baseline scenario is defined on the basis of a simulation from MeMo-It where the updated macroeconomic framework is embedded while fiscal policy instruments are left unchanged.

Table 1 - Public sector representation in MeMo-It

Expenditures	Revenues
E1. Compensation of employees *(average public wage**; public employment**)*	**R1. Social security contributions of employers** *(wage income; **contributions rate**)*
E2. Good and services net purchases	**R2. Social security contributions of employees and self employed** *(wage income; households gross operating surplus as proxy as proxy of self-employed labor income; **contributions rates**)*
E3. Private production subsides *(Gross domestic product**; rate of government subsidies on value added**)*	**R3. Value added tax (IVA)** *(Households consumption; government and ISP consumption; **value added average tax rate**)*
E4. Interest payments *(Stock of public debt; average cost of government debt)*	**R4. Excise tax on petroleum products** *(Total petroleum consumption (barrels);**excise on petroleum products tax rate**)*
E5. Social benefits *(**Population age structure**; Inflation)*	**R5. Regional tax on business (IRAP)** *(Value added at factor cost; **regional tax rate on business**)*
E6. Gross capital formation *(**Volume of public investment**; investment deflator)*	**R6. Property tax (IMU)**
E7. Private investment grants *(Gross private fixed capital formation**; coverage of government subsidies on private***	**R7. Other indirect taxes**
E8. Other expenditures	**R8. Personal income tax (IRPEF)** *(Wage income ; households gross operating surplus; households net social benefits income; **personal income implicit average tax rate**)*
	R9. Corporate income tax (IRES) *(Corporate gross operating surplus; **corporate income implicit average tax rate**)*
	R10. Interest and capital income tax *(Households net interest and dividend income; **interest and capital income implicit average tax rate**)*
	R11. Other direct taxes
	R12. Capital and other current taxes

In the second step the MeMo-It fiscal policy instruments[21] are designed according to the new fiscal policies as they are estimated in official planning documents or in assumed simulation scenarios .

In the third step, the main items of general government account are endogenously forecasted by MeMo-It simultaneous interactions between fiscal policy instruments and macroeconomic variables (tax bases - such as income and consumption - prices, private wages, interest rates, etc.).[22]

General government net lending is calculated by subtracting total expenditures from total receipts. Public debt is the cumulative net lending corrected for an exogenous variable to consider stock-flow adjustments (e.g., due to net acquisition of financial assets, changes in volume due to reclassifications, and statistical discrepancy).

For forecasting purposes, policy instruments and exogenous variables are set in order to reflect fiscal policy stance announced by government.

6. Memo-It's fiscal multipliers

Multipliers evaluation is the natural way to look to the model mechanics linking its performances to the theoretical assumptions described by the model specification.

Multipliers' analysis is a sort of impulse-response summary of the reduced form of model's parameters which is informative of the performance of MeMo-It. At the same time multipliers' analysis shed lights on the principal features of the transmission mechanism embodied in the model. These features are relevant in the economic debate on the growth impact of fiscal policy (Cogan et al., 2010, Coenen et al., 2012, Fair 2012b, Reichling and Whalen, 2012).

The term multiplier quantifies the effects on a number of endogenous variables, such as GDP and inflation, of permanent changes in exogenous variables, such as the fiscal instruments. For each endogenous variable we 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 over the period 2012 to 2018.

In particular, we report the results of four alternative fiscal *stimula*: an increase (i) in Government spending (GS) and (ii) in Government transfers to households (TRH); and a reduction in (iii) households income taxes (ITH), and (iv) in consumption taxes (CT). In order to make results comparable the four fiscal impulses are normalized to yield a permanent impulse (i.e. a reduction in fiscal revenues or an increase of Government spending) which *ex ante* is equal to one percent of baseline GDP in the initial year (i.e. 2012).

Regarding the model's assumptions on monetary policy in the shocked scenarios, we assume an accommodative monetary stance. To complement the results, we also report the

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[21] In government budget planning documents (DEF, Stability Law), impact effects are usually evaluated under the assumption of no changes in the behavior of economic agents (i.e. unchanged tax base) so they can be easily translated into fiscal policy instruments changes.

[22] As explicitly stated in section 2, at this stage we do not account for microeconomic effects originating from policy-induced distributional changes across agents.

findings of an exercise of a monetary policy restriction: a sustained increase in short-term interest rate of 100 basis points.

The direct effects of the four simulated fiscal policy measures pass through different channels in MeMo-It. 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 households disposable income in nominal terms and, in this way, affect consumption. Finally, the reduction in consumption taxes (Hp 4) is implemented through a decrease in the VAT tax rate which leads to reduction fall in consumption prices and an increase in households income in real terms. This, in turn, affects consumption spending Table 2 reports the GDP multipliers. The comparison of the effectiveness of the four alternative fiscal policy instruments clearly shows that short-term growth multipliers are larger for public spending, consistent with most empirical findings (see for example IMF, 2012). However, in the medium-term, tax cuts have a larger impact on potential output and stimulate stronger growth.

Table 2 - Effect of fiscal multipliers on GDP for 4 different instruments

	2012	2013	2014	2015	2016	2017	2018
Hp 1:	0.7	0.5	0.4	0.3	0.2	0.1	0
Hp 2:	0.2	0.4	0.3	0.3	0.2	0.1	0.1
Hp 3:	0.2	0.4	0.4	0.3	0.3	0.2	0.1
Hp 4:	0.1	0.4	0.4	0.4	0.4	0.4	0.3

As an example of the behavior of MeMo-It, table 3 reports the outcome of the HP 1 scenario with respect to real GDP, unemployment rate, consumer prices, and trade balance on GDP. The positive effect on GDP of the increase in Government spending implies pressure on the prices through the output gap. At the same time there are expected slight positive effects on unemployment and negative effects on trade balance because of larger domestic demand and of the worsening of the competitiveness.

Table 3 - Effect of multipliers for HP 1 scenario for relevant variables

	2012	2013	2014	2015	2016	2017	2018
GDP	0.7	0.5	0.4	0.3	0.2	0.1	0
Unemployment	-0.2	-0.2	-0.3	-0.3	-0.3	-0.2	-0.1
Consumer price	0.3	0.7	1	1.4	1.6	1.7	1.7
Trade balance (% GDP)	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Overall, the fiscal multipliers are 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 the non-government components are crowded out by higher inflation (due to demand pressures on supply and sticky prices). Additionally, if we compare the multiplier results in this paper with those by Coenen et al. (2012) using various DSGE models, we note that the time profile is similar. Qualitatively, similar results (but with reference to the whole Euro Area) are also reported in Oxford Economics (2011), and Hervé et al. (2011). This suggests that, despite different methodological approaches and unequal degree of coherence with data, MeMo-It new-

Keynesian theoretical roots clearly emerge: while in the short run it is possible to manage domestic demand, in the long run fiscal deficits lead to higher prices, lower competitiveness, lower investment and lower output.

7. What next?

This paper provides a snapshot of the main features of the MeMo-It, the macroeconometric model developed by Istat in 2012. However, model development is a continuous process that requires frequent updates of the existing tools to reflect data revisions and updates. Updating the model also involves a complete re-estimation of the most recent specification, unless the emergence of signals of parameter shifts suggests interventions to change the specification of some equations/blocks.

In addition to refining on the model, more efforts are planned on the short-term forecasting tools. The number of bridge equations will be enlarged in order to cover a larger portion of quarterly NAvariables (including public sector variables) and to extend the coverage from real-terms indicators to price indexes and NA deflators.

Finally, as witnessed by the high quality of the discussions which follow, new and better tools are constantly being developed by economic researchers. We aim to use these developments in order to contribute to the outwards shift of the frontier depicted in figure 2 above.

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The Istat MeMo-It Macroeconometric Model: comments and suggestions for possible extensions[1]

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Abstract

My discussion is articulated in three main points. First, I propose to make MeMo-It the first fully open source Italian Macroeconomic Model; the enlargement of the model's users to those outside Istat would ease the interaction of ideas between researchers interested in the empirical aspects of the Italian politico-economical issues. Second, I analyze the MeMo-It structure in the light of the taxonomy of Pagan (2003). As a result, I suggest that MeMo-It modellers should improve their knowledge of MeMo-It long run properties, in order to rise its degree of coherence with the economic theory, without lowering its current degree of coherence with the data. Third, I introduce some preliminary results to extend the MeMo-It ability to give relevant policy answers: my example is about the interaction of financial markets behaviors and fiscal multipliers, and it tackles the issue of controlling the ratio of public debt on GDP in the long run.

Keywords: macroeconometric models; open-source; long-run solution; financial markets; spread.

1. Introduction

Before starting my talk, I would like to thank the organizing committee of the Italian Economic Association (SIE) for kindly inviting me to discuss the paper that introduces the MeMo-It model. This macroeconometric model implemented by Istat for the Italian economy is an "econometric work", not an "exercise"; as an academic, I think I have a great opportunity of contributing to such a relevant investigation project, whose results must be considered seriously.[3]

In order to cut straight to the point, Istat's institutional aim has always been "measurement"; now Istat has also proposed a macroeconometric model. It is an interesting concomitance the logo in the cover of the Cowles Commission Monograph No. 11 in which the Nobel Prize Lawrence Klein introduced his seminal model for the US economy (Klein, 1950). This logo reports a sentence by the Scottish physicist Lord Kelvin: "science is

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[3] In inverted commas I quote Carlo Giannini (1987, p. 231): during the discussion of an econometric model developed by the Bank of Italy, he noted a substantial difference between an econometric model made by an institution and a model made in the academic (experimental) research. I am proud to be here in a position similar to that of Carlo, a master of all Italian econometricians.

measurement". I find promising to remember this historical *connubium* of modelling and measurement, as it represents what the Italian statistical agency aims to do.

My discussion will focus on two topics related to the questions: (a) to what extent should MeMo-It be made available to the general public? (b) Is MeMo-It really on the frontier of the macro-modelling practice? In short, my answer to question (a) is "as wide as possible". Regarding question (b), I think that the long-run properties of MeMo-It can be further investigated and improved with some extra effort. Under the assumption that such long-run solution caveat will be soon fully fulfilled, I will conclude my discussion with an econometric experiment which extends the range of issues that can be tackled by MeMo-It and that also allows me to survey the points of my discussion through a practical implementation.

2. MeMo-It degree of availability: how to "sin" in open source rather than in the basement

There are many ways of thinking and implementing a macroeconomic model. The methodological approach followed by MeMo-It may be summed up by the words that Reymond Fair, the successor of Klein, used in explaining the Cowles Commission approach (Fair, 1993, p. 3). The main points are: (1) the list of the variables of interest: in fact, only a subset of variables is included in the model since restrictions are imposed on a number of other variables according to some economic theory; Chris Sims judges these restrictions as "incredible";[4] (2) the stationarity issue which is handled (dealt with) through the use of deterministic trends and the estimates of cointegration relationships among a number of variables in levels.

So, it is evident the potential criticism that the MeMo-It model specification could draw for its being only loosely related to explicit microfoundations. The interaction between theory and practice in econometric modelling is a difficult task, humorously described by Edward Leamer (1978, p. vi):

"I began thinking about these problems when I was graduate student in economics at the University of Michigan, 1966-1970. At that time there was a very active group building an econometric model for the United States. As it happens, the econometric modelling was done in the basement of the building and the econometric theory courses were taught on the top floor (the third). I was perplexed by the fact that the same language was used in both places. Even more amazing was the transmogrification of particular individuals who wantonly sinned in the basement and metamorphosed into the highest of high priest as they ascended to the third floor."[5]

After more than 30 years, Leamer's basement is still very crowded because the aim of modelling the economy, a very complicated task, is at the heart of the economic activity: if successful, this activity is "suitable for [our] purposes of forecasting and of making policy recommendations" (Klein, 1950, p. 1). In other terms, the motivations and the need of making

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[4] He suggests the VAR approach, a reduced form which is itself a structure and it is identified when the policy variables are exogenous.

[5] By the way: at the University of Matera, during the SIE session in which MeMo-It was presented and discussed, we were out of danger…at the fourth floor of the building!

macroeconometric models are today the same as those of Larry Klein when he published the Cowles Commission Monograph No. 11 more than sixty years ago. Throughout this period, models not only survived to Leamer's criticism, but in general to a "barrage of criticism [...] coming from a variety of directions: to be inconsistent with the appropriate theory, and inadequately tested and estimated". (Pesaran and Smith, 1985, p. 125).

How can we combine the two ingredients, namely economic theory and data, in a fruitful way and by using statistically founded methods? I think that the "sin" cannot simply come from the way these ingredients are used; instead it is due to the opaqueness in which these ingredients are combined. Pesaran and Smith (1985, p. 125) suggest that "many applied econometricians appear rather embarrassed by their procedures and tend to justify their results in terms of a methodology which relates only tangentially to the actual purpose. This adds both to the confusion and the controversy".

Instead of hiding because they feel embarrassed, it would be better if modellers followed Leamer's "honesty is the best policy" approach. Therefore my first suggestion, in the spirit of Leamer, is "to confess the sin" because, once confessed, the sin is transformed in a puzzle that can be debated. I wish MeMo-It shall become open source, publicly available and fully documented.

Even though the paper I am discussing now is a first relevant step, I suggest to go further along the road of transparency. For this, the simplicity of MeMo-It model is a really appreciable feature: it can be easily used and replicated because, in order to be adopted, it only requires two files as inputs: (1) a small data-set, and (2) a procedure that reads the data, computes definitions of the models' variables and labels them, specifies and estimates the equations, and makes simulations. Then, if adequately accompanied by its user's guide, MeMo-It could be made freely downloadable from Istat web site, together with the settings to reproduce a benchmark forecast. This occasion would represent a great novelty as the "black box" would be opened. In this context, I can see a number of advantages for the scientific community, such as transparency about the forecasting process and the availability of a coherent annual database for Italy. An even larger advantage would be that of favouring the collaboration between Istat researchers and academic scholars. This is a quite important issue, since Istat is an institutional actor that should be clear and fair in the results and policy recommendations it proposes; external contributions could be very helpful in improving the model or in discovering some inexactness, if any.

3. MeMo-It and the frontier of macroeconometric modelling

Among many puzzling choices in making macroeconometric models, there is a big conflict between modellers who tend to privilege the informative contents of data with respect to theoretical aspects (the so called "reality first" modellers) and those who mainly care about the theoretical foundations of the model (the "theory first" modellers). This conflict emerges because there is an unavoidable trade-off between theoretical and empirical coherence in each model, as the "perfect model" does not exists. The classical Pagan (2003)'s representation, reported in figure 1 below, introduces the frontier concept, also recalled in the paper about MeMo-It: 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.

Figure 1 - Where MeMo-It is and where it could be
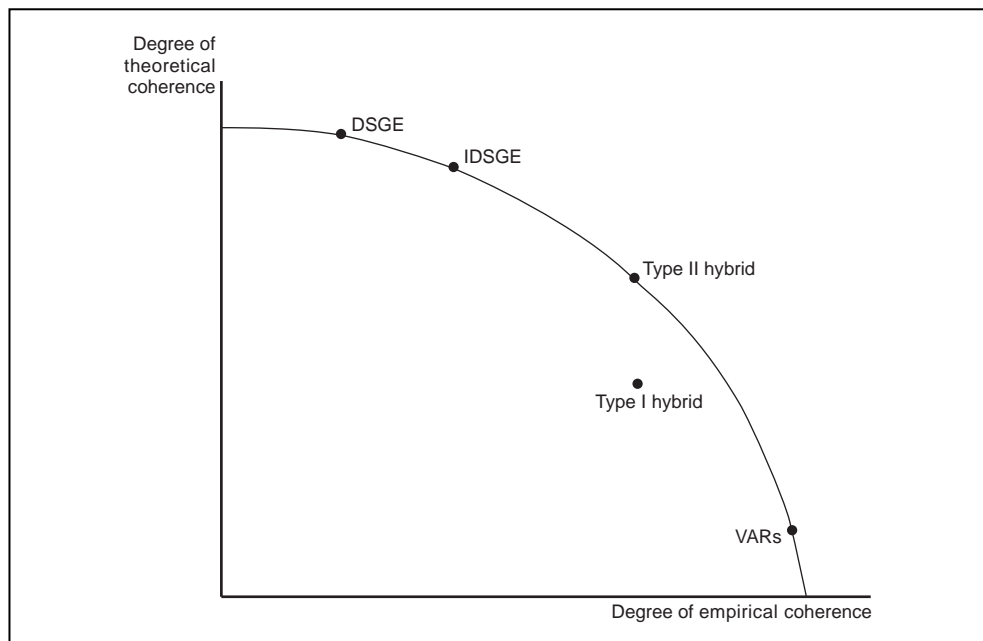
Source: Pagan (2003), figure 1, p. 68.

Given the modelling priorities of the Italian statistical agency, it is fully understandable that MeMo-It has been designed as a "reality first" model and that it takes its place towards the right corner of the frontier. In my opinion, MeMo-It is not exactly on the frontier, though quite close, but below, as it represents what Pagan (2003) defines "type I hybrid models" (i.e. with *implicit* long-run equilibrium; emphasis added). These models:

1. assume that in the long run there is only one implicit equilibrium path along which the economy evolves, as the long-run level-relationships are freely estimated within each block;
2. acknowledge that there are "gaps" measuring the adjustment path towards the long-run equilibrium (where they are zero);
3. provide that the speed of adjustment at which gaps are closed is estimated (together with the level relationship/long-run parameters) in the EqCMs context.

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, together with point (2) above, already accomplished by MeMo-It, type II hybrid models meet other three requirements:

1. 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);
2. some decisions may be influenced by expectations about the future;
3. they must provide a consistent treatment of stocks and flows.

The 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 consistent expectations; see Wallis and Whitley (1987).

In order to achieve this aim, I suggest the steps s1-s5 below, which are in line with Istat "reality first" modelling approach. In other terms, the extensions I suggest imply a shift of MeMo-It upwards on the frontier by improving 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 because MeMo-It block-structure 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, understand the main features of the long range simulation; if not, understand 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; see e.g. Daníelsson (2009).

s3) when a long-range solution is reached, compare its main features with the main stylized facts of mainstream DSGE or RBC models; see e.g. Szeto (2002);

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.

Even though I acknowledge that the accomplishment of these five steps is quite labour intensive, I also see a number of advantages: (1) the provided long-run solution (steady-state growth path) can allow to investigate a number of issues, such as environmental policies, inequality problems, and so on; (2) in the cleaning-the-model phase (steps s1-s2) contingent MeMo-It theoretical inconsistencies can be discovered, so that improvements in its specification can be implemented; (3) it will possible to prevent MeMo-it from being unstable because some shocks could be not uniquely identified (at the present state of the art, it is not possible to know whether MeMo-It is unstable); (4) since the long-run solution would warrant terminal conditions, the introduction in MeMo-It of forward looking behaviours (e.g. the new Keynesian Phillips curve) would not entail convergence problems; (5) in this improved theoretical context it is possible to deal with the issue of financial-markets expected chances of fiscal solvency or of Euro abandon more extensively, as well as with the related spread effects; on this point see also the latter part of my discussion.

Since MeMo-It dimension (more than one-hundred equations) prevents from simultaneous statistical inferences about its whole data generation process, the procedure suggested above

may be interpreted as informal Bayesian: the a priori information is given by the model structure and parameter estimates; the long-run simulation and the related multipliers are the ex-post outcomes. The investigator assesses the economic plausibility of the outcomes and decides what is the direction to modify MeMo-It initial specification assumptions in order to converge to an acceptable compromise between data information and theoretically desired reactivity of the long-run solution to a number of pre-determined alternative shocks.

4. An exercise: extending MeMo-It mechanism of financial transmission

In the present release of MeMo-It, the short-term Euribor rate is an exogenous policy variable, and the Italian long-term bonds rate is dynamically related to the policy rate: in the long run, the differential of bonds-policy rates vanishes apart from a constant; the implicit assumption is that of a fixed spread between long and short term interest rates.

The recent historical events tell us a different story. I created a quarterly data-set, from 1999Q1 to 2012Q2, made of the following variables:
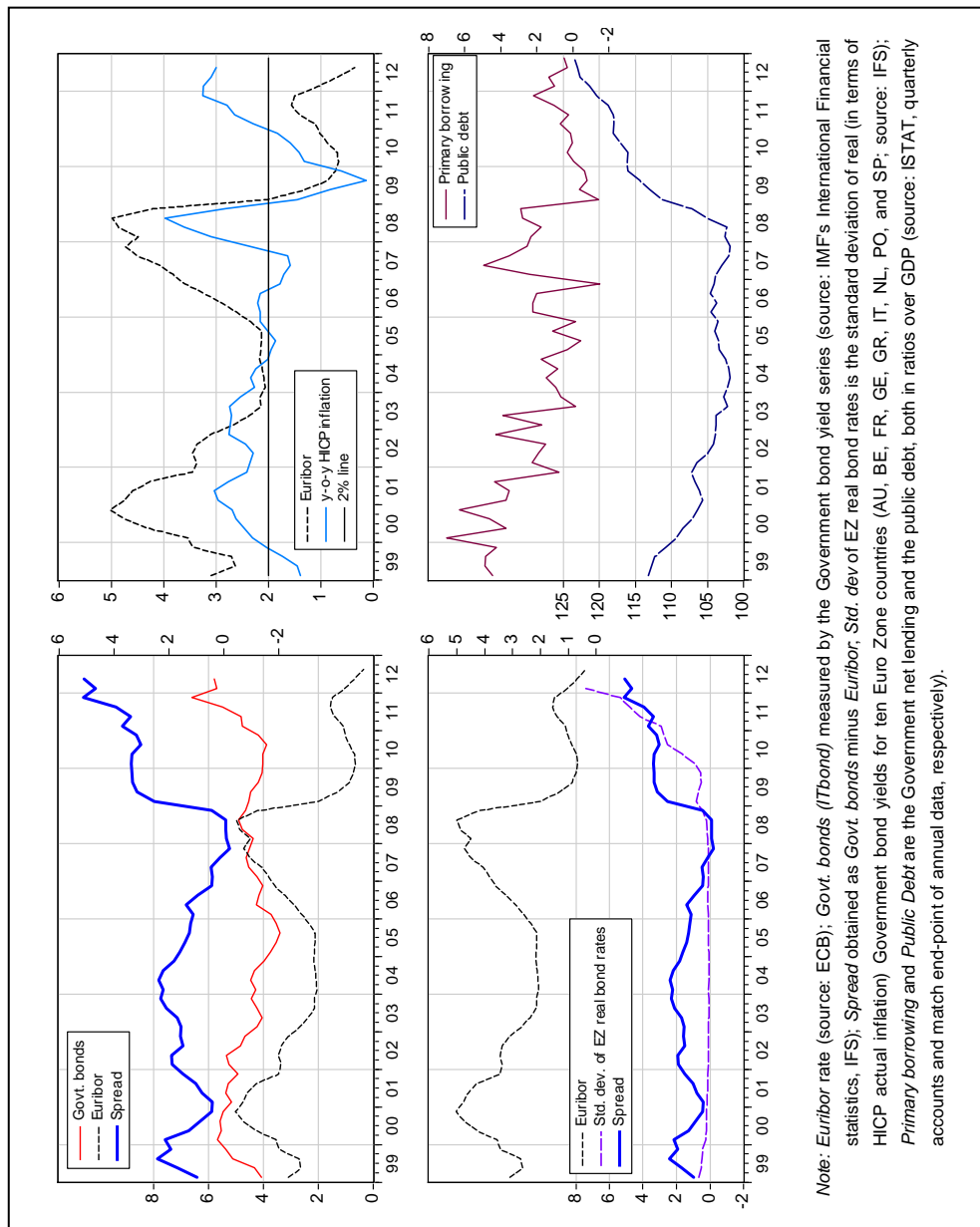
- *Euribor* rate (source: ECB);
- *ITbond*, measured by the Government bond yield series (source: IMF's International Financial statistics, IFS);
- *Spread* obtained as *ITbond* minus *Euribor*;
- *Primary* - the Government net lending - and *Debt* - the public debt - both in ratios over GDP (source: Istat, quarterly accounts and match end-point of annual data, respectively);
- *StdDev* given by the standard deviation of real (in terms of HICP actual inflation) Government bond yields for ten Euro Zone countries (AU, BE, FR, GE, GR, IT, NL, PO, and SP; source: IFS), that I consider as a proxy of market entropy.[6]

Figure 2 reports the pictorial evidence about the main issues emerging from the last 13 years. The plot in the upper-left panel shows the sudden increase of the Italian spread (thick line) since the end of 2008, in the eve of the international financial crisis, from less than 200 to more than 400 basis points. This upward shift is due to the ECB monetary easing (dotted line) not accompanied by a similar reduction in the Italian Treasury bonds rate (thin line). The extent of the monetary expansion during that period is evidenced in the upper-right panel: despite inflation rates (thin line) are persistently larger than the 2% (the horizontal line), in 2011 and 2012 , the ECB informal inflation target, namely the nominal policy rate (dotted line), is comparatively low.

As depicted by the lower-left panel of figure 2, something similar also occurred for other Euro Zone countries in the same period: the variability of the real interest rates across Euroland (broken line) increased markedly, following the pattern of the spread quite closely. The effect of the economic slowdown since the end of 2008 badly affected Italian Government balances and debt, as shown in the lower-right panel of figure 2.

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[6] Data, as well as further unreported results, are available upon request. In order to use the maximum span, Government net lending, debt and GDP in the third quarter of 2012 are provisionally estimated.

Figure 2 - The historical pattern of some variables of interest

Note: Euribor rate (source: ECB); Govt. bonds (ITbond) measured by the Government bond yield series (source: IMF's International Financial statistics, IFS); Spread obtained as Govt. bonds minus Euribor; Std. dev of EZ real bond rates is the standard deviation of real (in terms of HICP actual inflation) Government bond yields for ten Euro Zone countries (AU, BE, FR, GE, GR, IT, NL, PO, and SP; source: IFS); Primary borrowing and Public Debt are the Government net lending and the public debt, both in ratios over GDP (source: ISTAT, quarterly accounts and match end-point of annual data, respectively).

The discussion above suggests that the variability of the real interest rates across Euroland can be used as a proxy of the financial markets worries about the stability perspectives of some Euro Area countries. My proposal is to define a proxy for the Italian interest rate spread with respect to *Euribor* and to model it as a function of the financial

markets expectations about the public finances outcomes, together with Government fundamentals. More formally, instead of estimating a constant-spread dynamic adjustment between long and short term interest rates, I suggest to add a reaction function for the financial markets , in the MeMo-It model.

The spread is modelled as:

$$Spread_t = \beta_1 + \beta_2\, StdDev_{t-4} + \beta_3\, Primary_{t+1} + \beta_4\, Debt_{t+1} + \beta_5\, Spread_{t-1} + \beta_6\, Spread_{t-2} + \varepsilon_t$$

where (1) the market entropy (*StdDev* variable that proxies regime-switches) has the predicted sign as $\beta_2 > 0$; (2) the expected fiscal outcomes (*Primary* and *Debt*) have predicted signs as $\beta_3 < 0$ and $\beta_4 > 0$, respectively; (3) the spread inertia (measured by the two lags of the dependent variable) must satisfy the stationarity condition $\beta_5 + \beta_6 < 1$; finally (4) ε_t indicates unpredictable random shocks. Hence, the MeMo-It Government bond yield series can be obtained as $ITbond_t \equiv Spread_t + Euribor_t$, where the variable $Euribor_t$ remains exogenous, as in the present MeMo-It release.

The GMM estimates (and standard errors in brackets) over the period 2000Q1-2012Q2 are the following:

$$Spread_t = \text{-}11.8 + 0.339\, StdDev_{t-4} \text{-} 0.044\, Primary_{t+1} + 0.125\, Debt_{t+1} +$$
$$\quad (1.41)\ \ (0.051) \qquad\quad (0.014) \qquad\qquad (0.013)$$
$$+\, 0.996\, Spread_{t-1} \text{-} 0.197\, Spread_{t-2} + \hat{\varepsilon}_t$$
$$\quad (0.048) \qquad\quad (0.040)$$

Spread dynamics are stationary though highly persistent (inertia is about 0.8), parameters estimates are both significant and of the expected sign, and $\hat{\varepsilon}_t$ residuals follow a broadly white noise pattern.

Equation fit is reported in figure 3: shocks exhibit both a large outcome in 2009Q1, and other realizations outside the 66% confidence interval (of about ±50 basis points) in 2011-2012.

In order to interpret the results, let us assume (arbitrarily, until MeMo-It terminal conditions will not have been studied explicitly) a long-run solution where *StdDev* = 3 (i.e. the level immediately before the spreads' turmoil of 2011), *Primary* = 0, and *Debt* = 100% of GDP. The corresponding steady-state solution for the Italian spread would be about 180 basis points which, considering the confidence intervals, is not so far away from Di Cesare et al. (2012)'s estimate of 200 basis points fundamental level (that refers to the sovereign risk concept of spread).

Figure 3 - Reaction function of the financial markets - model fitting
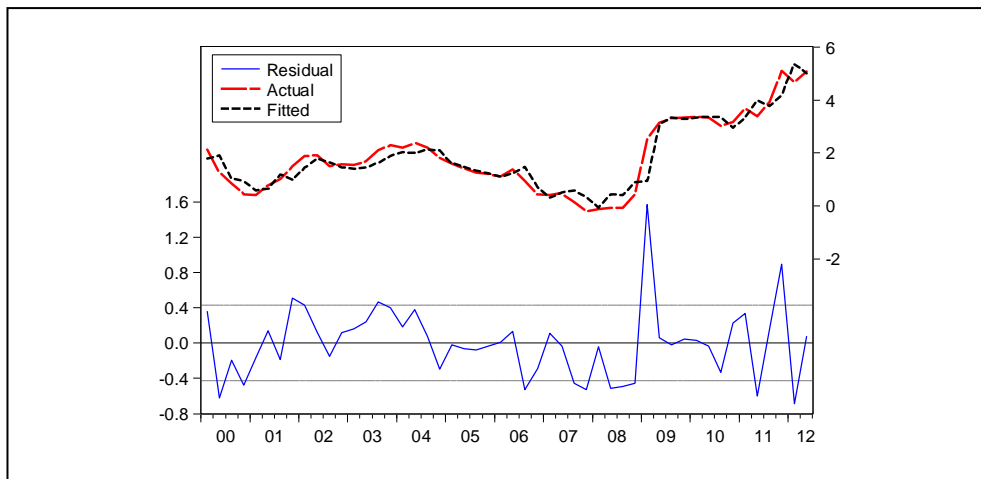
These outcomes are quite promising. However, to be coherent with the transparency principle I advocated in Section 2, I want conclude my discussion by "confessing" the potential sins of my specification search. Of course, further improvements are needed before this extension enters MeMo-It model.

First of all, the implementation of my function needs calibration for annual data, because it was estimated on quarterly data.

Second, GMM estimates are prone to be affected by problems of both weak instruments and an excess in the count of the moment conditions. In estimating by GMM, I used orthogonal conditions based on both internal (lags of model's explanatory variables) and external instruments (lags of growth and inflation rates); better fiscal policy instruments could be proposed. The unreported p-value of the over-identification Hansen (1982)'s J-test is about 99%, as usual when too many moment conditions are used; a solution is to reduce the number of instruments by exploiting the principal components techniques suggested by Bontempi and Mammi (2012).

Third, the set of fundamental explanatory variables may be extended on the basis of the findings in Di Cesare et al (2012).[7]

Fourth, the quite ad hoc *StdDev* driver of the switches between Euro-confident and sceptical financial market regimes can be deepened by using nonlinear modelling techniques.

Last but not least, the estimate of the *Primary* effect is quite small if compared with the *Debt* effect; probably for this reason, the constant term is estimated highly negative and this is questionable.

Anyway, the inclusion of a forward-looking spread function would improve MeMo-It. In fact, it would be possible to endogenously mimic for the reactions of the financial markets to fiscal policies, reactions that modify the long-run view of Italian Government accounts (given the exogenous ECB monetary policy).

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[7] In addition, and related with this paper, robustness checks may be carried out by using more orthodox spread measures.

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Analyzing MeMo-It supply side properties[1]

Ottavio Ricchi[2]

Abstract

The aim of this paper is to review the properties of the newly released MeMo-It econometric model by looking at its supply side. The analysis hinges on the link between potential output, which determines the level of GDP in the medium term, and all the channels of transmission that can affect it. The specification of the price, wage and participation rate equations are in turn examined so as to single out the interactions that arise amongst them. The analysis points out also that no homogeneity restrictions are imposed on the price and wage equations and it suggests that the impact on model properties of this decision should be farther investigated. The final section of the paper comments on the size of MeMo-It fiscal multipliers.

Keywords: Model properties, supply side, static and dynamic homogeneity.

1. Introduction

The release of MeMo-it is a welcome addition the number of macroeconometric models used to produce forecasts for the Italian economy. Bacchini et Al. (2013) describe the model for the first time.[3] The authors begin by explaining the reason of their choice of adopting a modelling approach that follows both the LSE tradition and the Ray Fair's updates of the Cowles commission techniques. They state that "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". They also review a wide set of recent contributions on modelling choices and argue that DSGE models are closely related to theory but not closely enough to data. They conclude that, given the institutional mandate received by ISTAT – mostly related to producing forecast for the Italian economy –, such a feature would represents a serious drawback.

This article does not address the above debate. Rathere, it is aimed at providing a practitioner's view on the model properties so as to suggest possible future developments. Section two summarizes the main features of MeMo-It and in particular those of its supply side. The latter is the core of macroeconometric models as it determines most of their properties. Section three follows the standard approach in

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analysing models pioneered by the Warwick Macromodelling Beareau in the early 90's.[4] Whilst section four looks at fiscal multipliers of the model. Section five concludes with some suggestions on possible future developments.

2. Main features of the model

This section follows closely Bacchini et Al. (2013) and it is aimed at drawing attention to the main equations of interest.

The ISTAT team made the choice to anchor MeMo-It to a – mostly exogenous – level of potential output which drives GDP growth in the medium term. Potential output is "modelled as a constant returns to scale Cobb-Douglas production function with two productive inputs, labor and capital stock, assuming a Harrod-neutral technical progress (Beffy et al, 2006; D'Auria et al, 2010)".

$$\log Ypot = HTFP + \alpha * Ldpot + (1 - \alpha) = \log Kt \tag{1}$$

In turn, *Ldpot* represents potential labour in terms of total hours worked, which is a function of trend labor force participation, working age population, trend hours worked and the non-accelerating inflation rate of unemployment. The *NAIRU* depends on lags of the output gap, the unemployment rate and "other structural variables". Output gap is defined as the percentage deviation between actual output (which is computed by adding up demand aggregates) and potential output. The potential capital stock *Kt* corresponds to the full utilization of the current capital stock.

The participation rate is modelled separately for male and female population, with labour supply being primarily driven by per capita earnings.

Price of output (*PV*) is a function of the output gap, of inertia (the lagged term of *PV*) and of two sources of supply shocks, i.e import prices (*PM*) and the ratio between potential output *Ypot* and potential labour *Ldpot*

$$\Delta \log PV_t = -\beta + \psi_1 * \frac{GAP_t}{100} + \gamma * \Delta \log PV_{t-1} + \delta * \Delta \log PM_{t-1} - \psi_2 * \log \frac{Ypot_{t-1}}{Ldpot_{t-1}} \tag{2}$$

Wages respond to consumer inflation, labour productivity, unemployment and a proxy for labour market tensions.

$$\Delta \log WIpc_t = -\chi + \vartheta * \Delta \log PCH_{t-1} - \lambda * \log \frac{UR\_T_t}{100} + \omega * \frac{Yact_{t-1}}{ULA_{t-1}} + \varphi * \log CONF \tag{3}$$

where $\Delta \log PCH_{t-1}$ is the lagged household consumption inflation, UR_T is the unemployment rate, $\frac{Yact_{t-1}}{ULA_{t-1}}$ measures labor productivity, and *CONF* is a proxy measure of the tension on the labour market.

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[4] See for instance Church et Al. (1995), Wallis (1997) and Murphy (1992).

Notably, all log-differenced deflators of the components of the domestic demand are modelled as estimation-based averages of $\Delta logPV$ and $\Delta logPM$ and of effective tax rates.

Concerning the demand block, consumption is function of disposable income, interest rates and households wealth. Investment depends on potential output, user cost of capital and business uncertainity. Trade equations depend on demand and on price competitiveness.

3. Understanding MeMo-It model properties

There are two, complementary, ways to look at model properties. One is to understand what drives the model behaviour in the long term, the other relates to the medium term and to adjustments from the short term to the medium term.

In relation to the long term, the main issues to be addressed are: what drives GDP growth, whether the unemployment rate settles to a constant value and the net asset stocks of institutional sectors (do they stabilize in the long term as ratio to GDP?). This area of analysis is related to the consistency of model behaviour with its theoretical framework and with the so called steady state properties.

Although most of these properties should be built into the model by construction, it is worthwhile verifying compliancy with theory by way of simulations. The standard approach here is to perform a baseline long-run simulation based on smooth projections of exogenous variables and to verify if the model settles to a stable rate of growth consistent with its theoretical framework. Given the choice of modelling choice of Potential output in MeMo-It (i.e. constant return to scale and Harrod Neutral technological progress) – if holding the NAIRU constant – GDP growth should end up being the sum of TFP growth and growth of labour supply.

Long-run properties are not determinant when trying to assess the model capability to perform forecasts or to evaluate the impact of fiscal policy on GDP. Within this framework it is relevant to understand the model behaviour in the short to medium term.

One way to analyse these properties is to find out how the model responds to shocks to exogenous variables. They are usually given a permanent and constant shock (so called step changes) with respect to their baseline values. The percentage change of endogenous variables of the new simulations with respect to the baseline are then computed. When the shock occurs to a government controlled variable (either expenditure or a tax rate) then the change of endogenous variables are called fiscal multipliers. However important insights on model properties are gained also by changing other exogenous variables such as foreign demand, exchange rates, interest rates, Total Factor Productivity and population growth.

The other means of gaining insight into model properties is to analyse the main model equations and to gauge how the model performs from their specification, the sign of their coefficients and their interrelations. The two methodologies are closely related as simulation can be run to verify what the model inspection suggests and, at the same time, it is equally possible that in order to properly understand the results of simulation it is necessary to look back at the model manual.

Most of the model properties are determined by the modelling of the supply side, including the specification of the price and wage equations.

MeMo-It falls within the category of new-keynesian econometric models. Their distinctive feature is to have output driven in the short term by demand conditions and in

the medium term by the supply side. The means by which this property is achieved is to have a potential output measure built into the model (see for instance Richardson (1990) or Oxford Economics (2011)). If output exceeds (is below) its potential level, there is a price increases (decrease) which determines a loss (gain) of competitiveness. GDP hits its potential level in the medium term because net foreign demand adjusts.[5]

When trying to understand the model properties it is useful to start by distinguishing between shocks that affect the level of GDP temporarily and shocks that generate permanent effects on output. These are usually defined respectively as demand side and supply side shocks. So an initial task is to work out which alteration to exogenous variables will feed into which of the two above categories. Model simulation will then provide evidence on the size of the output response to the shock and the time needed for the output response to reach its peak or, in the case of demand shocks, the time needed for output to return to its baseline value.

A straightforward starting point for undertaking the above analysis is to notice that all the shocks affecting potential output are deemed to change the equilibrium level of GDP. This feature, of course, was deliberately built into the model by the ISTAT team. With reference to equation (1), changes affecting the supply side are those to the trend component of Total Factor Productivity, working age population, working hours, trend participation rate, the NAIRU and, finally, to capital stock. Inspection of the investment equation highlights that capital stock is influenced by the user stock of capital and by gross operating surplus.

Whilst a few of the above variables, amongst which population and Total Factor Productivity, are clearly exogenous in MeMo-It, it is not immediately clear which additional variables will have a permanent effect on GDP. Although it is not within the scope of this paper to undertake a systematic analysis of this topic a few critical issues can be pointed out.

First, it is a challenge to assess which fiscal variables, and in particular tax rates, feed into the supply side of the model. The case of the VAT rate provides a good example. A decrease in the VAT rates will cause a reduction of consumer prices. This will raise both participation, which in MeMo-It depends on real wage levels, and consumption. Several forces (i.e. channels of transmission) at this point will come into play. First of all, owing to a higher participation rate, unemployment should at least initially increase. At the same time, in the short term the output gap should become positive due to higher demand. In turn, this will tend to raise inflation offsetting, at least partially, the direct impact on prices of the VAT decrease. Overall, unless the change in the actual participation rate feeds into the participation trend level there should be no permanent effect on output. In facts, it is important to verify the link between the participation rate of male and female population – affected by the real wage level – and the trend participation rate, which is a component of the potential output equation. The wording of the paper on MeMo-It seems to suggest that there is such a link but it is not completely clear on this matter.

The alternative channel through which the VAT change could have a permanent impact is if it feeds into the NAIRU. As from equation (1), also this variable influences the labour

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5   Also internal demand can be crowded out by inflation. For instance price increases can reduce the real value of financial assess. It is not clear weather this channel operates in MeMo-It.

market component (i.e. *Lpot*) of potential output.[6] The outcome of the fourth simulation (VAT tax reduction), which will be discussed further below, conveys a positive medium term impact. However the channel mentioned by the authors in explaining this increase is typically a demand side one, i.e. the disposable income increase.

The second issue to be pointed out coincides with the modeling choices of prices and wages. They are relevant not only because inflation forecasts are one of the main aims of the model, but also in relation to a clear understanding of the model properties. Indeed, the interaction between wage and price behavior is key in shaping both the model equilibrium and responses to shocks.

The first step of the analysis here consists in asserting that there is no direct link between wage dynamics and price behavior as the value added price equation (2) corresponds to a Philips curve and prices are not modelled as a mark-up on unit labour costs. The inverse is not true, however, because wages respond to consumer prices, which are a function also of the value added deflator.

This preliminary assessment needs to be complemented with further inspection of the relevant model equations and the relationship between price dynamics and cost factors should also be fully examined.

The absence of a wage inflation term in the price equation could lead to incorrect conclusions. It could be argued that in the case of a negative demand shock which causes the labour market slacke, and some downward pressure on wages via a higher unemployment rate, There will be no stabilizing mechanism driving back the economy to its medium term equilibrium. In facts lower wages will imply lower demand which will open a negative output gap leading in turn to lower prices.

A very similar argument can be used for supply side factors affecting wages, such as a change in social security contributions or a productivity increase. For instance, an increase in social security contributions will raise the share of total wages as a percentage of value added; this variable affects negatively, in turn, labour demand, labour income and consumption. The propagation mechanism will eventually reach the value added price through changes in the two GAP (labour and output) variables. In this case the gaps will become negative exerting a downward pressure on prices. Overall a negative impact on the economy it is to be expected, which is consistent with theory. It remains to be seen how the contribution increase will eventually lead to raising prices, which is what is also to be expected on an ex-ante basis. This is a typical case in which inspection of model equations requires support by simulation analysis.

An equally important issue related to wage and price equations specifications concerns the transmission mechanisms and the impact of nominal shocks on the economy. Both equations are characterized by nominal rigidity (e.g. wages do not react immediately to price changes by the same proportion). This is a common feature of most new-keinesian models and it implies that nominal shocks can alter resource allocation and have real effects, at least in the short term. Whether the above effects are temporary or permanent depends on two model properties. One is static homogeneity, which requires that the real equilibrium is unaltered if the level of all nominal variables are changed by the same proportion. This prevents the existence of a trade off in the long run between nominal and real variables.

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[6] On the contrary if the tax wedge is one the structural variables that affect the NAIRU in the MeMo-It model and a bridge is built between each individual tax rates and the tax wedge then a permanent effect will be in place.

In practical terms static homogeneity property implies that the log-level coefficients of the (nominal) independent variables add-up to one. This restriction is often tested and imposed in many econometric models and it coincides with the long run estimates of error correction models. Even if static homogeneity holds, the level of activity could still be function of the steady state rate of inflation; dynamic homogeneity must be insured for output to be completely independent from nominal variables. In fact, in the absence of dynamic homogeneity there will be a trade-off between the rate of inflation and output. Also this kind of restrictions can be tested and imposed[7].

In MeMo-It price and wage equations do not have a fully-fledged ECM representation (i.e. a specification in which the dependent variable and one or more independent variables have a lagged log level term). In fact the price equation, as outlined, it's a Philips Curve with the nominal variables modeled in differences only. Furthermore, the absence of dynamic homogeneity seems to imply that the Philips curve is not vertical in the long run. The impact on model properties should be investigated by shocking nominal exogenous variables (for instance the international level of prices and the nominal exchange rate) and finding out the model response of a few key variables.

Of course, the choice not to impose homogeneity (and other) restrictions is fully legitimate and it is consistent with the claim made by the authors that theory should not prevail on data. Such restrictions could be even counterproductive if their introduction reduces the model capability to produce good quality forecasts. Furthermore, their introduction, especially dynamic homogeneity, could be discarded if taking into account the monetary policy setting in Europe. According to this view, the ECB would not allow for permanent (or long lasting) changes of the rate of inflation[8] with respect to its target values.

4. Fiscal Multipliers

The other mentioned methodology which is used for model evaluation is the multipliers' analysis[9]. The set of results provided by the authors refers to fiscal policy shocks – government consumption, increase of transfers to households, personal tax decrease and consumption tax decrease – which are all worth one percent of GDP on an ex-ant basis. These shocks can be divided into two categories: expenditure shocks and tax shocks. The first ones are generally considered to act on the demand side of the economy and are, therefore, expected to produce only temporary effects. Tax shocks activate, at least potentially, an higher number of channels of transmission. To start with, they affect households consumption because acting either on the nominal disposable income or on the level of consumer price. However, they could also impact on the supply side by affecting wage and price behavior (thus influencing competitiveness) and/or labor supply. The existence of these effects depends on the model structure and on the specification of a few key equations.

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[7]   See for instance, Angelini et Al. (2006).

[8]   The absence of static homogeneity could be more worrisome as, for instance, the model response to an Euro devaluation could lead to a permanent change to the level of output. Would this be a plausible and likely outcome?

[9]   Of course, it is not only the output behaviour that provides information on model properties but also the response of other key model variables. The largest possible number of additional model variables should be provided so as to improve the understanding of transmission channels.

The size of multipliers provided by the authors is on the lower tail of the results generally produced by macromodels.[10] This is certainly the case for the consumption shock multiplier, which is equal to 0.7 in the first year. The impact on GDP declines afterwards and it reverts to zero in the final part of the simulation horizon. The peak value of the output response to a shock to government consumption is normally around one. In fact, the size of this multiplier and the speed of its return to zero depend on the price response caused by the positive output gap – usually conveyed by the price equation – as well as on the price elasticities of the export and import equations. Model simulation results can help verifying what holds down the value of the multiplier in MeMo-It. The size of the transfer to household multiplier is even smaller than the government consumption. However this result, as explained by the authors, is consistent with the notion that transfers to families should have a smaller impact on output than direct purchase of goods by the public sector. The multiplier of the personal income tax simulation has a pattern very similar to the income transfers simulation. Indeed, both seem to activate the same transmission channels, i.e. a change of households disposable income. It is unclear why both have a positive, although very small, positive medium term impact on GDP. Finally the VAT decrease simulation is the only one that shows a positive and permanent effect. The reason of it was related by the authors to labour supply effects.

5. The way forward

MeMo-It is a "young" model and the effort put up by the ISTAT team in building it in a very short span of time is highly commendable. With no doubt the debate spurred by its release will bring forward new ideas that should allow the team to further raise the standards achieved with the first release.

This paper suggests that there is a key area for possible improvements. The ISTAT team might want to work on a fine tuning of the supply side block. Thus it could further consider the trade-offs between free parameter estimation and testing and imposing restrictions that can enhance the model medium term behavior. Extensive model simulations can be used to assess progress being made and to evaluate the impact of the changes under scrutiny.

Furthermore it is advisable to further extend on the modeling of financial assets of institutional sectors. It is quite important for MeMo-It to track asset stocks changes relating them to saving and investment decisions. In fact, when running policy simulations, it important to check how asset positions – not only those of the government – unfolds as a consequence of policy changes. This kind of evaluation has become extremely important in the framework of policy assessment in the European Union.

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[10] This statement is supported by comparison of multiplier provided in table 1 of Bacchini et Al. (2013) with the values provided by model manuals of the Oxford Economic Forecasting, of the Italian Treasury ITEM econometric model.

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La pubblicazione nasce nel 1992 come collana di monografie "Quaderni di Ricerca ISTAT". Nel 1999 la collana viene affidata ad un editore esterno e diviene quadrimestrale con la denominazione "Quaderni di Ricerca - Rivista di Statistica Ufficiale". L'attuale denominazione, "Rivista di Statistica Ufficiale", viene assunta a partire dal n. 1/2006 e l'Istat torna ad essere editore in proprio della pubblicazione.

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