Economic Modelling 27 (2010) 125–133

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

The Italian Treasury Econometric Model (ITEM)☆

Claudio Cicinelli [a], Andrea Cossio [a], Francesco Nucci [b], Ottavio Ricchi [c,*], Cristian Tegami [a]

[a] Consip SPA, Italy
[b] Università di Roma La Sapienza, Italy
[c] Ministero dell'Economia e delle Finanze, Italy

ARTICLE INFO

Article history:
Accepted 3 August 2009

JEL classification:
C51
C52
E60

Keywords:
Macroeconometric models
Economic policy

ABSTRACT

In this paper, we provide a description of the Italian Treasury Econometric Model (ITEM). We illustrate its general structure and model properties, especially with regard to the economy's response to changes in policy and in other dimensions of the economic environment.
One of the key features of the model is the joint representation of the economy on both the demand and the supply sides. Since it is designed for the needs of a Treasury Department, its public finance section is developed in great detail, both on the expenditure and revenue sides. It also features a complete modeling of financial assets and liabilities of each institutional sector. After documenting the model structure and the estimation results, we turn to the outcomes of model simulation and ascertain the model properties. In ITEM the shocks that generate permanent effects on output are associated with: a) variables that affect the tax wedge in the labor market and the user cost of capital; b) labor supply change; and c) variation in the trend component of TFP (technical progress). By contrast, demand shocks have only temporary effects on output.

1. Introduction

The aim of this paper is to provide a description of the Italian Treasury Econometric Model (henceforth, ITEM.)[1]. In doing so, we illustrate its general structure and properties, especially with regard to the economy's response to changes in policy and in other dimensions of the economic environment.

The model ITEM has a quarterly frequency and includes 371 variables (247 of which being endogenous). The model structure features 36 behavioral equations and 211 identities, referring to accounting definitions and institutional relationships among variables. Being a medium-size econometric model, ITEM is suitable to track and explain the behavior of a considerable number of macroeconomic aggregates of the Italian economy.

Exogenous variables are grouped in three categories: a) those dealing with the international economic environment. These are essentially world demand, exchange rate, oil and commodity prices, and — in forecasting exercises — short-term interest rates; b) fiscal policy variables: i.e. a variety of tax and contribution rates, as well as several public expenditure aggregates; and c) other domestic exogenous variables, such as those related to demographics and, most importantly, the non cyclical component of total factor productivity (TFP).

With regard to the general structure, ITEM belongs to the class of macroeconomic models that assign a prominent role to the supply side of the economy. Indeed, one of its key features is the joint and explicit representation of the economic environment on both the demand and the supply sides. Behavioral equations for private consumption, investment, export and import included in the model structure are rather conventional. The equation for private consumption features a long-run relationship between household expenditure at constant prices, real labor disposable income, real household net financial assets and the real interest rate on short-term borrowing. With regard to the demand for capital goods, a long-run relationship between investment, employment, the unit labor cost and the user cost of capital is imposed with a unit elasticity of investment with respect to both output and the user costs, consistently with the optimal conditions of a profit-maximizing firm facing Cobb–Douglas technology. The ECM specification for exports features a long-run relationship between export, world demand and real effective exchange rate. Real non-oil imports depend upon absorption and the relative price of non-oil

☆ We wish to thank Ignazio Angeloni, Ray Barrel, Lorenzo Codogno, Sergio De Nardis, Carlo Favero, Riccardo Fiorito, Alberto Locarno, Libero Monteforte and Carlo Monticelli for helpful comments and suggestions. We are also grateful to seminar participants at the Bank of Italy, the Department of Treasury at the Ministry of the Economy and Finance, the European Commission, the University of Rome "La Sapienza" and the XVII International Tor Vergata Conference on Banking and Finance for useful discussions. The views expressed in the paper are those of the authors only and do not necessarily reflect the position of the Ministry of the Economy and Finance.
* Corresponding author. Via XX Settembre 87, 00197 Rome — ITALY. Tel.: +39 06 47617738.
E-mail address: ottavio.ricchi@tesoro.it (O. Ricchi).

[1] The actual development of the project at the Italian Treasury started in 1994 and a team of economists was involved, under the guidance of Carlo Favero and Riccardo Fiorito. In 1998, a version of the model was officially presented at the Department of Treasury and the name of ITEM, Italian Treasury Econometric Model, was assigned to it. A report with an overview of the first version of the model was also prepared (Favero et al., 2000). Since then the model has come under a growing scrutiny and a significant revision process has been undertaken which has led to the current version of the model.

0264-9993/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.econmod.2009.08.001

imports whilst imports of oil and energy have a simpler structure featuring a long-run relationship between oil and energy imports and the volume of economic activity.

A notable feature of ITEM is that gross domestic product is computed, via an accounting identity, on the supply side. In particular, total GDP is the sum of value added of market and non market sectors and net indirect taxes and, importantly, the value added of the market sector is obtained through a production function of the Cobb–Douglas type with constant returns to scale, where value added depends on labor, capital stock and total factor productivity (TFP).

The demand equation for labor input is estimated by imposing a long-run relationship coherent with the optimal conditions of the firm's profit maximization as it is done for the demand for capital goods. A specific characteristic of ITEM is that the TFP variable is modeled as a combination of two components: an exogenous trend component, that reflects long-run growth determinants, such as technical progress and organizational innovation, and a cyclical component. The latter reflects measurement problems in the available input statistics, which fall short of properly capturing cyclical variation in the degree of intensity of factor utilization. This cyclical component of TFP is thus modeled through a statistical equation that links it to demand conditions.

The model GDP accounting identities are closed by computing inventory changes as the difference between GDP and total demand. The fact that they are treated as a residual buffer, rather than a variable determined by a behavioral equation, represents a novel feature of our model dating back to its initial version (see Favero et al., 2000 and Fiorito, 2003).

Price and wage behavior is modeled similarly to most existing econometric models. Value added prices respond with a unit elasticity to unit labor costs and to the cyclical component of TFP. This channel provides a feedback from the supply side of the economy to the demand side. Indeed, price changes induced by tensions on capacity utilization and the demand side impinge on firms' external competitiveness thereby affecting aggregate demand. This brings back the observed TFP level toward its trend value. As far as the labor market is concerned, a bargaining model underlies the wage equation. The real wage is linked, in the long run, to labor productivity, the unemployment rate and the tax wedge on labor.

In ITEM real or nominal frictions usually characterizing several markets do not explicitly rest on microeconomic foundations. For example, we do not introduce price or wage stickiness by relying explicitly on theoretical underpinnings, like the state-dependent Calvo price staggering. However, we do allow our model specification to accommodate the effects of frictions. In particular the dynamic specification of the equations features a disequilibrium correction mechanism where the speed of adjustment varies from variable to variable. This modeling tool contributes to mimic, on empirical ground, the relevant effects of frictions.

To wrap up, output in ITEM — albeit computed directly on the supply side from an accounting identity — is determined in the short run by demand conditions. Indeed, the inclusion of TFP in the production function and the statistical equation to account for its observed cyclical variation are the technical devises to make demand conditions predominant in the short run. Output level is determined on the supply side as to what pertains the long run. In ITEM the shocks that generate permanent effects on output are associated with: a) variation of variables affecting the tax wedge in the labor market and the user cost of capital; b) labor supply change; and c) variation in the trend component of TFP (technical progress). By contrast, impulses on the demand side have only temporary effects on output and, in general, on the economy.

Moreover, since ITEM is designed for the needs of a Treasury Department, its public finance section is developed in great detail. Spending and revenue items are modeled almost with the same level of breakdown provided by the national statistical institute (ISTAT) in the general government appropriation accounts. On the expenditure side the most relevant distinction is between public consumption — decomposed in its labor and non-labor (purchase of intermediate goods) components, subsidies and public investment. These primary expenditure items summed to interest payments — estimated as a function of the debt stock and interest rates pattern — add up to total government expenditures. Shocks to government outlays have an impact on GDP, although generally a temporary one. Concerning revenues, all main components are separately included: direct taxes on labor (IRE, formerly called IRPEF) and on profits (IRES, formerly called IRPEG), indirect taxes — divided into value added tax (IVA), excises on fuel production and regional tax on productive activities (IRAP) — and social security contributions. For the latter we keep the official distinction between employers, self-employed and employees' contributions. Each revenue variable included in the above list is obtained by multiplying an implicit average tax rate to the corresponding tax base (see Mendoza et al., 1994). In addition, ITEM includes taxation on income from financial capital, on capital gains and on local duty on real estate (ICI). In general, tax rates are distortionary and they either enter into the fiscal wedge between real disposable wage and salary and the labor cost or contribute to determine the value of the user cost of capital. In both ways taxation ends up affecting the level of GDP permanently.

A relevant characteristic of ITEM is the explicit modeling of the accumulation process of financial assets and liabilities of the institutional sectors as well as of their feedbacks on agents' decisions. In particular, we have reconstructed the flow of funds for: a) the household sector, b) the non residents sector, c) the sector pertaining to public administration and d) the business sector featuring both financial and non financial firms. It is important to note that we also model in a comprehensive and coherent fashion all flows of capital income.[2]

The approach underlying ITEM is not that of dynamic stochastic general equilibrium models (DSGE) which has become increasingly popular (see, e.g., Smets and Wouters, 2003 and Forni et al., 2007). In other words, the relationship between variables and the propagation mechanisms of any impulse that characterize our theoretical framework is not obtained within a forward-looking model, fully based on agents' intertemporal optimization. In some respect such a carefully micro-founded theoretical model would have proved more appropriate than our own approach, as in that framework, for example, the parameters describing tastes and technology are readily identified (see Favero, 2007). On the other hand, however, a parsimoniously parameterized model of the DSGE type has some limitations with respect to a less theory dependent, but more data-driven, dynamic model like our own. For example, as we emphasized before, in ITEM we allow for a breakdown of fiscal variables into a large number of components and also explicitly consider the borrowing and lending activities of all the institutional sectors in the Italian economy thus making our model more informative. Whilst the recent DSGE models estimated in a Bayesian framework allow one to increase the number of parameters with respect to previous approaches, it is clear that DSGE models do not allow for a variable coverage as large as the one featured in ITEM.[3] Moreover, an institutional scope assigned to the Treasury model is that of forecasting macroeconomic aggregates

[2] The entire structure of the model is analyzed in greater detail in a separate Attachment to the online version of the paper (see Attachment I).

[3] As eloquently exposited in Favero (2001), Spanos (1990) introduces the distinction between structural and statistical identification in econometric modeling, positing that structural identification refers to the uniqueness of the structural parameters, as defined by the re-parameterization of the model's reduced form, whilst statistical identification deals with the selection of a well-defined model as reduced form. Whilst DSGE models pursue structural identification, models in the so called LSE tradition (where LSE stands for London School of Economics) pay a greater attention to statistical identification. Therefore, it is this latter feature that characterizes our model.