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Fiscal and monetary policy in an SFC model of the Italian economy

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Following the Great Financial Crisis of 2008–2009, there has been a shift in mainstream economic policy modelling towards 'realism', with DSGE models partly diverging from the representative agent framework, and large-scale New Keynesian structural models addressing real–financial interactions in greater detail. Still, the need for tractability of the former and the lack of theoretical structure of the latter prevented the complete introduction of modern – and complex – multi-sector/multi-asset financial system in policy models in use at Central Banks and Treasuries. However, empirical models adopting the stock–flow consistent (SFC) approach resolved most of these complications, with a surge in the number of country models over the past few years. The present work presents the main out-of-sample features of a quarterly SFC model of the Italian economy (MITA). Section 2 reviews the existing SEM models of the Italian economy and places SFC models along the suite of policy models in use around the world, discussing the main pros and cons of adopting the SFC approach over others. Section 3 briefly presents the model structure and main behavioural equations, as well as discuss the main differences and similarities with the other large-scale SFC model of the Italian economy. Section 4 shows the out-of-sample properties of the model, implementing different monetary and fiscal policy shocks, and assessing their effects in terms of growth, distributional dynamics and sectoral debt sustainability. Section 5 concludes.

Keywords: *Empirical stock–flow consistent models, Monetary policy, Fiscal policy, Italy*

JEL codes: *C54, E12, E17, E44, E58*

1 INTRODUCTION

Policy institutions need rigorous, albeit realistic, quantitative models to reliably forecast the future paths and dynamics of some variables of interest, which must be suitable for policy evaluations and scenario analysis.

After the formalization of Keynes' work in a general-equilibrium framework, first by James Meade (1937), then into the IS-LM framework by John Hicks (1937) and later spread in its neoclassical synthesis version made by Paul Samuelson (1955), this new paradigm was then used to analyse and implement macroeconomic policies. To the *Years of High Theory* (Shackle 1967) in macroeconomics corresponded the *Years of High Econometrics* (Louça 2007). Under the influence of Ragnar Frisch and the Econometric Society, and by the implementation of the National Accounts by Morris A. Copeland (1947), Meade and Richard Stone (1941) and Stone and Brwon (1962), empirical works in macroeconomics flourished.[1]

1. For an account on the history and developments of National Accounts, see De Bonis and Gigliobianco (2012) and Vanoli (2005).

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This led to the first economy-wide models being constructed, which later became, with the works of the Cowles Commission and others, what Ray Fair (Fair 2012) refers to as Macro 1. However, with the stagflation of the 1970s, 'structural' models developed following the Cowles Commission approach were abandoned by most central banks in favour of either dynamic stochastic general equilibrium (DSGE) types or micro-founded versions of investment–savings and liquidity preference–money supply (IS-LM) New-Keynesian models (Hendry and Muellbauer 2018). By 2007, mainstream economists claimed that 'the state of Macro is good' (Blanchard 2008), since New Keynesian and RBC economists were converging towards a simple, unique model which was thought to provide a clear description of a closed economy, with only three equations (i.e., the New Macroeconomic Consensus Model, NMC),[2] with an established empirical counterpart, Dynamic Stochastic General Equilibrium (DSGE) models. A few years later, the extent and the depth of the Great Recession had shown that these approaches had failed.

In a more recent piece, the same Blanchard (2018) claimed that there should be a distinction between *theory* and *policy models*, i.e., the Structural Econometric Models (SEM) in use at Central Banks and policy institutions. The latter are defined as models 'aimed at analysing actual macroeconomic policy issues. Models in this class should fit the main characteristics of the data, including dynamics, and allow for policy analysis and counterfactuals' (Blanchard 2018: 50). Most importantly, he argues that theorists and policy modellers should go their own ways. While the former will need to adapt their theories to face the pressing questions stemming from the GFC (i.e., an active role for money, credit, and financial institutions, as well as hysteresis effects), 'policy modellers should accept the fact that equations that truly fit the data can have only a loose theoretical justification' (Blanchard 2018: 51).

The crisis led indeed to a shift in mainstream economic policy modelling towards 'realism', with DSGEs partly diverging from the representative agent framework, and institutional SEM addressing real–financial interactions in greater detail. Still, the tractability requirements of the former, and the lack of a clear theoretical structure of the latter, prevented the complete introduction of modern – and complex – multi-sector/multi-asset financial systems in policy models. However, empirical models adopting the stock–flow consistent approach have already resolved most of these complications, leading to a surge in the number of country models over the past few years. This follows from the systematic integration of the saving/investment decisions of institutional sectors to the accumulation of financial assets and liabilities and their feedback effects on real variables, with a central role given to money and the financial system, usually absent in most state-of-art NMC models.

Italy, which has a rich historical tradition in building SEM, is a perfect example of this trend, with the Italian Ministry of Economics and Finance (MEF) recently producing the first 'institutional' SFC model (called ITFIN) amongst Eurozone countries (Barbieri Hermitte et al. 2023). Though the model adopts SFC principles, the macro econometric core is still New-Keynesian in spirit, and the different financial closures make it diverge in out-of-sample simulations with respect to the other SFC models of the Italian economy that follow instead a Post-Keynesian tradition (Canelli et al. 2021; Zezza and Zezza 2020; 2022).

The present work presents the main out-of-sample features of a quarterly SFC model of the Italian economy (MITA). Section 2 reviews the existing SEM models of the Italian economy and places SFC models along the suite of policy models in use around the world,

2. See Arestis (2011).

discussing the main pros and cons of adopting the SFC approach over others. Section 3 briefly presents the model structure and main behavioural equations. Section 4 shows the in- and out-of-sample properties of the model, implementing different monetary and fiscal policy shocks, and assess their effects in terms of growth, distributional dynamics and sectoral debt sustainability. Section 5 concludes.

2 LITERATURE REVIEW

2.1 Main SEM in use at Italian institutions

Given its prominent role in developing National Accounts, Italy always had a long tradition in building 'institutional' Structural Econometric Models, particularly at the Bank of Italy.

Originally developed in the mid-1980s by a team from the Bank of Italy's (BoI) research department led by Albert Ando (Visco and Bodo 1986), the Bank of Italy Quarterly Model (BIQM) is continuously updated and evolves to capture the new features (i.e., changed institutional frameworks, policy rules, expectation formation mechanisms, etc.) of the system and data sources, and is still the Bank main tool for the preparation of medium-term macroeconomic forecasts for the Italian economy, to assess the effects of monetary and fiscal policies and implement 'counterfactual' scenarios. Being one of the world's largest SEM in use at a Central Bank, it consists of 750 equations, with 95 behavioural equations estimated with limited information techniques, primarily OLS.[3] It aggregates the balance sheets of households and firms, but models separately the financial sector.

As with most central banks' macro econometric models, the BIQM[4] exhibits the theoretical properties of a neoclassical growth model in the long run, with output growth determined by factor endowments and technical progress. In contrast, in the short run, it behaves in accordance with Keynesian principles, with output mainly driven by aggregate demand fluctuations. In equilibrium, when no shocks occur, all adjustment processes are complete, expectations are fulfilled, the model converges to the NAIRU, and all real variables grow according to a combination of the exogenous rate of increase of population and technical progress. The rate of inflation is maintained at a constant level that is consistent with the equilibrium level of employment.

The production side of the economy is characterized by oligopolistic markets, in which firms assume a given production cost structure and select the optimal level of labour and capital inputs, which are then converted into output according to a constant return-to-scale technology, and prices are set as a mark-up over marginal cost. In formulating their spending plans, consumers are guided by the life-cycle hypothesis, taking into account their income and net wealth, as well as real interest rates. The accumulation of savings serves to finance capital expansion, thereby enhancing the production capacity. The relative prices of labour and capital ensure that the amount of savings is precisely equal to the capital requirements and that the labour market is in equilibrium. In the short run, a number of rigidities and adjustment processes affect equilibrium outcomes. These include

3. The Bank also uses several DSGEs and micro simulation models to forecast both short-run and long-run dynamics and perform Scenario Analysis. A detailed reference list can be found on the Bank institutional website https://www.bancaditalia.it/compiti/ricerca-economica/modelli-macroeconomici/index.html?com.dotmarketing.htmlpage.language=1&dotcache=refresh.
4. The latest model update is in Bulligan et al. (2017). A detailed description of the main features of the original model can be found in Galli et al. (1989).

delivery lags and other costs of changing the capital stock, sticky prices and wages, and expectation errors.

Several other models have been developed by research departments and public institutions, which share more or less the same structure, with a different level of detail depending on their use.

Amongst the most important is the Italian Treasury Econometric Model (ITEM), developed by the Treasury Department of the Ministry of Economics and Finance (Cicinelli et al. 2008). It is a medium-sized structural model consisting of 371 variables, with 211 accounting identities 36 behavioural equations. It is estimated using quarterly national accounts data and it is used for official Government projections and evaluations of domestic economic policies. As for the BIQM, it belongs to the class of macroeconomic models that assign a prominent role to the supply side of the economy, with frictions in wages and price settings only (relatively) affecting demand in the short run.

We then find the MeMo-It model developed by Istituto Nazionale di Statistica (ISTAT) (Bacchini et al. 2013a; 2013b). This model, which is one of the three main tools used by ISTAT for its economic projections, makes use of global economic indicators and microsimulation models, together with current domestic economic indicators to forecast short-run scenarios for the main aggregates of the national accounts. While it is relatively simple in terms of its real–financial connections, it is worth noting the recent efforts to include an 'environment' block in the model structure to capture links between economic and environmental variables, such as the use of natural resources and pollution.

Finally, there are a number of models run by other private or public institutions, as the CSC model by the Italian employers' federation Confindustria (Pappalardo et al. 2007), or the PROMETEIA model (Welfe 2013).

The next section delves into SFC models, placing them along the suite of policy models in use around the world, and discussing the main pros and cons of adopting the SFC approach over others.

2.2 Placing empirical stock–flow consistent models in the literature

As discussed in Zezza and Zezza (2019), the main principles of stock–flow consistency require:[5]

i. *Horizontal and vertical consistency*. To each payment from a sector corresponds a receipt for another sector (i.e., outflows equal inflows). Every change in a sector current account implies, at least, one change in the stock of asset/liability (i.e., quadruple-entry bookkeeping).
ii. *Balance sheet consistency*. Financial assets of a sector must match financial liabilities of one or more sectors, possibly pairing creditors to debtors.
iii. *Dynamic consistency*. Any stock of real and financial assets at current prices, at the end of an accounting period (A_t), is given by the relevant flow during the period (F_t), plus net capital gains (NKG_t) due to fluctuation of the market price of the asset ($A_t = A_{t-1} + F_t + NKG_t$). Net capital gains play a leading role in driving demand and supply of financial assets and should thus be carefully modelled.
iv. *Stocks-to-flows feedbacks*. Financial liabilities imply future payments from one sector to another. Moreover, every stock included must have implications for sectoral behaviour (i.e., real and financial wealth for consumption and investment of

5. See Nikiforos and Zezza (2017), Carnevali et al. (2019) and Pierros (2024) for a survey of the literature.

households and firms, liability structure for banks' lending, stock of public debt for Government fiscal stance, etc.).

To this list, we may add a fifth one, which applies specifically to empirical SFC Policy models.

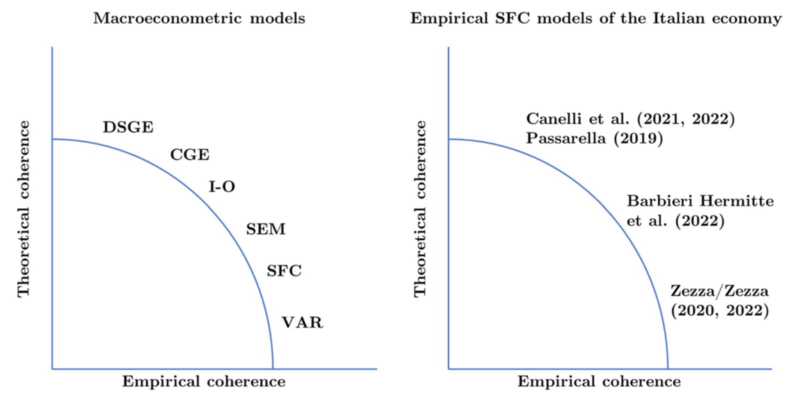
v. *Data consistency*. Whenever appropriate statistics are available – i.e., sectoral financial and non-financial accounts – model data should align as much as possible with published statistics.

In recent years, there have been numerous attempts at developing SFC models for whole countries by both academic researchers and policy institutions, most of which appear in this special issue. These can be split between theory-driven models – which start from a theoretical model and then calibrate it to data – and Godley–Levy (GL) type models, which are purely data-driven.[6,7]

Even though the complexity of SFC empirical models has been on the rise, most researchers still adopt a theory-driven approach to modelling, possibly due to the lack of a comprehensive description of the methodology followed by Godley and associates, and available software codes to replicate existing models. In the GL group, moreover, only the model for Italy discussed here explicitly disentangles the central bank, and splits the private sector between households, firms, and banks, while most others either adopt the New Cambridge three-sector structure (with the economy divided between private, public and foreign sector, as in the Levy model for Greece), or consolidate some of the sectors. The adoption of a particular approach and the degree of adherence to principle 5 above can have large implications for the model's ability to replicate historical data and may reduce the accuracy, reliability and adherence to official statistics in out-of-sample exercises.[8]

But how do these empirical SFC models differ from other structural macroeconometric models used for policy analysis?[9]

6. See Zezza (2009) and Zezza and Zezza (2019) for a discussion on how to build Godley-Levy empirical models.
7. Pierros (2024) uses a somewhat different taxonomy, distinguishing models by type – between New Cambridge, Godley-Lavoie and High-Complexity models – and by scope – i.e., 'external or sector imbalances', 'medium-term projections', 'fiscal, monetary or financial operations', 'functional income distribution', 'financialization' and 'green transition'. As we are interested in the comparison between the SFC approach and other standard macro approaches, we refrain here from further discussing differences within the SFC camp and stick to a simpler taxonomy.
8. In general, to assess the system-wide model's validity, one shall look at its ability to adequately replicate historical data, if transmission mechanisms of shocks make economic sense, if multipliers have meaningful values, if financial stocks and flows behave correctly (e.g., do not tank or go negative) and so on and so forth. This implies going a back-and-forth trial-and-error process, where one goes from model construction to validation on historical data to out-of-sample simulations and back, if model responses to shocks are not convincing. Yet, there is not a single measure to help defining 'goodness of fit'.
9. This quote from Haavelmo perfectly states what we intend for 'structural'. 'The totality of properties of the experimental conditions under which a particular economic relation is valid, is often called the structure of the economy considered, and the relation itself is called a structural relation. Thus, *a structural economic relation is not actually a particular kind of economic relation, but rather any economic relation associated with and valid for a specified real economic structure*' (Haavelmo 2015: 2, emphasis added). Thus, empirical SFC models (as well as 'old' Keynesian macro models à la Cowles Commission) are 'structural' because they incorporate a good deal of theory while remaining close to the 'environment' under analysis, even though the underlying microeconomic mechanisms are not explicitly modelled – as 'modern' Neoclassical and New Keynesian models – as the (policy-invariant) outcome of the forward-looking behaviour of rational agents.



Source: Own elaboration on Passarella (2019).

Figure 1 Empirical SFC models positioning along Pagan's (2003) 'best practice' curve

Table 1 Main features of model classes

Features	Model class				
	DSGE	CGE	IO	SEM	SFC
Vertical & horizontal consistency	Y	Y	N	Y	Y
Flow consistency	Y	Y	Y	Y	Y
Stock consistency	Y	Y	N	Y	Y
Dynamic consistency	Y	N	N	Mixed	Y
Stock-to-flow feedback	Y	N	N	Mixed	Y
Data consistency	Mixed	Y	Y	Mixed	Y
Output determined by …	Mixed	Supply	Supply	Mixed	Demand
Microfoundations	Y	Y	N	Mixed	N
Expectations	Rational	Rational	n.a.	Mixed	Adaptive
Detailed data for industries	N	Y	Y	N	N
Detailed data for institutional sectors	Mixed	Y	Y	Mixed	Y
Time series data	Y	N	N	Y	Y
Estimation methods	Bayesian	Calibration	Calibration	S.E.	S.E.

Notes: S.E.: single equation (e.g., OLS, ECM, 2SLS).
Source: Own elaboration.

Building on Passarella (2019), Figure 1 depicts Pagan's (2003) frontier of models – which shows the trade-off between theoretical and empirical coherence macro modellers usually face – while Table 1 summarizes the main feature of each model class. The left panel places SFC models with respect to other classes of macro-models. It is worth noting that within each group there is ample heterogeneity, so that an RBC-DSGE would be deemed to be more 'theory-oriented' than a NK-DSGE, or the BIQM would be more 'data-oriented' than the FRB-US, and so forth. Indeed, the right panel zooms-in, placing the three different SFC models of the Italian economy along the same curve, with the theory-driven model of Canelli et al (2024) in the upper part, the one presented here as the more data-driven, and the recently developed ITFIN model of Barbieri Hermitte et al (2023) lying somewhere in the middle.

On the two extreme we have DSGE and VAR models, which are supposedly the more theoretical and empirically coherent, respectively.[10] Both classes of models, however, can hardly be used for certain policy exercises – such as medium-term projections of the effects of public policies, as the ones published by governments in budgetary laws – since they lack the necessary level of detail: if for a document we need accurate medium-run forecasts for dozens of variables, these need to be all explicitly addressed in the model. This is usually not possible in DSGEs, as models need to be analytically solvable, while the number of variables in VARs needs to be limited to avoid incurring in the so-called Curse of Dimensionality, since the number of parameters to be estimated increases quadratically with the number of variables. A similar argument applies to CGE and IO models, which have a richer sectoral and industrial structure – and can thus answer to a larger set of questions – but do not employ time series data, limiting their use to static exercises. Indeed, even though large-scale DSGE models have found their way to policy institutions,[11] their main tool of analysis is still represented by SEMs, mostly grounded in what Fair (2012) refers to as 'macro 1' approach.[12]

Leaving theoretical considerations aside and focusing on estimation methods, in state-of-art DSGE what is estimated – nowadays mostly through Bayesian techniques – are the parameters of maximization problems faced by rational agents (households, firms, the monetary authority etc.).[13] In contrast, SEM – as well as SFC models – employ time-series techniques to estimate parameters of aggregate equations which, following the Cowles Commission method, feature adaptive expectations, using lagged values of endogenous variables, error-correction mechanisms and cointegration analysis.

There are two main advantages of the SFC approach over standard models. The first stems from the presence of a complex financial system interacting with the real economy, constrained by an accounting edifice that mimics the actual structure of the data.[14] This gives SFC models the ability to capture the interrelations between expenditure-saving decisions and their implications for financial markets – in terms of debt accumulation and

10. A comparison between SFC and DSGE models is given by Burgess et al. (2016) and Carnevali et al. (2019). All models are placed on the frontier, but we are aware that different researchers could have different opinions regarding the relative merits of their own approach.
11. See for instance the SIGMA model developed by the US Federal Reserve (Erceg et al. 2005), the QUEST III from the European Commission (e.g., Pfeiffer et al. 2023), and the IGEM model from the Italian Ministry of Finance (e.g., Acocella et al. 2020).
12. As the FRB-US model developed by the US Federal Reserve (Brayton et al. 2014), or the discussed BIQM from the Bank of Italy (Bulligan et al. 2017). Each institution follows its different 'degree of purity', with some microfounding some of the behavioural blocks, output being supply determined in the long run, and so on. In most cases, though, the 'theoretical background' of institutional models lies in the same neoclassical tradition.
13. We do not think that theoretical considerations are not worth debating. On the contrary, we believe there is not enough space in the present article to discuss them thoroughly. A critical take on the effects of the rational expectations revolution on models at policy institutions, is given by Wren-Lewis (2018) and Hendry and Muellbauer (2018), while Fair (2012) and Romer (2015) focus on DSGE's estimation methods.
14. Even though some SEM do link the flows of net lending from NFA to FoF tables (e.g., the Bank of Italy Quarterly Model), it does not separate households and firms and does not have the same level of detail for financial assets and real financial interactions as all empirical SFC models presented in this issue.

growth path sustainability – and to lay down explicitly the interconnections between balance sheets and flows of payments – in the presence of multiple financial assets, each with its own price/return. Thus, for example, fiscal and monetary policies may have unintended effects on the private sector through balance sheet transmission channel, and shocks coming from financial markets feedback in the real economy, through credit provisioning and asset accumulation (which imply future flows of capital incomes affecting net lending position and so on). The second is their strong path dependency and disequilibrium nature. In contrast to NMC models where dynamics are led by the presence of long-run attractors (such as a production function, the NAIRU/NAWRU), in SFC models the long-run is determined as a sequence of (demand-led) short-runs, within which agents are not on target[15] – reflected in the error correction mechanisms leading behaviour – and the convergence to the steady state is driven by the so-called 'stock–flow norms'.

There are of course some drawbacks in adopting the SFC approach for Policy Models, too. The first one relates to the adoption of the approach *per se*, for both young researchers and policy practitioners. While DSGE modellers have their preferred software and codes available – which helps knowledge spillovers and replicability – this is not yet the case for the SFC community engaged in building empirical models. In a way, this is seldom the case, as DSGE model can be simply calibrated to a specific country, while empirical SFC models are highly country specific. The second is operational. Since empirical SFC models tend to be very large and complex – larger than a standard SEM – they are particularly difficult to build in the first place and update and manage thereafter and usually need a dedicated team. Finally, as in standard SEM, the Lucas Critique applies: as SFC models make use of frequentist approaches to econometric estimation of behavioural equations – with a post-Keynesian theoretical background –, decisions are not the result of optimization exercises within a system of rational agents (which may not be deemed a 'drawback' by many). This, however, prevents the use of this class of models to assess the impact of policies that imply changes in structural relations.

The next section presents the structure of the quarterly model of Zezza and Zezza (2022), discussing the points of contact with other existing models and underlining their main differences. For a complete description of all model equations, the interested reader is referred to Zezza and Zezza (2020; 2022).

3 MODEL STRUCTURE AND MAIN FEATURES

In theoretical SFC models, the researcher has far more liberty on the decisions about the number of sectors and assets to include, on the closures and the behavioural specifications, all choices that may lead to a wide arrange of different models, suited for the question at hand. In contrast, in empirical SFC models the first constraint is related to the availability and structure of the appropriate data, from which all other decisions should follow.

When building an empirical model that satisfies the SFC-principles listed above,

> the idea is that we want to start from a complete description of the balance sheet of all institutional sectors, for all financial assets for which we have data, and then proceed to reduce the degree of complexity according to the specific features of the economy we are studying. Once

15. '[Agents] set themselves norms and targets, and act in line with these and the expectations that they may hold about the future. These norms, held by agents, produce a kind of autopilot. Mistakes, or mistaken expectations, bring about piled-up (or depleted) stocks – real inventories, money balances, or wealth – that signal a required change in behaviour' (Godley and Lavoie 2007: 16).

> the desired level of detail has been obtained, the complexity of the transaction matrix will also be specified. (Zezza and Zezza 2019: 136)

Of course, different strategies and modelling choices will lead to different models, depending on the desired level of detail, the main research questions one wants to answer, and the ultimate use of the model. If the model is to be used for policy, following the late Blanchard (2018), then it should track well historical data and allow for scenario analysis.

To design a model that respects the theoretical requirements of the SFC approach, the core of the statistics must be:

- The National Income and Product Accounts (NIPA) and the Non-Financial Accounts of Institutional Sectors (NFA) – published in Italy by Istat at quarterly frequency from 1999 to present.
- The Flow of Funds (FoF) and Financial Accounts of Institutional Sectors (FAIS) – published by the Bank of Italy at a quarterly frequency from 1995 to present.

NIPA provides data on GDP and components, from both the production and income side, on sectoral output and value added. From NFA, one can exploit the income side to get information related to wages, interest, dividends, profits, transfer payments and taxes. Finally, there are data on investment, split between gross fixed capital formation, changes in inventories and net acquisition of non-produced non-financial assets. The last entry represents the Net Lending/Borrowing of the various sectors or – as Godley called it, the *Net Acquisition of Financial Assets* (*NAFA*) – which has the property that the overall Net Lending position of the country matches the Net Borrowing position of the foreign sector. This is the so-called Fundamental Identity, usually portrayed as: $NAFA - GD - CAB = 0$ (Lavoie 2022, chap. 4).

Balance sheet data provided by FoF and FAIS – detailing the stocks and flows of (non-consolidated) financial asset and liabilities – offer a larger sectoral disaggregation than that provided in NFA published by Istat. Financial corporations are here divided into seven sub-sectors. Most important, the central bank is separated from domestic banks, which allows to model monetary policy in a more systematic way. The last entry represents the Net Wealth of the various sectors.

When using these two sets of data, some problems arise (discussed in Appendix 1 in the Supplementary Materials). Yet again, the desired level of detail for such a model largely depends upon *what the model is designed for*. The different solutions adopted will lead to different model structures, and this will have an impact on its ability to accurately replicate the data. Appendix 2 in the Supplementary Materials further elaborates on this point, using MITA and ITFIN as examples.

In our case, MITA 'is an attempt to merge the SFC methodology for jointly tracking the real and financial sides of the economy to the methodology that was adopted for structural models by central banks around the world before the counter-revolution of rational expectations' (Zezza and Zezza 2022: 138). Our aim was to design a model that satisfied all five SFC principles discussed above making the most out of available data, and that could 'speak' with people at policy institutions.

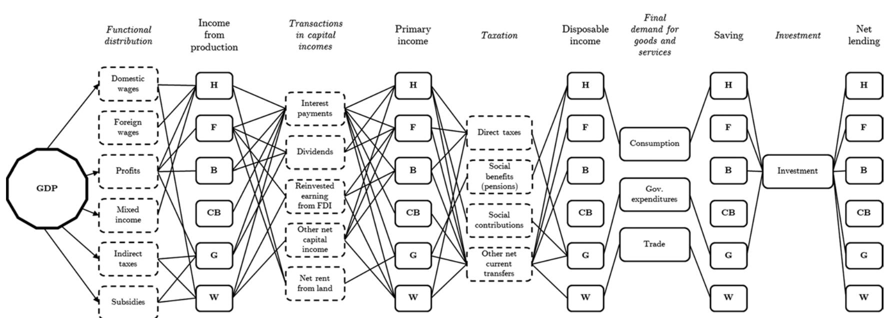
Table 2 describes the main features of the model, while Tables A3.1 and A3.2 report the canonical Balance Sheet and Transaction Matrix, respectively. Figure 2, in turn, shows the sequence of sectoral transactions – i.e., from the functional distribution of income amongst sectors (wages, profits, indirect taxes) to their net lending position, passing through transactions in capital incomes, taxation, and final demand.

MITA is a large-scale model with 272 equations, of which 37 stochastic equations estimated with single equation techniques. It features six sectors – households, Non-Financial

Table 2 MITA: main features

Features	Description
Institutional sectors	Households[a] Non-Financial Corporations Banks Central Bank Government Rest of the World
Real capital stocks/ sectors holding	– Households: housing – Non-Financial Corporations: machinery, non-residential – Government: infrastructures
Financial asset/ liabilities	15
Demand/supply of assets	Tobin Portfolio for households' illiquid financial assets; single (estimated) equations for other assets/sectors
Prices	Phillips-curve-type link between the unemployment rate and the wage level. Wages in turn impact on prices
Labour market	Employment and unemployment depend on aggregate demand, with productivity growth linked to economic activity
Endogenous	272
Exogenous	167

Notes: [a] We aggregate non-MFIs assets/liabilities to the household sector. For additional details, see Zezza and Zezza (2020).
Source: Own elaboration.



Notes: The figure shows the sequence of transactions amongst sectors taking place each period (quarter), from functional distribution to end-of-period net lending positions.
Source: Own elaboration.

Figure 2 MITA: transactions amongst sectors

Corporations, Banks, Central Bank, Government, Rest of the World. Importantly, we chose to only include in the 'Banks' sectors Monetary-Financial Institutions (MFIs) other than the Central Bank (i.e., commercial banks and Mutual Funds), and merge the remaining financial corporations in the household sector. In this way, we separate institutions with the power to create money from those only serving households as intermediaries. We model separately fifteen classes of financial assets (given the structure of sectors' balance sheets discussed in Appendix 2 in the Supplementary Materials), and four different capital stocks – housing, firms' (machineries and non-residential buildings) and public capital. Importantly, we introduce a residual 'Other Net Financial Asset' variable (ONFA, from hereafter), which assures that model variables track historical data as close as possible.[16] Demand for assets is mostly estimated econometrically, while labour market and price developments are linked to fluctuations in aggregate demand.

Regarding estimation of behavioural relations, for this class of models – which include hundreds of variables and several stochastic equations – the methodological approach must be pragmatic. We try to use, whenever possible, Error Correction Models, following a general-to-specific approach to reach the final form of our estimated equations, taking care of cointegration and parameter stability concerns.

However, since the model should be structural in Haveelmo's sense, theoretical considerations are also important. This means, in practice, that at times we prefer to include a variable in the estimation, even if not statistically significant (but with the 'right' sign), if it is needed to preserve important real–financial interactions – as real wealth in the consumption function (which is not statistically significant, but has the 'right' sign and value, and is fundamental to have a stock–flow norm for consumption behaviour), or foreign prices in the export equation. Moreover, we use dummy variables, when needed, to eliminate outliers or account for structural breaks. To some extent, this was also the methodology used to estimate structural models in the early stages of macroeconometrics (Fair 2012).

3.1 Model closures

While ensuring accounting consistency is a key step in building a coherent macroeconomic model – helping to reduce degrees of freedom and clarify the constraints any economic system must face – it is not sufficient on its own. As highlighted by Lance Taylor (Taylor 2004; Taylor and Lysy 1979), the main insights a model can generate ultimately depend on the direction of causality imposed by the modeller, commonly referred to as the model's 'closures'.

Given the k accounting identities derived from the transaction and balance sheet matrices, determining n endogenous variables requires the specification of n–k additional behavioural equations. These equations describe the behavioural rules that govern the decisions of economic agents and sectors. Broadly speaking, the modeller must specify:

i. how agents decide on their expenditures (i.e., the determination of consumption, investment, government spending, trade, etc.);
ii. how they finance these expenditures (e.g., government deficit financing, household and firm borrowing);
iii. how wealth is allocated (i.e., the demand and supply of financial assets);
iv. how the financial sector behaves and reacts (e.g., central bank responses to inflation or unemployment, drivers of bank credit); and
v. how productivity, wages and inflation are determined.

16. For each sector, ONFAs are estimated as *ONFA* = [*total asset in the data* – (*sum of modelled asset*)] – [*total liabilities in the data* – (*sum of modelled liabilities*)] Notice that they cancel out, since ONFA for the external sector is given by the sum of the others (i.e., $ONFA^{W} = -(ONFA^{H} + ONFA^{F} + ONFA^{B} + ONFA^{CB} + ONFA^{G})$).

3.1.1 Demand components

In line with the post-Keynesian foundations of the SFC literature (Godley and Lavoie 2007; Lavoie 2022), our model assumes that effective demand is the primary driver of economic growth, both in the short and long run.

In empirical SFC models, the main components of demand – aggregate consumption, investment, government spending, imports, and exports – are typically estimated using cointegration techniques and error correction models. These approaches ensure the model captures both long-term equilibrium relationships and short-term dynamics. Table 3 provides a summary of how each demand component is determined in the model.[17]

In our empirical specification, we follow a standard SFC hypothesis that households adjust consumption towards a target wealth-to-income ratio, often referred to as a stock–flow norm (Godley and Lavoie 2007). This norm is embedded in the long-run consumption equation, where we include per capita disposable income and wealth as explanatory variables. While the coefficient on wealth is small and not statistically significant, we retain it to respect the theoretical logic of gradual convergence to a norm. This reflects the idea that, over time, households aim to hold a stable ratio of wealth to income, rooted in institutional, social or historical regularities rather than in forward-looking optimization.

In our model, the interest rate on consumer credit (RBLCC) is included in both the long-run and short-run equations for consumption. However, this is a nominal interest rate, and its role is to capture cash-flow and credit constraint effects, not the return on accumulated wealth. In this respect, the interest rate influences the flow of consumption, particularly under tightening credit conditions (e.g., post-2009), but does not alter the wealth-to-income norm itself.

This distinguishes our approach from that of DSGE models, where the wealth-to-income ratio is typically endogenous and derived from intertemporal utility maximization. In such models, the real interest rate is central to determining optimal consumption and saving behaviour via Euler equations. Households choose their wealth holdings based on expected lifetime income and the rate of return on assets.

By contrast, in MITA, households are modelled as boundedly rational, using simple behavioural rules rather than solving forward-looking optimization problems. Nevertheless, we do not assume households are indifferent to interest rates. In fact, as detailed in Section 3.1.3, interest rates play a central role in shaping portfolio decisions. Households allocate their illiquid financial wealth across domestic government bonds, foreign bonds, equities, and bank bonds, according to Tobin-style portfolio behaviour. These decisions are governed by estimated portfolio share equations that depend on adaptive expectations of relative rates of return, where the return on an asset includes both interest income and capital gains. For example, the coefficient governing the share of domestic government bonds in the portfolio responds positively to its own expected return and negatively to the expected return on foreign bonds, consistent with theoretical constraints such as adding-up and relative return trade-offs.

In a similar way, investment in housing and productive capital are modelled as a process of adjustment to a stable stock–flow ratio of housing wealth-to-income in the former case, and of capital-to-income (i.e., profits) in the latter, with also a long-run effect of the interest rate on firms' loans.

17. Note that demand components are estimated in real terms, with separate (estimated) deflators for each component.

Table 3 MITA: determination of demand components, in real terms

Variable	Long-run	Short-run
Consumption	Real disposable income per capita (+) Real wealth per capita (+) Interest rate on consumer credit (–)	Real disposable income per capita (+) Share prices (+) Interest rate on consumer credit (–)
Investment (housing)	Disposable income in terms of price of investment in new houses (+) Real stock of houses (–) Interest rate on mortgages (–)	
Investment (firms)	Real GDP (+) Flows of profits net of dividends (+) Interest rate on loans to firms (–)	
Government consumption and investment	Exogenous	Exogenous
Imports	Real GDP (+) Relative prices (–)	Real GDP growth (+)
Exports	World demand (+) Real effective exchange rate (+)	Growth in world demand (+) Growth in domestic prices (–) Growth in foreign prices (+) Real effective exchange rate (+)

Source: Own elaboration.

The determination of the trade block is quite standard, with imports responding to changes in domestic activity and relative prices, and exports depending on world demand and exchange rates.

3.1.2 From net lending to demand for assets

For all sectors, we compute net lending as the difference between saving, transfers and taxes on capital account, expenditures in non-produced non-financial assets, gross fixed capital formation and changes in inventories, and link it to net lending from financial accounts with an exogenous discrepancy variable (which ensures consistency between real and financial flows). Net financial assets are determined by cumulating the opening period stock, net lending and net capital gains.

Net capital gains should be due to changes in the market price of assets, but also to write-offs due to bankruptcy. We estimate econometrically prices of all financial assets in the model – as well as interest rates –with simple mechanisms, and compute net capital gains for each sector, assuring that the sum of net capital gains across sectors cancels out, so that one variable can be obtained as a residual (*redundant*) from the accounting identity.

In particular, we model active/passive banks' interest rates as depending on the ECB refinancing rate and the interbank three-month rate (plus the interest rate on government bonds, for the interest rate on deposits, and the spread between Italian and German government bonds, for the interest rates on mortgages and loans to firms). The interest rate on government bonds is determined by an autoregressive process, which links our implicit rate to the official one. The same applies to the other implicit rates – i.e., for foreign issued liabilities and incoming/outgoing FDIs.

As per asset prices, we decided to model only some of them – the prices for government bonds, firms' shares, banks' equities and shares, foreign liabilities and FDIs –, while leaving the others exogenous. This choice was led by our pragmatic approach. First, the finding that the dynamics of most of these prices are difficult to model (econometrically), unless one adds many more regressors, that however need to be either endogenized or, if left exogenous, projected in out-of-sample exercises (meaning that one needs to make assumptions on their future behaviour). Second, that the more behaviours one models, the 'heavier' the model becomes, in terms of both the number of equations and dynamic links simultaneously at work. Of course, a more descriptive specification would imply better estimates for the single equations. But this does not directly translate into more realistic systemwide dynamics and, moreover, it may well make the analysis of the results trickier, given the possible multiple contrasting behaviours. The strategy, thus, was to track the major effects that interest rates, real flows, and other assets prices have on the prices of our financial assets.

The price of government bonds is linked to its interest rate. The price of banks' bonds responds to (i) the ratio between interest paid by banks relative to the existing stock and (ii) the lagged level of the price and that of domestic shares; the price of banks' shares is linked to the general price index for the Italian stock market. The price of shares issued by domestic firms depends, on the one hand, on a price index for the US stock market and, on the other, on the discrepancy between this index and the one for Italy. Finally, the price of foreign issued liabilities is estimated as a function of the exchange rate against the US$ and the interest rate on the ten-year Bund. Price of FDIs is simply linked to the general price for foreign issued liabilities.

3.1.3 Financial closures

We then turn to portfolio behaviour, i.e., how the changes in the net lending position translate into specular changes in the asset/liability structure of each sector's balance sheet. Closure and main mechanisms are summarized in Table 4.

3.1.3.1 Households In our model, households make sequential financial decisions shaped by institutional constraints and bounded rationality. First, they determine their desired holdings of liquid assets, i.e., currency and bank deposits, which provide transactional services and a buffer against uncertainty. Liquidity preferences are modelled in a simplified way, with households allocating between cash and deposits based on standard behavioural rules.

Next, households assess their borrowing needs. Bank loans are demanded either to finance residential investment or to smooth consumption. The volume of mortgage borrowing is influenced by investment in housing, the interest rate on mortgages, the outstanding stock of housing debt, and the incidence of write-offs. Consumer credit, on the other hand, responds to the ratio of consumption to disposable income and to the cost of borrowing, captured by the interest rate on consumer loans.

Once liquidity and borrowing decisions are made, households allocate the remainder of their wealth across a range of illiquid financial assets. These portfolio choices follow the Tobin framework, where the demand for asset i is a function of its expected rate of return relative to alternatives, and of expected regular income. We assume that households aim to hold a desired proportion of their wealth in each asset, adjusted by relative returns. This setup captures substitution effects across assets: higher returns on one asset induce portfolio rebalancing away from others.

Table 4 MITA: sectoral closures for balance sheet

Sector	Asset / mechanism
H	**Other net financial assets (stock)** Households' portfolio behaviour work as follows: (i) they decide how much money they want to hold in liquid form (either banknotes or deposits at banks) in the future; (ii) they decide how much new debt to take on; (iii) decide how to allocate funds between illiquid financial assets (i.e., stocks of banks' equities and shares, government bonds, NFC shares and foreign assets); (iv) remaining funds increase the stock of other net financial assets, which close the HH sector balance sheet
F	**Banks' loans (flow)** Non-Fin. Corp. finance investment mainly out of retained profits, the rest out of loans
B	**Excess reserves (stock)** When QE is active, banks accumulate excess reserves. If QE is not active, banks clear the market for government bonds
CB	**Monetary base (stock)** The CB accommodates the demand for money
G	**Gov. bond (flow)** Government finances its deficit by emitting Bonds
W	**Target2 balances (stock)** Redundant equation

Notes: H: household; *F:* firms; *B:* banks; *CB:* Central Bank; *G:* government; *W:* Rest of the World.
Source: Own elaboration.

The portfolio equations are constrained to obey adding-up conditions (Tobin 1969). Specifically, the sum of the desired portfolio shares must equal unity, and the marginal responses to changes in returns or income must net to zero. This ensures that a shift towards one asset implies a corresponding reduction in others, reflecting the fixed total of household financial wealth.

From an empirical standpoint, estimating precise asset demand functions based on relative returns is challenging due to data limitations, structural breaks and short time series. We thus adopt a pragmatic approach: (i) asset returns are computed as the sum of nominal interest payments and realized capital gains (i.e., the quarterly change in asset prices); (ii) households form adaptive expectations of these returns using a weighted average of past observations; and (iii) the portfolio ratio for each asset is defined as its share in total illiquid assets, and a system of equations is estimated to capture household preferences.

This approach generates some empirically robust and interpretable results. In particular, we find clear trade-offs between domestic and foreign government bonds, and between bank bonds and equities, suggesting households actively rebalance their portfolios in response to relative returns. Any residual wealth not allocated to specific assets is then assigned to 'Other Net Financial Assets', which closes the household balance sheet.

3.1.3.2 Non-financial corporations The financial decisions of nonfinancial firms in the model are structured around their liquidity management and investment financing needs. On the asset side, firms are assumed to hold liquid resources, in the form of bank deposits and government bonds, to manage payroll obligations and maintain operational flexibility. The stock of deposits is modelled as a function of the wage bill, reflecting a precautionary motive: firms aim to keep a buffer of liquid funds proportional to their ongoing labour costs.

In addition to deposits, firms may allocate part of their liquidity to short-term government securities. In this framework, government bonds are treated as near-money assets, and their demand is modelled relative to deposits, implying that firms choose a liquidity mix between deposits and bonds once the total desired liquidity is established. This captures the idea that firms seek both safety and yield when managing short-term assets.

Foreign direct investment (FDI) flows, both incoming and outgoing, as well as issuances of corporate equity, are treated as exogenous variables in the model. These are not the outcome of optimizing behaviour but rather reflect strategic decisions by domestic and international firms, influenced by long-term expectations and sentiment (i.e., animal spirits). As such, these flows are projected based on observed trends or policy assumptions, rather than being endogenously determined.

The financing of real investment is handled through a hierarchical process. Firms initially attempt to fund new capital expenditures using internal resources, i.e., retained earnings and liquid asset holdings. When these are insufficient, the residual financing need translates into additional bank borrowing. Hence, the demand for credit is derived from the gap between planned investment and available own funds. This mechanism ensures a consistent financial closure, where bank loans are endogenously determined by real investment decisions and liquidity constraints.

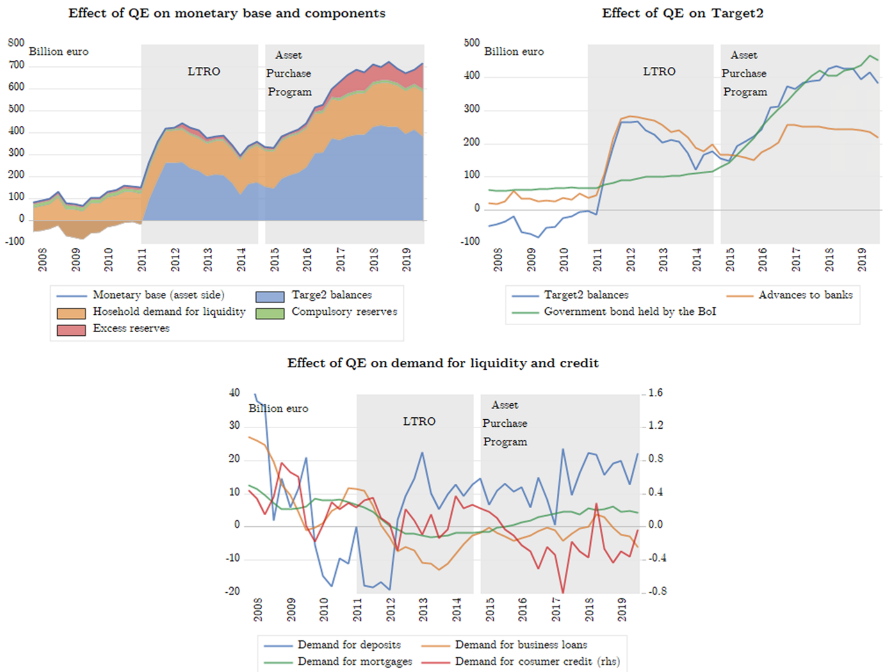
3.1.3.3 Central bank Following the Great Recession, with policy rates constrained by the zero lower bound, central banks in the euro area increasingly relied on balance sheet operations, notably large-scale asset purchases, to conduct monetary policy. In our model, we explicitly represent the operations of the national central bank – in our case, the Bank of Italy – within the institutional context of the Eurosystem.

We assume that the central bank earns interest on its holdings of government securities, foreign assets, and loans to banks (including both standard refinancing operations and non-standard liquidity provisions). In line with the Bank's Statute, we assume that these interest revenues are entirely transferred to the government, resulting in a net lending position of zero for the central bank in the flow-of-funds accounts.

In normal times, the monetary base is demand-driven and accommodates the liquidity needs of households, banks and foreign institutions. The liability side of the central bank reflects these monetary obligations (notably reserves and currency), while the asset side comprises the central bank's claims on the financial and external sectors. Importantly, as highlighted in Godley and Lavoie (2007), Lavoie (2022) and in recent central bank discussions (European Central Bank 2017; McLeay et al. 2014), the central bank adjusts its balance sheet to fulfil this liquidity demand, implying that Target2 balances (i.e., claims or liabilities *vis-à-vis* the rest of the Eurosystem) adjust residually, reflecting external imbalances not offset by other cross-border financial flows.

However, the adoption of unconventional monetary policies altered this mechanism. As shown in the top panel of Figure 3, the Asset Purchase Program (APP) and Long-Term Refinancing Operations (LTROs) sharply increased the size of the monetary base, beyond what would have been required by normal liquidity needs. These operations involved the central bank purchasing financial assets from banks and non-bank actors, injecting reserves into the system. Because only banks hold accounts at the central bank, all such transactions were settled via the banking system, leading to a mechanical increase in bank reserves.

This injection of liquidity resulted in a growing volume of excess reserves – reserves held beyond the level required by regulation. Excess reserves expanded rapidly from 2015 onwards, with QE-related purchases driving the increase. Notably, this expansion occurred without a corresponding rise in banks' demand for liquidity, underscoring that,



Notes: Demand for deposits and credit are the four-quarter moving average flows from financial accounts of institutional sectors, in billion euro.
Source: Own elaboration.

Figure 3 Effect of quantitative easing on bank of Italy balance sheet and private sector demand for liquidity and credit

during QE, the central bank determines the monetary base, rather than accommodating a pre-existing demand.

At the same time, QE operations had a significant impact on Target2 balances, as illustrated in the middle panel of Figure 3. Since a large share of securities purchases were cross-border, reserves often ended up in banks located in other euro area countries, thereby increasing the Target2 liabilities of the Bank of Italy. These liabilities rose first during the LTRO wave (2011–2014), and again with the sovereign bond purchases under the Public Sector Purchase Programme (PSPP) (from 2015 onwards). The evolution of Target2 balances thus closely mirrors QE dynamics, reinforcing the view that unconventional monetary policy significantly shapes the external monetary position of the national central bank.

In the model, the monetary base on the asset side of commercial banks is disaggregated into:

- Compulsory reserves, modelled as a function of sight deposits and the reserve requirement ratio;
- Excess liquidity, reflecting banks' precautionary motives and the impact of central bank asset purchases. We treat the 'excess' component as a residual, determined

endogenously through banks' portfolio decisions and the injection of reserves by the central bank.

On the central bank's balance sheet, the monetary base is determined by the asset side, with its holdings of:

- Government bonds, including both standard purchases and those under QE (PSPP), modelled as exogenous but adjusted for capital gains;
- Advances to banks, split into two parts:
  – LTROs and other QE-related lending, capturing non-standard monetary policy tools;
  – Ordinary refinancing operations, reflecting standard liquidity provision.

By separating these components, the model distinguishes the ECB's influence via QE from the routine operations of the Bank of Italy. It is important to note that this treatment does not imply direct monetary financing, nor does it assume the central bank controls interest rates on sovereign bonds. Rather, the yield on government debt is modelled separately as a function of the German benchmark rate and a country-specific risk premium.

Finally, the lower panel of Figure 3 highlights a key limitation of QE policies in the euro area: its inability to stimulate private sector demand for credit. Despite substantial liquidity injections by the central bank, there is no discernible increase in the demand for loans – whether for business, mortgages or consumer credit. Instead, the main response to QE appears to have been a reallocation within the financial sector's balance sheets, reflected in the persistent rise in demand for deposits. This outcome aligns with a core insight of endogenous money theory, that the central bank cannot, by itself, force new credit into the economy. If households and firms do not revise upward, their demand for liquidity or credit – due to expectations, deleveraging needs, or low investment opportunities – then even large-scale asset purchases will fail to translate into real economic effects. QE, in this sense, reshuffles the composition of assets and liabilities in the banking sector without triggering the credit creation process that is central to sustained growth.

3.1.3.4 Banks In line with the literature, we assume that banks passively accommodate the demand for loans from households and non-financial firms. Once loan demand is fulfilled, banks adjust their reserve holdings accordingly, with the central bank supplying reserves as needed. In this baseline setting, money is endogenous, and credit is demand-led.

However, the introduction of QE complicates this mechanism. When the central bank provides cheap liquidity through asset purchase programs, banks respond by rebalancing their portfolios – allocating more towards central bank reserves and other liquid assets. To capture this behaviour, we model the 'excess' stock of monetary base as the residual outcome of banks' portfolio decisions. Loans to households (both mortgages and consumer credit) and to non-financial firms remain demand-driven and are always supplied by banks.

Equity issuance by firms is treated differently. We assume that the financial sector acts as a residual buyer of new equity issues, with the volume of transactions influenced by the spread measure in the model. However, this assumption does not affect the market pricing of equities, which is estimated econometrically. New equity issued by banks is also treated as exogenous and assumed to match household demand, reflecting a stylized but neutral treatment of equity markets.

Finally, banks also act as market makers for government bonds. In practice, however, the ECB's large-scale QE purchases since 2015 absorbed the bulk of new government bond issuance, effectively suspending normal bond market clearing mechanisms for an extended period. In the model, we therefore shift the focus to the flow of foreign assets held by banks, which is specified as a function of the domestic government bond yield, the spread over German Bunds, exchange rate dynamics against the US dollar, and the interest income received from abroad relative to the stock of foreign assets.

3.1.3.5 Government Government sector's financial operations are quite straightforward when compared to the ones discussed above: it holds deposits, mainly to pay out wages to public employees, and the flows are estimated as a function of government expenditures over deposits; it buys all the residual shares of domestic firms; and issues new bonds to cover the deficit. Demand for other net financial assets are, as usual, left exogenous.

3.1.3.6 Rest of the world We decided to treat the foreign sector as the residual buyer for some of our assets. The RoW holds domestic banks' deposits as liquidity for trade and buys the residual supply of domestic banks' securities, while the acquisition of new government bonds is currently left exogenous. Moreover, we assumed that the demands for foreign assets coming from the domestic sectors are completely matched. To assure balance sheet consistency, other net financial assets of the foreign sector are determined as the sum of all other sectors, while the buffer stock is represented here by the Target2 balance, which is the redundant equation of the model.

3.1.4 Labour market and prices

The treatment of the labour market is rather simple in this version of the model.

Population is projected exogenously, and the share of the working-age population is obtained through exogenous parameters, identifying those below the working age and retired people. The size of the labour force is given by an exogenous participation rate. Employment is determined from a simple relation to real GDP through average labour productivity, which we model as a function of the business cycle and of part-time workers' share in the labour force. For both the long- and short-run specifications, we found the presence of a structural break related to the GFC. We model the ratio of part-time workers in the labour force as a function of the business cycle and the unemployment rate. Notice that this implies that increases in labour market fragmentation will translate into lower employment via a productivity channel.

The average wage, estimated as a function of domestic and foreign prices (through the import deflator) and the past unemployment rate, together with the level of employment determines the wage bill. The long-run elasticity of nominal wages to prices is one,[18] while import prices do not seem to have a long-run impact. An increase in the unemployment rate is found to have an impact on the level of wages (rather than on wage inflation, as in the Phillips curve). The short-run specification needs to be investigated further, since we find a negative short-run impact of price inflation on wage inflation.

Of course, most of these specifications may well be improved, but it was not the purpose of that initial version to come out with the 'best' econometric outcomes, but rather

18. The elasticity of wages to prices was larger than one, but since a test did not reject the hypothesis of a unit elasticity, we imposed this restriction.

to capture the major interrelations amongst our sectors and overall financial dynamics. A complete description of all model equations is available in Zezza and Zezza (2020; 2022).

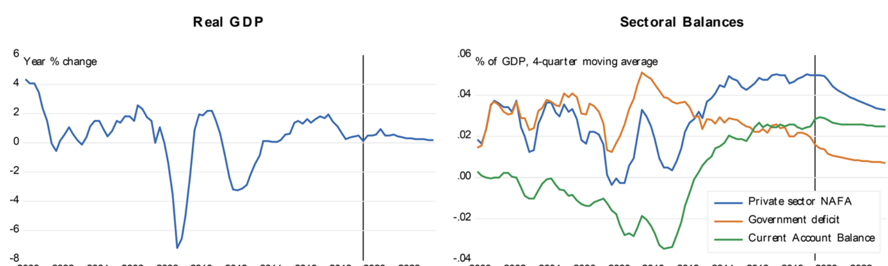
4 IN- AND OUT-OF-SAMPLE PROPERTIES

In this section, we first show the in-sample properties of the model, i.e., their ability to track the dynamics of historical data. We then discuss how we constructed the baseline scenario and, finally, show the results of out-of-sample exercises. In particular, we perform four different shocks: a monetary policy shock, increasing the base interest rate (in scenario 1); and three fiscal policy shocks, reducing government expenditures, increasing direct taxes on households and firms, and increasing the indirect tax rate (in scenario 2, scenario 3 and scenario 4, respectively).

Figures A4.1–A4.5 show how the model performs in replicating historical data over the period 2001q1–2019q4. Starting with GDP, Figure A4.1 displays the evolution of real GDP, in volumes and annual growth rates, showing that our estimate satisfactorily replicates historical data. The single components of GDP, in real values, are displayed in Figure A4.2. We overestimate consumption and investment for the period 2013–2016 – thus leading to a higher GDP growth rate in the simulation for the relative period – and accurately track the dynamics of the other components of demand. The same applies to net lending (Figure A4.3) and, to a lesser extent, net financial assets positions (Figure A4.4). Finally, sectoral net capital gains are also tracked satisfactorily (Figure A4.5). Overall, the model performs rather well and shows the ability to capture major trends in important variables.

In the published version (Zezza and Zezza 2020; 2022), the model was updated up to 2020q2 (start of the COVID crisis), so we chose not to produce scenario analysis at the time. Updating the whole model proved difficult during the pandemic, so the baseline presented here is meant to only show the *properties* of the model.

The strategy adopted to construct the fictitious baseline for the period 2020q1–2023q4 was to produce stable projections (GDP growth converging to 0.1%, as in the period 2018q1–2019q4, and government and foreign financial balances stabilizing with respect to GDP), by putting all small flows to 0, deactivate QE-related bond acquisitions, and setting exogenous variables to be growing at a stable (slow) pace (i.e., gov. spending, exchange rate, world demand etc.). The baseline scenario is shown in Figure 4, along with the simulated sectoral balances for the private, public and foreign sector.



Notes: The vertical line indicates the start of projections.
Source: Own elaboration.

Figure 4 Baseline projections for real GDP and sectoral balances

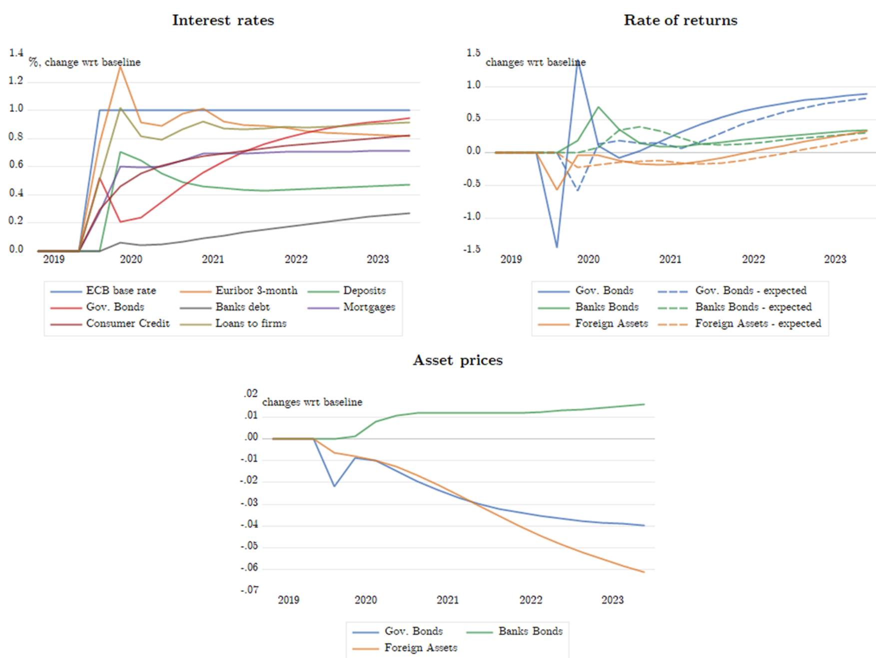
4.1 Monetary policy

We start by analysing model responses to a (contractionary) monetary policy shock, i.e., an increase in the ECB base rate of 100 basis points, to explore the transmission mechanisms, the effects, and the real–financial dynamics at work in our stylized financial sector.

As shown in Figure 5, an increase in the base rate immediately impacts all other interest rates, including deposit, lending, mortgage and bond rates, within the first quarter. This rise in interest rates drives changes in the relative rate of return on assets and leads to significant asset price adjustments. For instance, bond prices (both domestic and foreign) decrease, as investors demand higher yields.

An important aspect is the behaviour of the interbank market. According to our estimates, the Euribor initially overshoots relative to the base rate, leading to a positive interest rate differential in the same quarter of the shock, before turning negative in subsequent quarters. This behaviour in the interbank market affects banks' funding costs, which rise significantly as they are forced to pay more to borrow. Consequently, banks pass these higher costs onto firms and households by raising loan rates, which dampens investment and consumption. In contrast, deposit rates rise more slowly, meaning that the additional income households and firms receive on their deposits does not fully offset the increased interest payments on loans.

In terms of wealth dynamics, the shock has a more pronounced effect on private sector wealth (Figure 6). As financial conditions tighten, households start reimbursing their mortgages, which further decline as a share of disposable income due to falling housing investment in the following quarters, increasing overall net wealth as liabilities decline.



Source: Own elaboration.

Figure 5 Transmission of monetary policy shock to interest rates, rates of return and asset prices

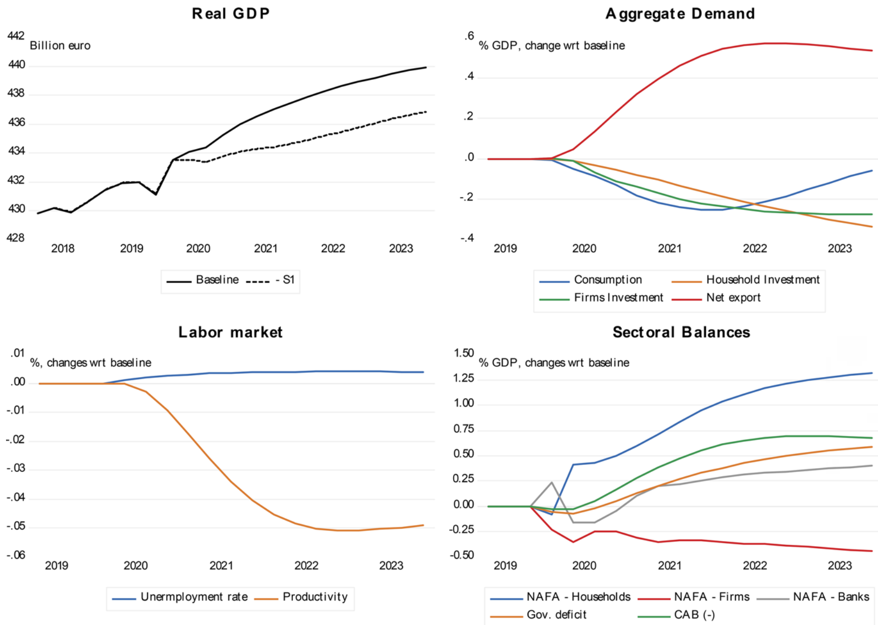
Notes: Sectoral balance sheet data are expressed as a percentage of the sector's disposable income. Solid lines denote assets, dashed lines liabilities. Changes with respect to baseline.
Source: Own elaboration.

Figure 6 Balance sheet effects

On the other hand, firms respond to the reduction in incomes by getting into debt, on one side, and increasing their foreign denominated assets and issuing share, on the other. Government debt decreases sharply as a share of GDP and stabilizes at a lower level than in the baseline (Figure 7).

Shifting focus to the broader macroeconomic impacts, Figure 8 offers insights of the real economy. Consumption and household investment fall sharply in response to higher borrowing costs and tighter credit availability. At the same time, firms cut back on capital expenditures as the cost of financing increases. Net exports improve following the shock, as domestic demand contracts, leading to a permanent boost in the trade balance, driven by a fall in imports. Consequently, real GDP declines as the reductions in private demand outweigh the positive contribution from net exports. This contractionary environment also affects the labour market, with a notable rise in the unemployment rate and a corresponding decline in productivity. Higher unemployment emerges as businesses scale down production in response to the weakened demand.

After an initial improvement, the government deficit widens relative to the baseline, driven by lower tax revenues and higher expenditures on unemployment benefits and other automatic stabilizers. This fiscal deterioration reflects the weakening macroeconomic environment and the increased burden on public finances. On the other hand,



Source: Own elaboration.

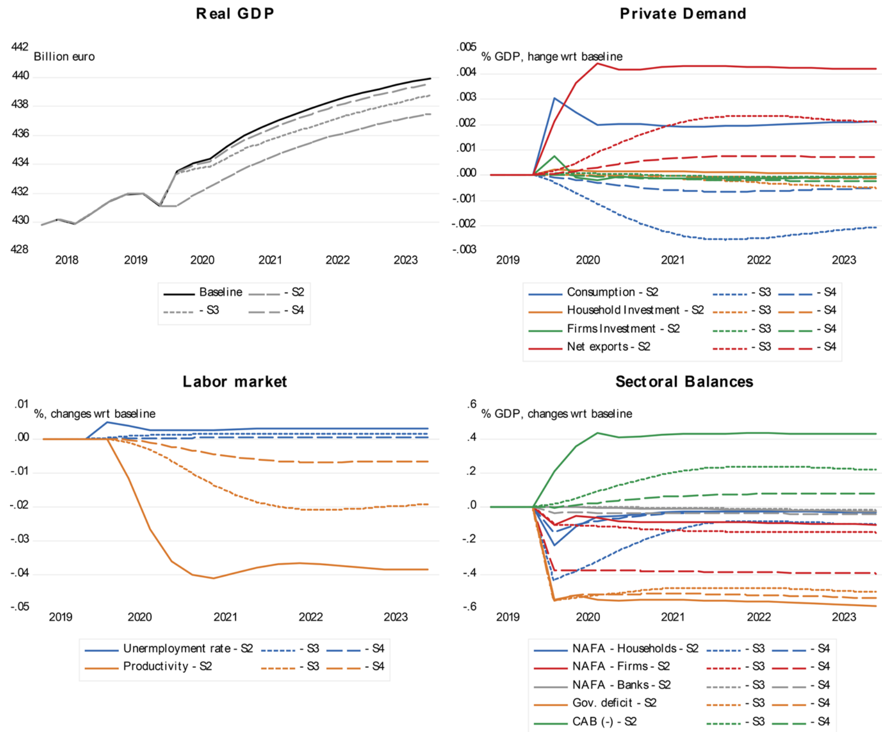
Figure 7 Real effects of monetary policy shock

the current account surplus increases, reflecting the aforementioned improvement in net exports. The private sector, particularly households, responds to the shock by increasing savings, as indicated by a rise in net lending as they reduce consumption and investment, opting for caution in the face of higher interest rates.

All in all, the model illustrates the complex transmission channels of a contractionary monetary policy shock. The interaction between financial markets, private sector behaviour, and sectoral balances creates an intricate dynamic where private savings rise, external imbalances improve, but at the cost of a significant economic slowdown and worsening public finances (though Government Debt is somewhat lower).

Yet, interest rate policies are not the only tool in the hands of Central Banks. As discussed earlier, following both the GFC and the COVID pandemic the ECB has put in place several unconventional measures to sustain economic activity when interest rate could no longer be lowered. In this version of the model, the Central Bank can sustain banks' balance sheet through two main instruments: refinancing operations and direct purchases of government bonds. However, as explained in Section 3.1.3, the effects of both these policies are only financial. Indeed, when liquidity injections are not related to domestic households and firms demand for money, these translate mechanically into an increase in excess reserves in banks' balance sheet, with no effects whatsoever on consumption and investment – as we could not find any sensible transmission mechanism as per the effects of QE on interest rates nor lending behaviour.

Model simulations show that when the Central Bank increases its purchases of Government bonds, this only results in a change in banks' balance sheet composition, with bonds being replaced by (excess) reserves. As interest rates do not react, households



Source: Own elaboration.

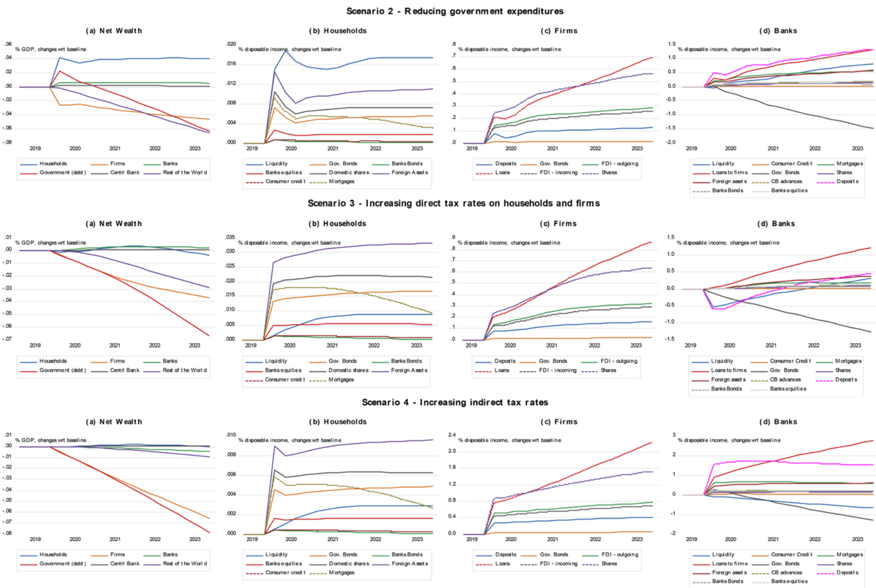
Figure 8 Effects of fiscal policy shocks on the real economy

and firms demand for loans does not move, so demand components do not change with respect to baseline. What this shows is that, consistently with endogenous money theory, QE can only have real effects if it changes agents' behaviour with respect to their demand for liquidity and loans.

For the future, we plan to link QE operations to financial conditions (which in the model is captured by the spread between Italian and German bonds), conditional on finding meaningful estimates.

4.2 Fiscal policy

Scenarios 2–4 explore model responses to different contractionary fiscal policy shocks. In scenario 2, we permanently reduce government expenditures at time t (2020q1, in our factionary baseline), but and then let it grow from $t + 1$ at same rate as in the baseline (i.e., at 0.1%). This shock changes the composition of GDP, leading to adjustments in other demand components. In scenario 3, in contrast, we increase direct taxes on households and firms by 0.5%. This shock in turn reduces their after-tax incomes, inducing adjustments in spending and saving patterns. Finally, in Scenario 4 we increased instead the indirect tax rate, which affects the distribution of incomes from production. Notice that shocks are calibrated in such a way that the extra government deficit at impact is similar, around 2.5 billion euro at current prices.



Notes: Sectoral balance sheet data, in panels b–d, are expressed as a percentage of the sector-specific disposable income. Solid lines denote assets, dashed lines liabilities. Changes with respect to baseline.
Source: Own elaboration.

Figure 9 Financial implications of fiscal policy shocks

Figure 9 looks at the real effects of the shock. In all scenarios, as the government reduces its spending, or increases tax rates, real GDP drops substantially. The impact multiplier of government spending is 1.02, rising to 1.08 in following quarters. In contrast, the multiplier of direct taxes is below 0.01 at impact, and reaches 0.54 three years after the shock. For indirect tax rate, the multiplier is even smaller: 0.02 at impact, and 0.18 three years from the shock.

In all scenarios, consumption drops substantially. In scenario 1, however, the share of consumption in GDP increases, due to the very large drop in production, giving rise to greater demand for liquidity by households. The fall in domestic incomes reduces imports, improving the trade balance, with the stronger effects recorded for scenario 1. Again, this is not enough to offset the fall in domestic demand. Weak growth translates into higher unemployment rates and lower productivity.

Facing lower demand, firms respond by resorting to debt, while households increase their demand for asset, in a 'search for safety'. In all three scenarios, both government and external debt drop substantially relative to the baseline. However, this comes at the cost of a recession and, in the case of tax hikes, permanently lower growth rates.

5 CONCLUSION

This article presented the main behavioural features and out-of-sample properties of MITA, a quarterly SFC model of the Italian economy (Zezza and Zezza 2020; 2022). Developed in response to the ongoing debate surrounding policy models, particularly in light of Blanchard's early critique of mainstream approaches (Blanchard 2018), MITA provides a framework that accounts for the intricate real–financial interactions that are often absent in most standard policy models. As such, it offers an alternative to the neo-classical models used in many policy institutions, especially regarding financial stability and sectoral balance-sheet dynamics.

We showed how the SFC structure allows to incorporate complex financial dynamics and behaviours, while preserving national accounting consistency. MITA includes a rich financial block, with a disaggregated household portfolio and Tobin-style allocation, a balance-sheet-based transmission of monetary policy, and detailed mechanisms for financial accumulation and interest income.

Our results suggest that the model performs reasonably well both in tracking in-sample historical data and in generating plausible dynamic responses to monetary and fiscal shocks. Model simulations confirm key results from the SFC literature: interest rate shocks primarily affect the private sector through changes in debt service and income distribution; fiscal consolidations reduce GDP and raise unemployment, with multiplier effects that vary by the type of instrument used.

A key feature of the model is the integration of unconventional monetary policy via QE operations. We explicitly model the balance sheet of the Central Bank, and the excess reserves created through QE, showing that these operations had no meaningful impact on consumption, investment or lending. Rather, QE only led to changes in the composition of banks' balance sheets – bonds were replaced by central bank reserves – with no active response from households or firms. This confirms a central tenet of endogenous money theory: liquidity injections by the Central Bank have no real effects unless they change the behavioural decisions of economic agents.

Our model is not without limitations, though. As with any medium-scale empirical SFC model, it requires significant effort to update and maintain, and is not suited for real-time forecasting. Its theoretical underpinnings also imply that it cannot account for expectation-driven structural breaks, as decisions are not derived from intertemporal optimization.

Nonetheless, this article shows the potential of empirical SFC models as policy tools. By offering a coherent framework to integrate monetary and fiscal policy analysis with detailed financial flows, it provides insights that complement – and overcome – standard SEM and DSGE approaches, and should thus be included in the suite of models in use at policy institutions.

SUPPLEMENTARY MATERIALS

Appendices 1–2 can be found under the Supplementary Materials tab within the online edition of this journal article at https://doi.org/10.4337/ejeep.2025.03.07.

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