An empirical Stock-Flow Consistent regional model of Campania

Rosa Canelli\textsuperscript{1} | Riccardo Realfonzo\textsuperscript{1,}\textsuperscript{○} | Francesco Zezza\textsuperscript{2,3,}\textsuperscript{○}

\textsuperscript{1}Università degli Studi del Sannio – Benevento, Benevento (BN), Italy
\textsuperscript{2}Sapienza Università di Roma, Roma (RM), Italy
\textsuperscript{3}Levy Economics Institute of Bard College, Annandale-on-Hudson, New York, US

Correspondence
Francesco Zezza, Sapienza Università di Roma, Italy and Levy Economics Institute of Bard College, USA. Email: francesco.zezza@uniroma1.it; francesco@zezza.it

Abstract
We develop an innovative Stock-Flow Consistent macroeconometric regional model with five sectors, exploiting economic and financial statistics for Campania, covering the period 1995–2018, and propose a methodology to close the financial account of the private sector when financial data are lacking. The model is then used to perform medium term Economic Policy Scenario Analysis. We find that a debt-funded fiscal expansion has permanent positive effects on growth, with an impact multiplier above one and a medium-run multiplier of 0.71. In the case of a balanced-budget rule the same increase in government spending has still positive effects on growth – with a medium-run multiplier of 0.6 – but adverse ones on the private corporate sector.

KEYWORDS
quantitative policy modelling, regional development planning and policy, regional macroeconometric model, stock-flow consistent modelling

JEL CLASSIFICATION
E12, E60, R11, R15
Since unification, the Italian economy has been characterized by strong regional disparities. Over the last 160 years, the development of the Italian economic system has been characterised by a dual pattern of growth, emphasised by significant regional inequalities between the Centre-North and the South (the so-called Mezzogiorno). Some convergence took place during the “economic miracle” (from 1950s to 1970s) fostered and led by a particularly incisive set of public policy programmes, mainly carried out through the Cassa per il Mezzogiorno (Graziani, 1975, 1979, 2000; Iuzzolino et al., 2013). From the 1980s onwards, and at a higher pace since the introduction of the common currency, the process inverted. In fact, the regional divide has progressively increased and even more so since the outbreak of the global financial crisis of 2008, as shown in Figure 1.

Drawing on the Italian economic divide, Krugman (1991) coined the concept of Mezzogiornification of Europe in order to identify the deep changes in the production structure and the growing concentration of industries set in the central areas of the European Monetary Union (EMU) at the expenses of the peripheral ones, with significant implications for countries’ trade balance positions. Mezzogiornification mainly implies that economic dualism which characterised the Italian economy is re-emerging, shaping the relationships between central and peripheral countries of the EMU, far away from the convergence path theorised by the European Commission (1990). Therefore, the debated Questione Meridionale offers important insights for stressing the role of the State in leading the catching-up process at the national and European level, through a systemic industrial and innovation policy able to rebalance the economy towards a new path of economic growth and social development (Realfonzo, 2008).

In this framework, the Italian government authorities promoted in 2017 a plan for large investments aimed at reducing the chronic economic divide and at promoting the convergence process among the main regions of the nation. Central to the investment plan was the realisation of Special Economic Zones in southern regions, and Campania – which is the main contributor to GDP in Mezzogiorno – was the first region to apply.

Economic policies may – and this is usually the case – have idiosyncratic effects within the same country, due to disparities between regions (Aiello et al., 2019; Bachtler & Begg, 2018; Laurent & Mignolet, 2009; Pellegrini, Terribile et al., 2013). Therefore, a useful tool for policymakers, economists, and practitioners for tracking how policy changes affect particular areas is represented by regional models. Indeed, there is a large body of literature of General Computable Equilibrium (CGE) and Input–Output (I-O) models analysing regional economic systems. As we will see, in most of these models the financial sector is left aside: banks and money, credit and debt, financial assets and

![Real GDP](source: ISTAT. Notes: percent change in real GDP. 2007 = 100)
portfolio allocation are usually absent, notwithstanding their importance and centrality in shaping economic growth in highly financialized systems.

Pioneered by Wynne Godley, the Stock Flow Consistent (SFC) approach integrates a post-Keynesian analysis of real markets with flow-of-funds analysis of balance sheets and a tobinesque approach to portfolio choice, providing the appropriate structure to study contemporary economies, with all the links between a complex “real” and “financial” side explicitly addressed. However, there has not been any attempt to develop a regional model adopting the SFC approach yet.

The aim of the present work is to fill this gap, by developing the first Stock-Flow Consistent macroeconometric regional model, exploiting regional data for Campania from the Italian National Statistics Institute (ISTAT) and Bank of Italy (BoI), covering the period 1995–2018. We discuss how to build a consistent system of accounting identities to accurately describe the economic system at hand, and propose a methodology to “close” the financial accounts when complete data at the regional level are lacking. We expand the three-balances New Cambridge model originally developed by Godley into a five institutional sector structure, to better disentangle the different roles played by each in the determination of demand and output, investment in real assets and the portfolio allocation of financial assets and liabilities, across sectors and within their balance sheets.

The model consists of 66 equations, twelve of which are behavioural equations estimated over annual data for the period 1995–2018, aimed at performing medium-term economic policy Scenario analysis.

The rest of the paper is structured as follows. Section 2 presents the literature review, focusing on the SFC approach (Section 2.1) and on existing empirical regional models for Italy (Section 2.2). In Section 3 we introduce our database and discuss the accounting structure of the model– describing the Transaction and Balance sheet matrices for Campania. Section 4 presents the main equations of the model, while in Section 5 we simulate the model, performing different shocks, and discuss its properties. Section 6 concludes.

2 LITERATURE REVIEW

In recent decades, two different classes of macroeconomic models have emerged as the main tools of analysis for governments, central banks, and major international institutions, each with its pros and cons (Pescatori & Zaman, 2011). The first type is represented by structural models, which are built starting from the fundamental principles of economic theory, often at the expense of the descriptive capacity of the model. The main ones are currently constituted by dynamic stochastic general equilibrium models (DSGE). The second typology is represented by large-scale models, which are a hybrid between structural models – as they make extensive use of economic theory for the definition of the relationships between variables – and purely econometric models (such as VARs) – as they are built starting from a large block of equations directly derived from national accounts data.

2.1 The stock-flow consistent approach

The basic principles of the Stock-Flow Consistent approach can be dated back to the 1970s and 1980s with the independent works of Wynne Godley (and the New Cambridge School) on one side, and of James Tobin (and the New Haven School) on the other. Originally developed to provide a robust policy tool based on actual data, its consistency requirements, as we will see shortly, are the same as those embedded in the System of National Accounts (SNA, European Commission et al., 2009) and Flow of Funds tables, and so allows for a systematic treatment of whole economies. SFC macroeconomic models focus on the financial side of the economic system, and on the interdependencies that connect the balance sheets of the various institutional sectors to their real transactions in a monetary production economy, with an explicit role for banks and financial institutions.
Interest in the SFC methodology surged in recent times, driven by two main reasons. The first one, which is more academic, was that the major contribution of Godley and Lavoie (2007) – which provided a systematic account on the construction of increasingly complex theoretical models – clarified that this class of models are flexible enough to host various theoretical views and to discuss how modern economies work. The second, related this time to policy, is that econometric models following the approach have been effective in providing timely warnings of coming recessions and of increasing financial fragility and instability, as well as producing more accurate macroeconomic projections relative to traditional models.

Referring the interested reader to Godley and Lavoie (2007) and the mentioned surveys, Zezza and Zezza (2019) summarize the requirements of Stock-Flow Consistent models:

- Horizontal consistency – “everything comes from somewhere and goes somewhere” (Godley & Lavoie, 2007, p.6), i.e., there cannot be any black hole. This implies that any source of funds for a sector is a use of funds of one or more other sectors, that any surplus matches a deficit or that the imports of a country embody the exports of others, possibly identifying who-to-whom relations.
- Vertical consistency - each transaction should be recorded once in the current account of the sector involved (payments/receipts), and at least once more as a change in the assets/liabilities of that sector (credit/debit). This means that wages received by household are recorded both in the current account as income receipts, and in the balance sheet as a change in its deposits (assuming it is not used to extinguish debts or acquire financial assets).

The two preceding principles imply that every transaction needs a quadruple entry in the accounting structure, as in Copeland (1947), assuring the consistency of the system.

- Flows-to-stocks consistency – the end-of-period value of any real or financial stock at current prices is given by the accumulation of the relevant flows during the period, plus the possible capital gains due to changes in asset prices. This introduces path-dependence, which plays an important role in SFC dynamics.
- Balance sheet consistency - the liabilities of a sector are the asset of another (possibly matching creditors and debtors). This means that the overall net wealth of the system sums up to zero. This principle applies both to changes in the balance sheets (flow of funds) and to the end-of-period stocks.
- Stock-to-flows feedback - increases in the stocks of financial liabilities imply higher future payments from one sector (debtor) to another (creditor). Taking these flows properly into account reinforces the path-dependence characteristic of SFC models.

As in the System of National Accounts, the accounting of SFC models rely on the same sequence of matrices for describing an economy (Zezza, 2015): going from flow accounting (production; distribution of income; use of income) to flow of funds (which give details of changes in real and financial assets for each sector), to the revaluation account (which measures changes in the value of stocks due to fluctuation in market prices), to balance sheets (which measure end-of-period net real and financial wealth for each sector).

The accounting framework of SFC models is represented by the Transactions Matrix (TM) and the Balance Sheet Matrix (BSM). The Transaction Matrix represents all the main monetary flows that take place in each period, for the entire economic system. Sources of funds are conventionally registered using a positive sign, while uses of funds have a negative sign. The net lending of the sector – i.e., the end-of-period financial position – is given by the difference between sources and uses of funds – i.e., the difference between saving and investment. Recalling the first accounting principle, horizontal consistency implies that flow and uses of funds for each transaction sum up to zero, while vertical consistency involves that the sum of each column of the matrix is zero. The Balance Sheet Matrix describes the allocation of real capital and financial assets across institutional sectors. Assets are denoted using a positive sign, whereas liabilities and net worth are given a negative sign. The stock consistency requires that the sum of each row equals to zero.
It should be noted that these accounting consistency requirements should be respected by any macro model – irrespective of the theory behind its construction. Moreover, next to the previous five accounting principles, other requirements come out of logical consistency:

- Flows of capital incomes (i.e., interest payments and receipts, dividends etc.) should be endogenously determined from the accumulated stocks of financial assets/liabilities. Thus, the flow of interest payments on debt $S$ at time $t$ would be given by the relative interest rate $r$ over the opening stock – i.e., on the end-of-previous period stock. These quasi-identities usually introduce non-linearities, affecting the trajectories of the model during simulations and reinforcing path-dependency.
- Stocks of financial assets/liabilities should feed-back on the behaviour of at least one sector. For example, positive saving implies accumulation of real and financial wealth, while the values of the stocks must in turn be relevant for consumption/saving decisions, introducing stock-flow norms that constrain the dynamics of the model.

While accounting consistency is important per se for building a sound macroeconomic model, since it reduces the degrees of freedom and provides some important insights about the constraints faced by any economic system, it is not enough. As shown long ago by Taylor (2004) and Taylor and Lysy (1979), the conclusions that can be drawn from a model are primarily led by the direction of causality the author imposes over the variables, in other words, its closures. From this standpoint, the SFC literature has always grounded itself within the boundaries of post-Keynesian economics. Thus, it is effective demand that drives economic growth both in the short and in the long-run, with output driving the adjustment and inflation being the result of wage-bargaining processes, as in Kalecki (2013).

Given the $k$ accounting identities that come out of the Transactions and Balance Sheets matrices, if we want to determine $n$ endogenous variables we need $n - k$ additional equations. These are given by specifying how agents in the system determine and finance their expenditures and net borrowing positions, and how they allocate their wealth. Finally, another set of behavioural equations are needed to model productivity growth, wages, and inflation, as well as to define the behaviour of the Public Sector and the Monetary authority, when needed.

In theoretical models, the short-run equilibrium of the system is driven by price adjustments in financial markets while changes in output ensure that savings are equal to investments. Changes in variables that rule expenditure or portfolio decisions and/or the departure of stocks or other variables from their target levels at the end of the period will determine further adjustments in following periods. The long-run equilibrium steady state is reached when stock-flow ratios are stable: thus, sectors’ reactions to changes in stocks and stock-flow ratios in the short-run drive the system towards the long-run steady state.

2.2 Review of models of Italian regions

The SFC literature has so far focused on either whole-country models, or theoretical multi-country models, showing that the integration of the real and financial markets of two (or more) open economies will generate different results than other traditional models. What is missing, however, are the applications of the Stock-Flow Consistent approach to the analysis of a single regional economy – and this is the goal we set for ourselves in the present work. Moreover, since Campania is small – when compared to the rest of the country – using a multi-regional structure would have greatly increased the complexity of the model, without altering our main conclusions.

The same cannot be said for the neoclassical and New-Keynesian schools, where theoretical and empirical contributions dealing with the modelling of one – or more – regional systems abound.

Table 1 summarises the regional models currently in use in Italy at government and academic institutions, highlighting their main features. For brevity, we focus only on empirical works, which are described in more details in Appendix I.
<table>
<thead>
<tr>
<th>Model</th>
<th>Institution</th>
<th>Dynamic/Static</th>
<th>Dimension</th>
<th>Blocks of equations/Main components</th>
<th>Sectors of activity</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMODS North–South econometric Model</td>
<td>SVIMEZ</td>
<td>Dynamic</td>
<td>Bi-regional</td>
<td>Prices, supply, and value added, components of aggregate demand and distribution of income, wages and employment, trade block, public sector.</td>
<td>24</td>
<td>Paniccia et al., 2000</td>
</tr>
<tr>
<td>Multisector econometric Model of Piemonte</td>
<td>IRES</td>
<td>Dynamic</td>
<td>Single-regional</td>
<td>Consumption, disposable income, investment (including public works expenditure), exports, value added, wages and employment, GDP, labour market, prices. 107 equations and 422 identities</td>
<td>16</td>
<td>Buran et al., 2006</td>
</tr>
<tr>
<td>MOMACAL Macroeconomic Model of Calabria</td>
<td>University of Calabria</td>
<td>Dynamic</td>
<td>Single-regional</td>
<td>Production, prices, labour market and wages, consumption, income, balance of trade, public sector</td>
<td>9</td>
<td>Aiello &amp; Pupo, 2003</td>
</tr>
<tr>
<td>MEMT Econometric Multisector</td>
<td>OPES-Trento Statistical</td>
<td>Dynamic</td>
<td>Single-regional</td>
<td>Consumption (6 categories), disposable</td>
<td>19</td>
<td>Podestà, 2010</td>
</tr>
<tr>
<td>Model</td>
<td>Institution</td>
<td>Dynamic/Static Dimension</td>
<td>Blocks of equations/Main components</td>
<td>Sectors of activity</td>
<td>References</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------</td>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>Model of Trentino</td>
<td>Service-Prometeia</td>
<td>Static</td>
<td>income, value added, investments, exports, wages and compensation of employees, employment and productivity, prices and GPD, labor market, public sector and provincial government sector.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100 equations and 400 identities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MicroReg Microsimulation Model</td>
<td></td>
<td>Static</td>
<td>Consumption and income of households, public sector</td>
<td></td>
<td>Maitino &amp; Sciclone, 2008</td>
<td></td>
</tr>
<tr>
<td>MRIO Multi-Regional Input-Output Model</td>
<td>IRPET</td>
<td>Static</td>
<td>Intermediate inter-industry flows, household expenditure, gross fixed investments, government and NPISHs expenditure, net interregional imports, indirect taxes, net trade.</td>
<td></td>
<td>Lattarulo et al., 2003</td>
<td></td>
</tr>
<tr>
<td>MRSUT Multi-Regional Supply and Use Table</td>
<td>IRPET</td>
<td>Static</td>
<td>Value added and output, domestic final demand, foreign import and export, interregional trade</td>
<td></td>
<td>Paniccià &amp; Rosignoli, 2018</td>
<td></td>
</tr>
<tr>
<td>MRMC-SUT Multi-Regional Multi-Country SUT</td>
<td>Bank of Italy-IRPET</td>
<td>Static</td>
<td>MRSUT with international trade matrices for Italy’s major</td>
<td></td>
<td>Bentivogli et al., 2018</td>
<td></td>
</tr>
</tbody>
</table>

(Continues)
Although characterised by different degrees of sophistication, all the dynamic models presented in Table 1 suffer from the same two shortcomings. The first is related to the closure of the models, as long-term growth is ultimately determined only by supply. Despite the introduction of increasingly realistic adjustment mechanisms, which slow down the movements of relative input prices, these are only present in the short term, thus eliminating the possibility of hysteresis effects and, more generally, of accounting for the impact of demand developments on long-term growth.

The second is that these models only deal with real markets. There is no mention to banks or financial sector, credit, money, or financial assets. Moreover, the equations for the accumulation of real capital stocks are usually absent.16

Alongside these shortcomings, which apply tout court to most I-O models, there is the one specifically inherent to static analysis. It is surely important to assess how economic policies can have idiosyncratic effects on the industrial structure, or how these policies affect the value chains in which firms are embedded or the terms of trade. However, the limit of static simulations is that although they can show the “ending point” – i.e., the long-run equilibrium positions – nothing can tell us about the “traverse”. This assumes that the parameters or calibrations are stable – as well as the behaviours of the economic agents considered – and that the adjustment to long-run positions is rapid.17

3 | DATA AND ACCOUNTING STRUCTURE

To develop a macroeconomic model that ensures all the criteria of the Stock-Flow Consistent approach are met, and uses national accounts data correctly, the first step to take is setting up the Transaction and Balance Sheet Matrices.

For Italy, regional statistics are compiled by multiple sources. ISTAT collects the statistics for the Territorial Economic Accounts, which form the core of our database, covering the period 1995–2018. Financial data are instead collected by the Bank of Italy, with longer time series for the stock of loans (1996–2020) and shorter ones for monetary deposits (2011–2020), both with a very detailed sectoral decomposition. Statistics on international trade (imports and exports of goods from/to the rest of the world, with the classification of economic activities, product, and country of origin/destination) are collected by the Agency for Customs & Trade and released by COEWEB, as quarterly time series covering the period 1991–2020.
3.1 The transaction and balance sheet matrices

In models for an entire country, the SFC approach suggests starting from the description of the Balance Sheet Matrix – i.e., how real and financial asset and liability stocks are distributed among the institutional sectors. This is not possible in a regional model, as the Bank of Italy does not produce complete statistics on sectoral balance sheets with territorial detail. The strategy adopted for the construction of the model was thus to start by defining the structure for the Transaction Matrix (Table 2) – using data from Istat territorial accounts.

As we said, the representation of the accounting structure of SFC models resembles the national accounts and Flow of Funds tables. Indeed, the TM is organized exactly in the same way: in the columns we distinguish five sectors (households, firms, government, other regions, and rest of the world), with current and capital account, and in the rows the transactions between sectors, with all variables measured at current prices.

The first row of the TM records the component of GDP, namely consumption (C), investment in fixed capital (I) and inventories (DINV), government expenditures (G), net imports from other regions (NMor), and imports (Mw) and exports (Xw) to the rest of the world.

The next three rows, together with the first column, detail the sectoral distribution of incomes generated in production between wages (W), profits (P), and net indirect taxation (NINDT). We assume that part of the profits is distributed to households.

The second block of the matrix records the distribution of primary incomes, detailing the flows related to capital incomes (payments/receipts of interest, dividends, and other capital incomes). As the table shows, we have assumed that all financial relationships between households, firms, banks, and the public authority are held with financial entities located in other Italian regions. While this may seem like a rather risky hypothesis, it should be realistic in the Italian context. When a customer in Campania, whether it is a family or a business, turns to a bank to ask for a loan or deposit her savings (or invest them), in most cases this is done through a financial institution based outside the Region, particularly in the Centre-North.

The third block records the distribution of secondary incomes, i.e., the redistribution following the payments of direct taxes (TAX) – on households’ incomes (INCTAX), and firms’ profits (DTAX) – social contributions (SOCCON), pensions (PENS), and other transfer (OT).

Next, we have the components of expenditures (consumption, investment, and government expenditures) and trade. The difference between sources and uses of funds for each sector determines its Net Lending/Borrowing (NL) position. Finally, the lower part of the TM records the Flow of Funds, i.e., how changes in net lending translate into changes in the stocks of deposits (D), loans (L), and other financial assets (OFA), inside the balance sheet of the relative sector.

For the Balance Sheet Matrix, the choice on the level of detail has been reduced by the limited amount of data available. As mentioned above, the only historical series long enough to enter directly into the model is that on the stocks of loans to the different sectors (L), while the one for monetary deposits (D) is only available from 2011 to 2020. The most important aspect, however, is the absence of data on the rest of the financial portfolio and of its allocation between the institutional sectors. Following Albareto, Bronzini, Carmignani, and Venturini (2008), we used the information present in the Financial Accounts of the Institutional Sectors (FAIS), together with the available territorial historical series, to build quotas in national aggregates, and use them to project regional series backwards using the appropriate techniques. The Balance Sheet Matrix for Campania is presented in Table 3.

We split the stock of real capital between the private and public sectors, differentiating between real estate (KH), machinery (KM) and non-residential construction (KNR). With respect to financial stocks, we assume that the share of mortgages on the total loans of households is the same as for the rest of the country. As we do not have territorial statistics on the rest of financial assets and liabilities, how can we build a complete set of accounts for our financial sector? To do so, we build a residual category of “Other Financial Assets” (OFA), using the principles behind the SFC methodology – and national accounting. The changes in Other Financial Assets (\(\Delta(OFA)\)), in fact, are nothing less than the difference between the net financial position in the period and the change in net wealth over the same period.
<table>
<thead>
<tr>
<th>Sectors -&gt;</th>
<th>Production</th>
<th>Private sector</th>
<th>Public Sector</th>
<th>Foreign sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Households</td>
<td>Firms</td>
<td>Government</td>
</tr>
<tr>
<td>GDP</td>
<td>+ GDP</td>
<td>- C - Ih</td>
<td>- I f</td>
<td>- G - Ig</td>
</tr>
<tr>
<td>Wages</td>
<td>- W</td>
<td>+ W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profits</td>
<td>- P</td>
<td>+ Ph</td>
<td>+ Pf</td>
<td></td>
</tr>
<tr>
<td>Net indirect taxes</td>
<td>- NINDT</td>
<td></td>
<td></td>
<td>+ NINDTg</td>
</tr>
<tr>
<td>Net capital incomes</td>
<td>+ KYh</td>
<td>+ KYf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net interest</td>
<td>+ INTf</td>
<td>+ INTf</td>
<td>- INTg</td>
<td>- INT</td>
</tr>
<tr>
<td>Dividends</td>
<td>+ DIV</td>
<td></td>
<td></td>
<td>- DIV</td>
</tr>
<tr>
<td>Other capital incomes</td>
<td>+ OKY</td>
<td></td>
<td></td>
<td>- OKY</td>
</tr>
<tr>
<td>Direct taxes</td>
<td>- INCTAX</td>
<td>- DTAX</td>
<td>+ TAX</td>
<td></td>
</tr>
<tr>
<td>Pensions</td>
<td>+ PENS</td>
<td></td>
<td></td>
<td>- PENS</td>
</tr>
<tr>
<td>Net social contributions</td>
<td>- SOCCON</td>
<td></td>
<td>+ SOCCON</td>
<td></td>
</tr>
<tr>
<td>Other net current transfers</td>
<td>+ OT</td>
<td></td>
<td>- OT</td>
<td></td>
</tr>
<tr>
<td>Memo: Consumption</td>
<td>- C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memo: Investment</td>
<td>- Ih</td>
<td>+ Ih</td>
<td>- I f</td>
<td>+ I f</td>
</tr>
<tr>
<td>Memo: Government expenditures</td>
<td></td>
<td></td>
<td></td>
<td>- G</td>
</tr>
<tr>
<td>Memo: Trade</td>
<td>- Xw + Mw</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net lending/borrowing</td>
<td>- NLh</td>
<td>+ NLh</td>
<td>- NLf</td>
<td>+ NLf</td>
</tr>
<tr>
<td>[Total]</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Changes in deposits</td>
<td>- d (Dh)</td>
<td>- d (Df)</td>
<td></td>
<td>+ d (D)</td>
</tr>
<tr>
<td>Sectors -&gt;</td>
<td>Production</td>
<td>Private sector</td>
<td>Public Sector</td>
<td>Foreign sector</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>----------------</td>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Households</td>
<td>Firms</td>
<td>Government</td>
</tr>
<tr>
<td>Changes in loans</td>
<td>+ d (Lh)</td>
<td>+ d (Lf)</td>
<td></td>
<td>- d(L)</td>
</tr>
<tr>
<td>Changes in Other Financial Assets</td>
<td>- d (OFAh)</td>
<td>- d (OFAf)</td>
<td>- d (OFAg)</td>
<td>+ d (OFA)</td>
</tr>
<tr>
<td>[Total]</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Legend: h = household; f = firms; g = Government; or = Other Italian regions; w = Rest of the World.
Notes: (+) sign stands for “sources of funds”; (−) sign stands for “uses of funds.”
- i.e., once the changes in assets and liabilities (in our case, loans and deposits $\Delta(L)$ and $\Delta(D)$, respectively) have been determined. In symbols:

$$\Delta(OFA) = NL + \Delta(L) - \Delta(D)$$

Once created this flow variable and having assigned an initial value for the stock, one only needs to cumulate the flows to compute the stock. This also ensures that the accounting consistency of the model is respected. Changes in the net financial positions of the sectors, therefore, result in changes in their stocks of assets and liabilities, which generate higher or lower future flows of capital incomes in the following periods, adding a further interaction between real and financial markets.

Although simpler in its structure than other existing empirical SFC models, this work is a useful simulation tool for analysing economic trends in the region and ascertain the effects of exogenous shocks, sophisticated enough to answer multiple policy questions and to perform different scenario analysis. The model consists of 66 equations, twelve of which are determined by stochastic equations estimated on annual data for the period (1995–2018). The model tracks the evolution and dynamics of the main components of GDP, financial balances, and portfolio allocation, the impacts of public expenditure on private sector productivity and investment, the effects of economic policies on the regional production structure and consumption behaviour, as well as the performance in trade.

In the next section we will briefly introduce the equations of the model and describe the main transmission channels. For the econometric specification, we adopted a general-to-specific approach, taking care of the order of integration of each variable in the model: starting from a general model in term of dynamics, we tested the restrictions on nonsignificant parameters to find the final parsimonious model. All stochastic equations have been tested for autocorrelation, heteroskedasticity and normality of residuals, and parameter stability. We must stress, nevertheless, that the short size of our sample at annual frequency prevented us from the adoption of more advanced estimation techniques, from which model dynamics would certainly benefit. The size of our sample also prevented the adoption of proper tests for parameter stability. With longer time series, of course, these problems may be partly overcome.
4 | THE MODEL

Large-scale models are typically used to perform macroeconomic policy forecasts and to conduct scenario analysis on the possible effects of such policies. The model presented here is indeed developed to analyse the effects on the regional private sector of the implementation of economic policies by the Public Administrations aimed at reducing the North–South divide. It was therefore necessary to extend the New Cambridge model by splitting the private sector between households and firms and adding other Italian regions to the foreign sector. This allowed us to obtain a five sectors structure – with households, firms, Public Administration, Other Italian Regions, and the Rest of the World – which reduces to a three-sector model – with private, public, and foreign sectors. The equations follow the presentation of the accounting structure of the previous section, with the addition of stochastic equations that close the model.  

4.1 | Real transactions

As in the first row of the Transaction Matrix, GDP (Equation 1) is given by the sum of demand components. These are households’ consumption and their housing investment (C and \( I_h \)), firms investment (in machinery and warehouses, and inventories, \( I_f \) and \( DINV_f \)), Government expenditures and investment (G and \( I_g \), respectively), and exports to the rest of the world (\( X_w \)), minus net imports from other Italian regions (\( NM_{or} \)) and the imports from the rest of the world (\( M_w \)). Since we do not have the data for all demand components at constant prices, we will determine all model variables at current prices and use the GDP deflator\(^{25} \) to compute real values (Equation 2).

The GDP deflator (\( p^{dpc} \), Equation 3) is estimated through a stochastic equation which links inflation to wage dynamics, including a shift variable for 2001, which is statistically significant, and shows that the ratio collapsed when the country fully joined the monetary union. For the average wage (WAGEU, Equation 4) we find a wage-curve where the rate of growth in average wages is positively driven by the growth in inflation (proxied by the GDP deflator, with a coefficient of 1) and the level of participation rate in the labour force (PARTRATE), and negatively by the growth in the unemployment rate (UR). Finally, we find evidence for a sort of Kaldor-Verdoorn effect, as the productivity level (PROD, Equation 5) positively depends on the share of private sector value added in GDP (\( \frac{VA_{pvt}}{GDP} \)) and the level of the average wage in real terms (\( \frac{WAGEU}{p^{dpc}} \)). Given the short size of our sample, which prevents the adoption of more complex dynamic specifications, and given the contemporaneous feedbacks among prices, wages, and productivity, we chose to estimate Equations 3 to 5 with an IV estimator. Estimation results are shown below.

\[
\begin{align*}
GDP &= (C_h + I_h) + (I_f + DINV_f) + (G + I_g) - NM_{or} + X_w - M_w; \\
GDPK &= \frac{GDP}{p^{dpc}}; \\
\log(p^{dpc}) &= f\left(\frac{WAGEU}{PROD}\right); \\
\log(WAGEU) &= f\left(\log(p^{dpc}); \log(UR); PARTRATE; \right) \\
PROD &= f\left(\frac{VA_{pvt}}{GDP} \cdot \frac{WAGEU}{p^{dpc}}\right).
\end{align*}
\]
<table>
<thead>
<tr>
<th>Equation</th>
<th>Coefficients</th>
<th>Method</th>
<th>Sample</th>
<th>Adj. R^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - GDP deflator</td>
<td></td>
<td>2SLS</td>
<td>1996 2017</td>
<td>0.99</td>
</tr>
<tr>
<td>Wages to productivity ratio (before 2001)</td>
<td>0.64***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wages to productivity ratio (after 2001)</td>
<td>0.59***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 - Average wage</td>
<td></td>
<td>2SLS</td>
<td>1996 2017</td>
<td>0.99</td>
</tr>
<tr>
<td>Prices</td>
<td>1***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>–0.11***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation rate</td>
<td>0.82***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 - Productivity</td>
<td></td>
<td>2SLS</td>
<td>1996 2017</td>
<td>0.73</td>
</tr>
<tr>
<td>Private sector value added share in GDP</td>
<td>118.48*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average wage in real terms</td>
<td>1.82**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: All equations pass the standard tests for autocorrelation, normality and heteroskedasticity of residuals.

Production is undertaken by private and public enterprises. Regional value added (VA, Equation 6) is computed by subtracting from GDP the tax revenues on production and imports, net of subsidies to firms (NETTAX, Equation 7), which are computed by applying an ex-post tax rate (τ_{nettax}) to GDP. Private sector production (VA_pvt, Equation 8) is determined by subtracting the public sector share (VA_g) from total value added.

\[
VA = GDP - NETTAX \quad (6)
\]
\[
NETTAX = τ_{nettax} \cdot GDP \quad (7)
\]
\[
VA_{pvt} = VA - VA_g \quad (8)
\]

We then pass to functional distribution – i.e., how incomes generated in production are split between the different institutional sectors. Profits (P, Equation 9) are computed as the difference between GDP and the sum of wages (W) and net indirect taxes (NINDT_{gt}), with firms’ profits (P_f, Equation 10) computed as a residual, after subtracting households’ share (P_h). Wages (Equation 11) are determined by employment (EMP) and the average wage, while employment (Equation 12) is determined by the relation between real GDP and average labour productivity. Finally, net indirect taxes are computed through an average tax rate on production (Equation 13). Obviously, the sum of the components is equal to GDP, as in the first column of the Transaction Matrix.

\[
P = GDP - (W + NINDT_{gt}); \quad (9)
\]
\[
P_f = P - P_h; \quad (10)
\]
\[
W = WAGEU \cdot EMP; \quad (11)
\]
\[
EMP = GDPK/PROD; \quad (12)
\]
\[ NINDT_{gt} = \tau^{\text{indt}} \cdot GDP. \] (13)

The third block of Table 2 records the flows of capital incomes of households and firms. Households’ outlays \((KYP_h, \text{Equation 14})\) are the sum of the interest they paid on their existing loans \((\text{INTP}_h, \text{Equation 15})\) and of the other transactions in capital account \((\text{TRKP}_h)\). Capital incomes received \((KYP_h, \text{Equation 16})\), are in turn the sum of the interest incomes received – on their stocks of deposits and other financial assets \((\text{INTR}_h, \text{Equation 17})\) – dividends \((\text{DIVR}_h)\) and other capital incomes \((\text{TRKR}_h)\). Since we do not have the relative time series in the territorial accounts, interest paid by firms on their loans are computed by the model \((\text{INTP}_f, \text{Equation 18})\) as well as the receipts on their deposits \((\text{INTR}_f, \text{Equation 19})\), based on the BSM.

\[ KYP_h = \text{INTP}_h + \text{TRKP}_h; \] (14)

\[ \text{INTP}_h = r^{LC} \cdot LCh_{t-1} + r^{LMO} \cdot LMO_{ht-1} + \text{disc}_{h}^{\text{imp}}; \] (15)

\[ \text{KYR}_h = \text{INTR}_h + \text{DIVR}_h + \text{TRKR}_h; \] (16)

\[ \text{INTR}_h = r^D \cdot D_{ht-1} + r^B \cdot (\text{ratio}^B_h \cdot OFA_{ht-1}) + r^F \cdot (\text{ratio}^F_h \cdot OFA_{ht-1}) + \text{disc}_{h}^{\text{intr}}; \] (17)

\[ \text{INTP}_f = r^{LF} \cdot LF_{ft-1}; \] (18)

\[ \text{INTR}_f = r^D \cdot D_{ft-1}. \] (19)

Households pay direct taxes on their primary income \(^{29}\) \((\text{INCTAX}, \text{Equation 20})\) and social contributions on their income from production \((\text{SOCCON}, \text{Equation 21})\) – both computed from implicit average tax rates. They also receive pension payments \((\text{PENS}, \text{Equation 22})\) – based on the number of retired people \(^{30}\) and the average wage – and other net current transfers \((\text{OCTN})\), which are instead left exogenous. Firms pay direct taxes on their profits, determined as well through an implicit average tax rate \((\text{DTAX}, \text{Equation 23})\).

\[ \text{INCTAX} = \tau^{DT}_h \cdot (W + P_h + \text{KYR}_h - KYP_h); \] (20)

\[ \text{SOCCON} = \tau^{SC}_h \cdot (W + P_h); \] (21)

\[ \text{PENS} = \tau^{\text{PENS}}_h \cdot (\text{WAGE} \cdot \text{RETIRED}); \] (22)

\[ \text{DTAX} = \tau^{DT}_f \cdot P_{ft-1}; \] (23)

Reading top-down each column of the TM, we reconstructed the disposable income of the various sectors. For households, disposable income is the sum of incomes from production, capital incomes and pension received, net of taxes paid on their incomes, social contributions, and other transfers in current account \((YD_h, \text{Equation 24})\). For firms, it is the sum of profits and capital incomes, net of taxes paid \((YD_f, \text{Equation 25})\). For the Public sector, finally, is given by the sum of tax revenues from direct and indirect taxation and social contributions, net of pension payments and of the transfers made to households \((YD_g, \text{Equation 26})\).
\[ YD_h = W + P_h + (\text{KINCR}_h - \text{KINCP}_h) + \text{PENS} - (\text{SOCCON} + \text{INCTAX}) + \text{OCTN}; \]  

\[ YD_l = P_l + (\text{INTR}_l - \text{INTP}_l) - \text{DTAX}; \]  

\[ YD_g = \text{NINDT}_g + (\text{INCTAX} + \text{DTAX} + \text{SOCCON}) - (\text{PENS} + \text{OCTN}). \]

Following Godley and Lavoie (2007), Muellbauer (2016), and Zezza and Zezza (2020), we model consumption (Equation 27) as a function of disposable income\(^3\) and the opening stock of wealth \((\text{KH}_{t-1} + \text{NW}_{ht,t-1})\). Notice that this is coherent with a dynamic process of adjustment toward a stable stock-flow norm between household income and wealth. In this way we add another feedback channel in the model - if household see their wealth increasing (in housing and financial assets), consumption will adjust accordingly until reaching a new, stable, stock-flow ratio. We found the presence of a structural break relative to the financial crisis, which we took care of through a shift variable, while we included a dummy for 2002 to eliminate autocorrelation among residuals.

\[ C = f(YD_h; \text{KH}_{t-1} + \text{NW}_{ht,t-1}). \]  

**Equation 27 Household consumption Coefficients**

<table>
<thead>
<tr>
<th></th>
<th>Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method: OLS</td>
<td>Sample: 2000 2017</td>
</tr>
<tr>
<td>Adj. R(^2): 0.98</td>
<td></td>
</tr>
<tr>
<td>Disposable income</td>
<td>0.84***</td>
</tr>
<tr>
<td>Stock of wealth</td>
<td>0.06**</td>
</tr>
<tr>
<td>Dummy 2002</td>
<td>-1696.258**</td>
</tr>
<tr>
<td>Shift GFC</td>
<td>-2075.438***</td>
</tr>
</tbody>
</table>

Notes: The equation passes the standard tests for autocorrelation, normality and heteroskedasticity of residuals.

Government consumption and investment are left exogenous, as autonomous decision of the public authority.

As we said in the introduction, we do not have time series relative to interregional trade, but only net (total) imports. However, since COEWEB releases data relative to imports and exports of goods from/to the rest of the world, we can decompose net imports from other Italian regions \((\text{NM}_{or})\). As in Aiello and Pupo (2003) and Buran et al. (2006), net imports from other regions are estimated as a function of private sector (non-residential) final demand and the level of regional GDP, relative to that of other regions \(\frac{\text{GDP}}{\text{GDPr}}\). Equation 28). With respect to international trade, the growth in imports from the rest of the world \((M_w, \text{ Equation 29})\) is estimated again as a function of private sector (non-residential) final demand, while exports to the rest of the world \((X_w, \text{ Equation 30})\) are estimated with an Error Correction Model as a function of world demand, with a short-run elasticity of 0.87 and a long-run one of 0.32. For the first two equations, we found the presence of a structural break related to the financial crisis, which we took care of through a dummy variable, which is always statistically significant.

\[ \text{NM}_{or} = f\left( (C + I_l) ; \frac{\text{GDP}}{\text{GDPr}} \right); \]
\[ \log(M_w) = f(\log(GDP)); \]  
\[ d\log(X_w) = f(\log(WD); d\log(WD)). \]

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Equation 28 Net imports from other regions</th>
<th>Method: OLS</th>
<th>Sample: 1996 2017</th>
<th>Adj. R^2: 0.97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private sector final demand</td>
<td>0.39***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional GDP/GDP Other regions</td>
<td>1047139***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy GFC</td>
<td>3094***</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equation 29 Imports from the rest of the world</th>
<th>Method: OLS</th>
<th>Sample: 1996 2017</th>
<th>Adj. R^2: 0.90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private sector final demand</td>
<td>2.01***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy GFC</td>
<td>-0.22**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equation 30 – Exports to the rest of the world</th>
<th>Method: OLS</th>
<th>Sample: 1996 2018</th>
<th>Adj. R^2: 0.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>World demand (short run)</td>
<td>0.87***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>World demand (long run)</td>
<td>0.32**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: All equations pass the standard tests for autocorrelation, normality and heteroskedasticity of residuals.

We now turn to the determination of gross fixed investment of the various sectors. In the model, we have three different real assets: homes (KH), machineries (KM), warehouses/infrastructures (KNR). Following Byrla\(l\)sen and Raza (2020), Godley and Lavoie (2007), and Zezza and Zezza (2020), investment in housing is determined by a stochastic equation which links the growth rate in investment – relative to the existing stock of homes \(I_h/KH_{t-1}\), Equation 31) – to disposable income and the interest rate on mortgages \(r^{\text{LMO}}\). Firm’s investment is determined by a stochastic equation which links its growth rate – relative to the existing capital stock \(I_f/KM_{t-1}+KNR_{t-1}\), Equation 32) – to their disposable income and the changes in loans \(\Delta L_f/KM_{t-1}+KNR_{t-1}\). Notice that in both cases the specifications are consistent with a process of adjustment to a stable stock–flow ratio of capital to output.

\[ \log \left( \frac{I_h}{KH_{t-1}} \right) = f \left( \log \frac{YD_h}{KH_{t-1}}; r^{\text{LMO}} \right); \]  
\[ \log \left( \frac{I_f}{KM_{t-1}+KNR_{t-1}} \right) = f \left( \log \frac{YD_f}{KM_{t-1}+KNR_{t-1}}; \log \left( \frac{\Delta L_f}{KM_{t-1}+KNR_{t-1}} \right) \right). \]
### Coefficients

**Equation 31** Investment in housing  
Method: OLS  
Sample: 2001 2017  
Adj. $R^2$: 0.97  

<table>
<thead>
<tr>
<th>Coefficient</th>
</tr>
</thead>
</table>
| Disposable income | 3.8***  
| Interest rate on mortgages | −0.13***  

**Equation 32** Firms’ investment  
Method: OLS  
Sample: 2001 2017  
Adj. $R^2$: 0.83  

<table>
<thead>
<tr>
<th>Coefficient</th>
</tr>
</thead>
</table>
| Disposable income | 0.35***  
| Changes in loans | 0.44***  

Notes: All equations pass the standard tests for autocorrelation, normality and heteroskedasticity of residuals.

Once netted out sectoral investment from saving, we finally get to the net lending/borrowing of the various sectors – i.e., their financial balances. These are represented by the column totals, and must respect the fundamental identity,\(^{32}\) i.e., that the sum of net lending for all sectors is zero. In Godley’s terminology, these are labelled as “Net acquisition of Financial Assets” (NAFA, of households and firms, Equations 33–34), the Public Sector Borrowing Requirement (PSBR, usually called Government Deficit, Equation 35), and the Current Account Balance (CAB, vs other Italian regions and the rest of the world, Equations 36–37).

\[
\text{NAFA}_h = YD_h - (C + I_h); \tag{33}
\]

\[
\text{NAFA}_f = YD_{nf} - (I_f + DINV); \tag{34}
\]

\[
\text{PSBR} = YD_g - (G + I_g); \tag{35}
\]

\[
\text{CAB}_w = M_w - X_w; \tag{36}
\]

\[
\text{CAB}_w = -(\text{NAFA}_h + \text{NAFA}_f + \text{PSBR} + \text{CAB}_w). \tag{37}
\]

Figures 2 and 3 display, respectively, the net lending/borrowing position of each sector and the aggregate financial balances. A couple of things stands out.

In the years prior to the financial crisis, households were getting into debt and firms were reducing their accumulation of assets. At the same time, the public sector was trying to reduce (nation-wide) the debt-GDP ratio by cutting spending – thus reducing its deficit. This implied a higher exposition with the foreign sector, in this case represented by the other Italian regions – since the CAB with the rest of the world has been balanced until 2009. In 2009, private sector incomes collapsed, and the households’ NAFA turned positive. After the Sovereign debt crisis, the private sector started again to accumulate financial assets, with firms leading the way – with their NAFA increasing up to 10 percent of GDP in 2014. As the public sector deficit did not increase substantially – so that the adjustment took place in the private sector – the aggregate CAB against the foreign sector narrowed, from −7% of GDP in 2012 to −2% in 2017. However, to the surge in firms NAFA corresponds a drop in their investment and the diversion of more funds through the financial sector – i.e., towards Centre-North regions.
FIGURE 2  Sectoral Financial Balances  Source: author’s calculations. Notes: households, firms, government, other regions, and rest of world Net Lending/Borrowing position, as percent of GDP

FIGURE 3  Financial Balances  Source: author’s calculations. Notes: aggregate Financial Balances as percent of GDP
4.2 Stocks and flows

Among the peculiarities of the SFC approach, a prominent spot is occupied by the ability to integrate the spending and investment choices of the different sectors with the accumulation of real and financial capital stocks, consistently with the BSM presented above. The stocks of real capital \((K_{i,j})\) for sector \(i\) and stock \(j\), at time \(t\), evolve depending on the relative flows of investments \((I_{i,j})\), given the cost of replacing capital. In symbols:

\[
K_{i,j,t} = K_{i,j,t-1} + I_{i,j,t} - \text{ccr}_{j,t} \cdot K_{i,j,t-1}.
\]

Net financial wealth \((NW_i)\), Equations 39–40) for sector \(i\) is instead given by the end-of-previous-period stock of wealth plus the current net lending/borrowing position. If a sector is in a net lending (borrowing) position, it is either accumulating (selling) financial assets or extinguishing (increasing) debts. Recall that we assume that all financial intermediation is done through banks located in other Italian regions – thus we add the net lending position of all our extended foreign sector to the opening stock of wealth.

\[
NW_h = NW_{h,t-1} + N\text{FA}A_h;
\]

\[
NW_f = NW_{f,t-1} + N\text{FA}F_h;
\]

While the variation in wealth ultimately depends on the end-of-period financial position of each sector, the decision regarding how to allocate their financial investment between the different assets, or the possibility of taking on new loans, depends on sectoral portfolio choices.

In SFC models à la Godley-Lavoie, the coefficients for portfolio choices are usually determined through a relative rate of returns matrix, as in Tobin (1969). When dealing with real world statistics, however, it is difficult to estimate from the data (given their structure, the available time span, the presence of structural breaks, etc.) the appropriate relations—if they exist—between the relative rate of returns and the demand and supply for different assets and liabilities. In their model of the Italian economy, for example, Zezza and Zezza (2020) only find statistical evidence for a negative relationship between the rate of return on Public debt and foreign assets, and between banks' obligations and banks' shares – inside households' portfolio structure. In our case, given that financial statistics at the territorial level are lacking and that our model does not have that many assets to determine, we choose to adopt some of the principles of the SFC approach to model asset allocation, consistently with the Balance Sheet Matrix presented in Table 3 and post-Keynesian theory.

On the asset side of households' balance sheet, we find monetary deposits at banks \((D_h)\) and other financial assets \((OFA_h)\), while they take on mortgages \((LMO)\) and loans for consumption expenditures \((LC)\). The demand\(^{33}\) for deposits is determined as a fixed share of savings (Equation 41). As mortgages represent the largest source for funding investment, households' demand for mortgages – relative to income - is estimated as a function of investment in housing, the changes in assets value \((\Delta(D_h + OFA_h)/YD_h)\) and the relative interest rate (Equation 42). The demand for consumer credit (in real terms) depends instead on real consumption, along with the changes in real assets \((\Delta(D_h + OFA_h)/\Delta pgdp)\) – used here as a proxy for collateral availability – and the real interest rate on short term credit \((\Delta r_{LC} \Delta pgdp)\), Equation 43).\(^{34}\) Finally, the stock of other financial assets is determined as a residual – i.e., as the difference between the end-of-period stock of wealth and the other components of their balance sheet \((OFA_h)\), Equation 44).

\[
\Delta(D_h) = \text{ratio}_{D} \cdot \text{SAV}_h;
\]

\[
\frac{\Delta(LMO)}{YD_h} = f\left(\frac{I_h}{YD_h}, \frac{\Delta(D_h + OFA_h)}{YD_h} ; r_{\text{LMO}}\right).
\]
\[ \Delta \left( \frac{LC}{p_{08}} \right) = f \left( \frac{C}{p_{08}} ; \Delta \left( \frac{D_h + OFA_h}{p_{08}} \right) ; r^C \cdot \Delta p_{08} \right); \]  

(43)

\[ OFA_h = NW_h - D_h + LMO + LC. \]  

(44)

### Household Demand for loans

<table>
<thead>
<tr>
<th>Equation</th>
<th>Mortgages</th>
<th>Coefficients</th>
<th>Method: OLS</th>
<th>Sample: 2000 2017</th>
<th>Adj. R(^2): 0.93</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment in housing</td>
<td></td>
<td>1.14***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes in assets</td>
<td></td>
<td>0.73***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest rate on mortgages</td>
<td></td>
<td>−0.003**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equation</th>
<th>Coefficients</th>
<th>Method: OLS</th>
<th>Sample: 2000 2017</th>
<th>Adj. R(^2): 0.82</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real consumption expenditures</td>
<td></td>
<td>0.02***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes in assets</td>
<td></td>
<td>0.04***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real interest rate on consumer credit</td>
<td></td>
<td>+2.74</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: All equations pass the standard tests for autocorrelation, normality and heteroskedasticity of residuals.

On firm's asset side we have deposits \( (D_f, \text{Equation 45}) \), determined as a fixed share of wages paid. Firms' demand for loans – relative to GDP \( \frac{\Delta LF}{GDP} \), Equation 46 – is determined as a function of their net lending and the outstanding stock-to-GDP ratio \( \frac{LF}{GDP} \), meaning that firms will finance their investment through credit if their own funds are not sufficient, assuming banks accommodate their demand for credit. Again, the stock of other financial assets is determined as a residual \( OFA_f, \text{Equation 47} \).

\[ DEPS_{nfc} = \frac{\text{ratio}_{nfc} \cdot WAGES}; \]  

(45)

\[ \frac{\Delta LF}{GDP} = f \left( \frac{NL_f}{GDP} , \frac{LF}{GDP} \right); \]  

(46)

\[ OFA_f = NW_f - D_f + LF. \]  

(47)

<table>
<thead>
<tr>
<th>Equation</th>
<th>Coefficients</th>
<th>Method: OLS</th>
<th>Sample: 2000 2017</th>
<th>Adj. R(^2): 0.79</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net lending</td>
<td></td>
<td>−1.17***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock of loans</td>
<td></td>
<td>−0.20***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: The equation passes the standard tests for autocorrelation, normality and heteroskedasticity of residuals.
### Table 4: Baseline and Scenario I-IV: effect of the shocks on endogenous variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Scenario I: Deficit-financed expenditure</th>
<th>Scenario II: Balanced-budget rule</th>
<th>Scenario III: Increasing growth in world demand</th>
<th>Scenario IV: Increasing the interest rates on private sector borrowing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline 1y 5y 15y</td>
<td>1y 5y 15y</td>
<td>1y 5y 15y</td>
<td>1y 5y 15y</td>
</tr>
<tr>
<td>Growth of GDP</td>
<td>0.02% 0.04% 0.05%</td>
<td>0.10% 0.08% 0.09%</td>
<td>0.08% 0.06% 0.07%</td>
<td>0.08% 0.04% 0.04%</td>
</tr>
<tr>
<td>GDP</td>
<td>105.98 107.47 112.50</td>
<td>102.80 83.10 95.80</td>
<td>81.80 63.70 80.20</td>
<td>86.80 38.4 48.2</td>
</tr>
<tr>
<td>Consumption</td>
<td>71.05 72.39 76.75</td>
<td>52.13 30.86 41.13</td>
<td>10.84 -0.95 7.63</td>
<td>44.01 13.78 20.86</td>
</tr>
<tr>
<td>Investment in housing</td>
<td>5.15 5.16 5.36</td>
<td>-0.08 4.99 2.78</td>
<td>-0.06 -2.75 0.28</td>
<td>0.00 -0.06 1.86</td>
</tr>
<tr>
<td>Investment by firms</td>
<td>9.78 10.66 11.45</td>
<td>-0.15 17.48 11.72</td>
<td>-0.11 -11.64 -11.72</td>
<td>0.00 9.60 6.08</td>
</tr>
<tr>
<td>Net imports from other regions</td>
<td>10.10 11.27 13.52</td>
<td>45.45 61.64 52.68</td>
<td>29.82 27.68 25.99</td>
<td>38.40 30.05 26.37</td>
</tr>
<tr>
<td>Net imports from world</td>
<td>1.33 1.18 1.03</td>
<td>5.82 12.16 11.35</td>
<td>1.26 -4.24 -7.50</td>
<td>-81.83 -42.51 -41.76</td>
</tr>
<tr>
<td>Household NAFA (% GDP)</td>
<td>0.45% 0.35% 0.13%</td>
<td>0.009% -0.002% 0.000%</td>
<td>0.002% 0.002% 0.000%</td>
<td>0.008% 0.001% 0.000%</td>
</tr>
<tr>
<td>Firms' NAFA (% GDP)</td>
<td>10.64% 10.20% 9.84%</td>
<td>0.009% -0.005% 0.001%</td>
<td>-0.002% -0.015% -0.015%</td>
<td>0.008% -0.003% 0.000%</td>
</tr>
<tr>
<td>Government Deficit (% GDP)</td>
<td>-12.92% -12.93% -13.20%</td>
<td>-0.065% -0.061% -0.055%</td>
<td>0.000% -0.007% 0.002%</td>
<td>0.027% 0.015% 0.015%</td>
</tr>
<tr>
<td>(-) CAB vs other regions (% GDP)</td>
<td>0.58% 1.28% 2.32%</td>
<td>-0.042% -0.057% -0.044%</td>
<td>-0.028% -0.025% -0.020%</td>
<td>-0.036% -0.028% -0.022%</td>
</tr>
<tr>
<td>Variable</td>
<td>Baseline</td>
<td>Scenario I: Deficit-financed expenditure</td>
<td>Scenario II: Balanced-budget rule</td>
<td>Scenario III: Increasing growth in world demand</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>-----------------------------------------</td>
<td>----------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>(-) CAB vs rest of the world (%GDP)</td>
<td>1.25% 1.10% 0.92%</td>
<td>-0.004% -0.010% -0.009%</td>
<td>0.000% 0.005% 0.007%</td>
<td>0.078% 0.040% 0.037%</td>
</tr>
<tr>
<td>Real wages</td>
<td>41.6 42.3 45.2</td>
<td>44.5 21.6 29.8</td>
<td>35.4 17.4 24.7</td>
<td>37.6 8.4 15.3</td>
</tr>
<tr>
<td>Productivity</td>
<td>56.5 57.1 58.3</td>
<td>0.015 0.025 0.028</td>
<td>0.012 0.019 0.024</td>
<td>0.013 0.013 0.014</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>18.0% 16.8% 12.5%</td>
<td>-0.0006 -0.0003 -0.0003</td>
<td>-0.0005 -0.0002 -0.0003</td>
<td>-0.0005 -0.0001 -0.0002</td>
</tr>
</tbody>
</table>

Notes: the first column of the Table displays the values for major endogenous variables in the Baseline (in real 2015 billion euro, or percent change). The rest of the Table reports the changes - relative to the baseline - in endogenous variables in Scenario I to V at 1, 5, and 15 periods after the shock (in real 2015 million euro, or percent change).
In this Section we will make use of the model developed above to perform economic policy Scenario Analysis. Before running the simulations, we shall underline once more that for this class of models, the validation is given not only by the ability to replicate the data, but also by the realism of out-of-sample dynamics. This implies that, although it may be better to use simpler models for short-term forecasting (such as VARs), these dynamic structural models are the only one able to describe the traverse toward medium-run equilibrium positions, thus providing a completely different tool for Policy Analysis. Moreover, the SFC approach enables to ascertain the effects of these policies on sectoral financial behaviour and balance sheet dynamics, which are usually not considered in standard SEM at the regional level.

The model is solved for the period 2001–2017, and we then project our exogenous variables up to 2034 in the future, assuming a stable growth path.

When building a baseline scenario, different strategies can be chosen. Notice that, in our case, the primary objective of the simulations presented here is not to forecast the economy by pinpointing the future short-term growth rates, but rather to explore the structural linkages between financial and real side of the economy in the short to the medium run for the region under analysis. This choice was primarily led by the fact that in 2020 Campagna has been hit – as the rest of the world – by the Covid19-Pandemic. This most certainly has affected aggregate behaviour, and time series will show structural breaks as more observations become available. As we do not have yet statistical information at the regional level related to the Pandemic period, we found it sensible to run simulation exercises not including the Covid-shock.

We simulate four different Scenarios, comparing the effects of distinct exogenous shocks on the regional economy over the medium run.

**FIGURE 4**  GDP and demand components  Notes: The Figure reports Real GDP (r.h.s.) and demand components in real terms. Million euro, differences with respect to baseline. Scenario I to IV
To begin with, we test the effects of different fiscal shocks. In Scenario I, we simulate the impact of a deficit-financed expansion of Government expenditure equal to 1% of GDP. In Scenario II, instead, to ascertain the effects of a balanced-budget rule for the Government sector, the same increase in expenditure is accompanied by an increase in the indirect tax rate on private sector production, so that the Net Lending of the Government (e.g., its deficit) goes to zero.

We then pass to standard external shocks. In Scenario III, we increase the growth in the level of world demand, while, in Scenario IV we simulate the effect of a credit crunch, i.e., a 1% increase in interest rates on private sector borrowing. Table 4 summarizes the overall results, alongside the baseline. Figures 4 to 7 detail the outcomes of the simulations. More specifically, Figure 4 shows the effects of the four exogenous shocks on the components of demand; Figure 5 displays the effects of the shocks on Financial Balances, i.e., the aggregate net lending/borrowing positions – relative to GDP; Figure 6 presents the evolution of financial stocks in private sector balance sheet; Figure 7 shows the dynamics in labour market, for the four simulation scenarios.

5.1 | Deficit-financed expansion

In Scenario I we permanently increase government expenditures by 1% of GDP, equal to 107 million euro. The increase in spending leads to an immediate increase in nominal GDP of 108 million – with a short-run multiplier just above 1 – which translates in an increase in growth rate equal to 0.1%, compared to baseline, driven by rising private sector output. As functional distribution does not change, and government does not increase tax rates on
production, the increased spending immediately pushes private sector wages and profits, with revenue from production increasing in the following periods due to rising economic activity.

In the first year following the shock, the increase in household income leads to higher consumption, while firms accumulate all their extra-profits. The private sector financial surplus initially increases household wealth, which is also assumed to be a collateral for mortgages, so that the demand for mortgages also increases, while firms initially reduce their debt burden (i.e., extinguish their loans).

The current account balance towards both other regions and the rest of the world immediately deteriorates, as the demand for exports coming from the rest of the world does not change, while imports – from both other regions and the rest of the world – increase, due to the higher private sector final demand.

Notice also that the increase in spending generates a twin deficit: as the regional government deficit is financed by the central authority, the current account balance against other regions deteriorates, with the private sector returning to balance over the medium-run.

When households and firms start to invest the CAB further deteriorates, pushing GDP down in the following years. As household investment increase, their financial position turns negative, as they continue to accumulate mortgage debts, which further increases their interest burden. Notice that to every increase in net interest paid corresponds a higher current account deficit towards other regions, which also contributes to reduce domestic output. By the end of our simulation sample, however, household net wealth is higher than in the baseline, due to the robust increase in monetary holdings and other financial assets, which more than compensate the increase in liabilities.

Firms, in turn, start to accumulate financial assets, increasing their real financial wealth with respect to the baseline. The higher private sector holdings of financial assets imply higher payments from other regions to domestic

---

**FIGURE 6**  Private sector Balance sheets  Notes: The Figure reports private sector balance sheet. Million euro, differences with respect to baseline. Scenario I to IV
sectors, so that the CAB starts to recover somewhat after 3 periods. As private sector incomes increase, moreover, the government deficit starts to fall, due to higher revenues from taxes on wages and profit.

The increase in economic activity boosts wages, and productivity, while the effect on employment is relatively small\(^\text{38}\) (Figure 7, upper-left quadrant).

By the end of the simulation sample, the increase in spending led to an increase in nominal GDP of 76.6 million euro – with a medium-run multiplier of 0.71.

Notice that, for this class of demand-led models, when simulating increases in single components of demand results are symmetric, meaning that carrying on the same exercise – decreasing instead government spending – would generate the same results with inverted signs. Thus, decreasing spending will lead to a short-run decrease in GDP equal to the change in spending (as the impact multiplier is just above 1), and a 0.71 negative change in the medium-run.

5.2 Balanced-budget rule

In Scenario II we ascertain the effects of a balanced-budget rule for the Government sector. Contrary to Scenario I, in this case the same increase in expenditure of 1% of GDP is accompanied by an increase in the indirect tax rate on private sector production, so that the Net Lending of the Government (e.g., its deficit) goes to zero in the year of the shock.
Figure 5 (in the upper-right quadrant) shows that the net lending of the public sector is nihil in the first year, goes slightly negative in the following four periods and then starts to fall, producing a budget surplus by the end of the sample.

The increase in spending leads here to an immediate increase in nominal GDP of 86 million – with a short-run multiplier of 0.8 – which translates in an increase in the growth rate equal to 0.08%, compared to the baseline, driven again by rising private sector output and government expenditures.

Contrary to Scenario I, however, as the government levies higher taxes on production, this reduces profits of households and firms, while wages increase – with respect to the baseline – but less than in Scenario I. As household wages increase more than the fall in their profits, consumption increases in the first period, followed by housing investment. In subsequent years, both consumption and housing investment fall with respect to baseline, because of the higher tax rate, and recover only after 6 and 15 periods, respectively. To protect their purchasing power, households initially sell financial assets and use their monetary deposits – whose stock slightly fall relative to baseline. Demand for mortgage loans follows the dynamics of housing investment.

As for the following periods, the effects of the shock on the household sector and on the labour market are similar to Scenario I, although everything is scaled down, as the impact on incomes is lower due to the fall in profits.

Households’ net financial wealth increases, as the lower investment – relative to the baseline – implies a lower demand for loans, which indeed turns negative five periods after the shock. The positive net lending translates into higher demand for deposits and financial assets, whose stocks rise, leading to higher interest receipts, that further reduce the decline in income in the following periods.

Firms face a permanent drop in their profits. In the first year following the shock, part of the fall in profits generates a permanent reduction of their investment – which stays below the baseline level throughout the simulation horizon. The rest of the fall translates into a financial deficit: firms sell their financial assets, to reduce the impact on incomes, and increase their demand for loans. The increase in debt continues in the following periods, implying higher interest payments on their loans which are not counterbalanced by receipts on assets.

The increase in economic activity leads to a deterioration of the current account balance toward other regions, pumped also by higher financial payments from firms, while the CAB against the rest of the world improves, as imports fall due to the lower firms’ investment (which drastically reduce non-housing private sector final demand).

As shown in Figures 4–7 and Table 4, in Scenario II the “second twin” is represented by the private (corporate) sector: as the government balances its budget, the CAB deficit is matched by a decline in the financial position of the private (corporate) sector, which increases its indebtedness towards other regions and reduces its reliance on foreign products. By the end of the simulation sample, nominal GDP is 65.1 million above the baseline, with a medium-run multiplier of 0.6.

### 5.3 Scenario III: Increasing world demand

In Scenario III we increase the growth rate of world demand by one percent with respect to the baseline. This implies an increase in exports equal to 90.4 million on impact, which generates an increase in nominal GDP relative to baseline of 91.9 million, with a multiplier of 1.02. By the end of the simulation sample, exports and GDP are 54.1 and 40.2 million above the baseline respectively, implying a medium-run export multiplier of 0.73. The rate of growth in GDP eventually stabilises at 0.07% more than in the baseline by the end of the simulation.

The increased domestic output generates higher incomes for the private sector, so that household consumption rises, followed by housing and firms’ investment in following periods. Imports from other regions respond to rising economic activity, but the net effect on the overall current account balance is positive, due to the fall in net imports from the rest of the world. Private sector net wealth rises significantly, as the increase in loans is more than offset by the surge in monetary holdings and the accumulation of other financial assets. Finally, the increase in output generates a sustained increase in productivity and a timid one in wages, which brings a small reduction in the unemployment rate.
5.4 | Scenario IV: Interest rate shock

As we said, in our last simulation exercise we check how the regional economy responds to an exogenous shock in the cost of borrowing for households and firms. To do so we impose a 100b.p. increase in the interest rates on mortgages, consumer credit, and loans to firms.

Figure 7 reports the effect of the shocks on the labour market, for our four Scenarios.

As expected, the interest rate hike generates a recession in the short run.

The immediate drop in consumption (of 26.7 million) brings down imports from both other regions (−10.1) and the foreign sector (−2.9), so that the reduction in nominal GDP is only of 13.6 million.

In the following periods also the other components of demand start to fall, especially housing investment, which peaks (downwards) three years after the shock and recovers somewhat afterwards. As interest rates rise, the private sector diverts its funds away from investment and asset accumulation towards consumption expenditures, while using the remaining funds to reimburse debts. In particular, the large drop in housing investment strongly reduces the demand for mortgages, whose stock collapse. The recession causes a strong and permanent reduction in wages and productivity, and a slight increase in the unemployment rate. By the end of the sample, GDP is still growing 0.01% less than in the baseline.

This suggests that in the case of exogenous shocks to the cost of borrowing, the public authority should intervene to sustain investment, providing transfers/tax reductions for the private sector.

6 | CONCLUSION

The debate on the North–South economic divide has been widely discussed by the literature. Recently, the public debate focused again on the role of Mezzogiorno in shaping the economic recovery, through the implementation of a set of policy interventions aimed at strengthening the economic growth of the Southern regions and at reducing the chronic gap with the Centre-North.

In this line, regional models stand as a noteworthy analytical tool for evaluating the effectiveness and impact of national (or local) policies in enhancing economic growth in a specific area. Even though there is a large literature of empirical works in the neo-classical and New-Keynesian tradition – either SEM or IO models, with varying degrees of sophistication – in these models the financial sector is usually left apart.

The financial sector, and its interconnections with the real economy are instead central to the Stock Flow Consistent (SFC) approach, which integrates a post-Keynesian analysis of real markets with flow-of-funds analysis of balance sheets, and a Tobin-esque approach to portfolio allocation. However, there has not been any attempt yet to develop a regional model adopting the SFC approach.

In the present work we provided the first SFC macro-econometric regional model, which represents the opening building block of this literature. We developed a five-sector structural SFC model of Campania – the largest region of Italy’s Mezzogiorno – using data from ISTAT and the Bank of Italy relative to flows of incomes and expenditures, and stocks of financial assets and liabilities. The model is made of 66 equations, twelve of which are estimated over annual data for the period 1995–2018.

We provided a useful methodology to close the financial accounts for which data is unavailable and keep the accounting consistent. The model links the investment and saving decision of the institutional sectors to their balance sheets, and describes how this wealth is allocated, within each sector and across the different assets.

We performed four simulation exercises, to analyse how the model reacts to different fiscal (deficit-spending and balanced-budget) and exogenous shocks (world demand and interest rates). In Scenario I, we found that increasing government expenditures through a deficit financed expansion has a short-run multiplier of 1 and generates an increase in medium-run real GDP of 0.71, fifteen periods from the shock. Conversely, in Scenario II we checked how a balanced-budget rule for the regional public authority changes the result above, so that in this case, the higher
expenditures are accompanied by an increase in the indirect tax rate. While the effect on GDP is only slightly lower than in Scenario 1 – with a short run multiplier of 0.8 and a medium run one equal to 0.6 – the distributional impact is completely different. The higher taxes on production generate a fall in the profit share, so that firms’ investment permanently fall relative to baseline, while there is a surge in corporate indebtedness, which further deteriorates the current account balance.

In Scenario III, we analysed the effects in changes in world demand on the regional economy. As expected, the increase in exports to the rest of the world leads to an increase in the growth of real GDP in both the short-run and medium-run, which leads to a sustained rise in private sector financial wealth. Finally, in Scenario IV we checked how the model responds to changes in financing conditions for private sector borrowing. We found that increasing interest rates on private sector loans has recessionary short-run effects, largely due to the collapse of housing investment. As aggregate demand recovers so does the growth in real GDP, which however remains lower than the baseline level throughout the simulation horizon. This suggests that the public authority should intervene to sustain investment, providing transfers/tax reductions for the private sector.

Although simpler in its structure relative to other empirical SFC models – which however deal with whole countries – this work is the first example in this literature for analysing economic trends at the regional level, sophisticated enough to address the impact of diverse policy questions and perform different medium-run macroeconomic policy scenario analysis. Moreover, the structure of the model can be easily enlarged – or stretched – to include new blocks (the production block, a more sophisticated labour market, but also an “environment” block), provided one keeps the accounting consistent, and respects the principles of the SFC approach.

The model allows to treat the real and the financial sides of the economy in an integrated way - properly accounting for their interdependencies - and assess the impact of demand developments on growth. The approach proposed here has never been adopted at regional level and adds dynamics and an active role for the financial sector to classical large-scale econometric models. The main limitation of the work is represented by the lack of available financial data, which prevent us to build a more complete balance sheet. More accurate data regarding the financial stocks of the private sector at the territorial level, as well as non-financial accounts for every institutional sector, would greatly help to enrich the detail of this class of models.

A promising avenue in this sense would be to integrate the data from Bank of Italy relative to the Household Wealth Survey at the territorial level, which however are not publicly available.

Finally, the model would benefit from longer time-series, which would make possible to adopt more advanced econometric techniques to estimate behavioural equations.

ACKNOWLEDGMENT
Open Access Funding provided by Universita degli Studi di Roma La Sapienza within the CRUI-CARE Agreement. [Correction added on 18 May 2022, after first online publication: CRUI funding statement has been added.]

ORCID
Riccardo Realfonzo https://orcid.org/0000-0003-3773-4545
Francesco Zezza https://orcid.org/0000-0001-7469-7611

ENDNOTES
2 Special Economic Zone (SEZ) are a widespread instrument adopted by public authorities to boost economic development in particular areas (Akinci & Crittle, 2008; Ambroziak & Hartwell, 2018; Crane et al., 2018; Jensen, 2017; Wang, 2013; Zeng, 2016). The model presented here – which is a simplified version of the one presented in Canelli et al. (2021) – was originally developed to analyse the effects of the implementation of a SEZ in the Campania, and to simulate the effects on the regional private sector of the implementation of economic policies by the Public Administrations.
3 As intended by Lucas (1976).
4 See Smets and Wouters (2007).
5 See, among many, Brayton, Laubach, and Reifschneider (2014), Bulligan et al. (2017), and Zezza and Zezza (2020).
6 For a comprehensive survey of the SFC literature, see Nikiforos and Zezza (2017) and Caverzasi and Godin (2015).
7 See Cripps, Godley, and Fetherston (1976), and Godley and Cripps (1974, 1983).
8 See Backus, Brainard, Smith, and Tobin (1969) Brainard and Tobin (1968) and Tobin (1969, 1982).
9 The SFC approach has indeed been used to cover a broad variety of theoretical issues in post-Keynesian economics: an early SFC perspective on financialization is in Lavoie (2008) and a recent one is in Gitme, Lagoso-Setog, and Reyez-Ortiz (2019), while Sawyer and Veronese Passarella (2017) focus on monetary circuits; Dos Santos and Zezza (2008) discuss income and wealth distribution in the context of a Kaleckian growth model while Mandarino and Dos Santos (2020) use instead a Sraffian super-multiplier model; Dafermos, Nikolaidi, and Galanis (2017) and Carnevali, Deleidi, Pariboni, and Veronese Passarella (2020) provide applications for a SFC approach to ecological economics; finally, another rich line of research uses the SFC principles to build Agent-Based simulation models: see, among many, Caiani et al. (2016).
12 “In contrast to neo-classical economics, [in SFC models] the adjustment processes towards the steady state will be based on simple reaction functions to disequilibria. [...] Still agents in our models are rational: they display a kind of procedural rationality. [...] They 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, p. 16, 2007).
13 See Lavoie (2014).
14 Recalling that, for both the Transactions and the Balance-sheets matrices, the last identity is implied by all others, and thus needs to be dropped to avoid over-determination. This is the so-called “redundant equality”.
15 For a review of regional CGE models, see Partridge and Rickman (2010). For I-O models, see Miller and Blair (2009).
16 The last release of the SVIMEZ bi-regional model (NMODS) has some financial variables which enter their estimations – for example, net wealth in the household’s consumption function. The difference with the approach proposed here lies in the absence, in NMODS, of the equations describing the accumulation of real and financial stocks and of the intrinsic dynamic given by stock-flow adjustments.
17 As in most cases, these are models where expectations are model consistent, so that the choices of consumption and investment turn out to be always correct.
18 See Zezza and Zezza (2019) for a detailed account on the construction of empirical Stock-Flow Consistent models for whole countries, starting from national accounts, flow of funds and sectoral financial accounts statistics.
19 The subscripts h, f, g, or, and w denote households, firms, government, other regions, and the rest of the world, respectively.
21 As in Albareto, Bronzini, Carmignani, and Venturini (2008), we use national data for capital stocks and project the sectoral series as fixed shares of regional GDP.
22 Which is set to be twice the deposits, as in Financial Accounts.
23 The most complex empirical SFC model to date is the one presented in Zezza and Zezza (2020), who build a quarterly model of the Italian Economy with six sectors (households, firms, banks, government, the central bank, and the foreign sector) and 15 classes of financial assets.
24 We are leaving out some twenty identities from the description. The complete list of model equations is given in Appendix III.
25 In this first version of the model, we chose not to model relative prices. The choice was led, primarily, by the strong differences in behaviour between the deflators for consumption, investment, and public expenditures between regional and national data, which is probably due to poor data quality. Secondly, from the full introduction of the euro in 2001, the whole country experienced 20 consecutive years of low (and falling) inflation: for Campania, the decline was from 2.7 in 2001 to just above 1% in 2018, reaching a record low of 0.4 in 2014.
26 (disc_{h}^{int}) and (disc_{f}^{int}) are small exogenous variables which link our model variables – computed from the BSM in eqs. 15 and 16 – to the official measures published in Istat territorial accounts.
27 Since we do not have regional financial statistics relative to “other financial assets”, we use the data from FAIS to compute the shares of Bonds (ratio_{h}^{B}) and foreign assets (ratio_{f}^{C}) in households’ portfolio. Notice that in FAIS Bonds and
foreign assets represent more than 60% of total households’ financial assets, the rest being domestic equities of firms, and bank shares and debt instruments.

28 Dividends and other capital incomes – paid and received – are left exogenous.

29 Namely, the sum of wages, profits, and net capital incomes.

30 We assume that the share of retired people in the regional population is the same as in the rest of country.

31 There is a potential endogeneity problem for $YD_t$. However, a VECM specification with the same variables suggests only one cointegrating vector with similar coefficients for the equation for $C$. The current specification is coherent with the Engle-Granger approach to cointegration, since the residuals are stationary, passing the test reported in Enders, Applied econometric time series (4th ed.) supplementary manual, Table C.

32 See (Lavoie, chap. 4.6, 2014).

33 Namely, the sum of wages, profits, and net capital incomes.

34 We found, as in (Zezza & Zezza, 2020), a positive relation with the interest rate on consumer credit, which may imply the existence of Ponzi schemes.

35 Appendix II discusses the validation of the model against historical data.

36 The baseline scenario relies on a few important assumptions. i) We let all interest rates in the model to remain constant, using their values for 2017. ii) We set the (change) in the level of world demand at 9% per-year, slightly lower than the mean for the period 1995–2017 (equal to 9.9). iii) We set the growth in nominal GDP for other regions at 1% per-year. iv) We set government expenditures, investment, VA, and public wages to grow at 1% per year. v) We let all tax rates to remain constant, using their values for 2017. vi) due to demographic situation in Italy, population is expected to decrease at 0.1% per year, while the number of retired grows at 0.1%. These assumptions imply a rate of growth in nominal GDP and prices which stabilise around 0.9 and 0.4%, respectively.

37 Notice that all simulation results are presented compared to the baseline. All shocks are applied on the first year of the projection sample, i.e., 2018.

38 This result is common in all simulation. This is partly explained by the fact that the unemployment rate is already decreasing in our baseline, as it is converging to a long-run level of 12%, which is consistent with recent estimates of NAWRU for southern Italian regions. Moreover, several studies confirm that employment in Mezzogiorno does not respond strongly to demand policies, as the labour market is characterized by a large (and growing) share of part-time workers, low female employment, and a large share of inactivity in the working age population (which averaged 46% between 2014 and 2019).

39 For a description of the model, see (Paniccià et al., 2000).

40 http://lnx.svimez.info/svimez/il-rapporto/.

41 For a description of the model – developed alongside the research department of Bank of Italy – see (Damiani et al., 1987).

42 See (Guagnini & Nobile, 2008).


44 See (Mastrorocco & Calò, 2016) and Gori and Paniccià (2015).

45 See https://www.centroeuroparicerche.it/attivita/competenze-e-aree-di-ricerca/macroeconomia-e-finanza-pubblica/


47 For a review of regional Input Output tables see Ferrara (1978) and Costa and Martellato (1987).

48 See (Paniccià & Rosignoli, 2018).

REFERENCES


SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.


APPENDIX I: LARGE-SCALE MODELS OF ITALIAN REGIONS

In this section, we briefly present the regional models currently in use in Italy at both government and academic institutions, focusing only on empirical works. The review starts by looking at dynamic structural models – which more closely resemble the model proposed in this work – and then move on to a brief account of the major static models.

We open this brief review mentioning the bi-regional model developed by SVIMEZ, the Italian research centre for Industrial development in Mezzogiorno – the NMODS – which is used to perform their short- and medium-run forecasts, systematized annually in the Rapporto sull’economia del Mezzogiorno. The model is the result of the research started in the 1960s with the work of Sylos Labini and later continued by SVIMEZ, which led to the creation of the first bi-regional econometric model of the Italian Economy. It is currently used to provide forecasts on the evolution of the main economic variables, as well as to assess the impact of economic policy interventions on the two partitions in which the Italian economy is articulated – taking into account the different mechanisms governing their evolution.
The NMODS is a New-Keynesian structural model where supply determines long-term growth, while demand effects are exhausted in the short term. The model consists of five distinct blocks of equations, which describe the determination – for each macro-area – of: prices, supply and value added, components of aggregate demand and distribution of income, wages and employment, and, finally, the trade block. Moreover, to increase the interpretative capacity of its scenario analysis, SVIMEZ has also estimated the Public Sector accounts for all Italian regions – consistently with the indications coming from the EU for the computation of public sector fiscal balances.

There are also several mono-regional models. The Multi-Sectoral Model (MMS) developed by Prometeia is the most widely used by the Italian regions. The MMS offers a rather complex representation of the functioning of a regional economy and can be applied to carry out different types of analyses. It allows monitoring the regional economic trend, performing medium-long term simulations, and evaluating the impact of public policies. The model has reached the 4.0 version, characterised by higher level of disaggregation, made possible by the availability of more detailed regional information (time series and I-O tables).

Starting from southern regions, the first contribution we find is represented by the Multi-Sectoral Model of the Sicilian region. The model, originally developed for the impact assessment of POR funds for the period 2000–2006, is still used for macro-economic forecasts and as an analysis tool to simulate the impacts of policy choices from the Statistical Service of the Regional Administration board. A similar approach was adopted by the Department of Economics and Statistics of the University of Calabria, which developed the MOMACAL model. The latter presents a multi-equational and multi-sectoral structure that allows accounting for theoretical elements of both neo-Keynesian and neoclassical inspiration. The model assesses the effects of structural and cohesion funds on the regional economic system.

Following a similar pattern, the Autonomous Province of Trento set up the Econometric Multi-sectoral Model of Trentino (MEMT) that integrates the econometric approach based on time series analysis with the intersectoral approach based on I-O (Podestà, 2010). Traditionally, in these dynamic models, the components of final demand are determined by means of econometric equations estimated on the historical series of national accounts, while the levels of production and added value are calculated by applying an input–output table of the economy to the levels of final demand. The model is made up of more than 100 stochastic equations and over 400 identities, which allow replicating the dynamic characteristics of the local system. It provides a disaggregation of production activities into 19 branches (one for agriculture and construction, eight branches of industry and nine of public and private services). Household consumption expenditures are divided into six expenditure items, as well as disposable income of household accounts for six components. MEMT is used to outline short-medium term predictive scenarios concerning the main economic variables of the province of Trento, and to develop medium-term forecast scenarios, evaluating the consequences of economic policies implemented at local level.

We also have to mention the Remi-IRPET macroeconometric multi-sectoral model - a dynamic approach based on an input–output core structure developed for assessing the macro-economic effects and the medium-long term impacts of public policies. It was used, among others, by Apulia and Tuscany regions.

Another tool is represented by the Italian macroeconometric model developed by the Centro Europa Ricerche (CER). It is a medium-term policy-oriented model, built on annual time series. The model is made up of 470 variables (400 endogenous and 70 exogenous): 60 endogenous variables are estimated using behavioural equations while the rest is determined through accounting identities. The structure of the model resembles the national accounts. It includes three sectors (private, public, and foreign sector) and consists of seven blocks of equations, namely (1) consumption, savings and wealth of households, (2) production and demand factors, (3) international trade, (4) labour market, (5) income, (6) public expenditures, and (7) interest rate. All the blocks are interconnected, allowing identifying the different economic policies transmission mechanisms and the effects of exogenous shocks on economic activity. The model gives prominence to the public expenditures block and incorporates a detailed territorial disaggregation, adopting a top-down estimation approach.

Next, we find the work of the Piemonte Institute of Social Economic Research (IRES), which has developed a large multi-sector model, starting from the NMODS developed by SVIMEZ. Mainly used for economic policy short-
term scenario analysis, the model is also utilized to perform analysis of the impacts of regional development strategies over the medium- and long-run. Made up of over 400 equation (with some 100 behavioural equations), the model is articulated in eight blocks and has been estimated on annual data from 1970 to 2006. Industrial production is disaggregated into sixteen different sectors of activity, while household consumption expenditure distinguishes eight spending categories, and the household disposable income account is divided into six components.

There are also several static models, mainly input–output models. It should be noticed that, despite the different growth path which characterizes the Italian regions, input–output modelling at regional and multiregional level has not found fertile ground in Italy, like in other European countries. While national I-O tables have been released on regular basis by the Italian national institution of statistics since the 50s, regional I-O tables were mostly built by regional research institutions or private associations and many of them were left without any type of maintenance or data updating for a long time. Nevertheless, the most prominent examples are represented by the models developed by the Institute for Regional Economic Planning of Toscana Region (IRPET) who has built several analytical tools in collaboration with Bank of Italy, SVIMEZ, and ISTAT. Among the main ones we find: the regional micro-simulation model (MicroReg) aimed at estimating the short-run effects of redistributive effects of public policies on the household sector; the Multi-Regional Input–Output (MIO) model with the variant according to the NUTS2 (MRSUT) classification; and the Multi-Regional and Multi-Country models developed with the Bank of Italy (MRMC-SUT and IRIC-IOT), used for public sector fiscal balances. Similarly, IRPET developed an input–output model together with the Autonomous Province of Trento, which represented the building block for the creation of the abovementioned MEMT. The model allows capturing the features of the local economic system disaggregating the productive system in 30 productive branches; household consumption expenditure is differentiated in twelve spending categories, while public administration expenditure is classified into ten main categories. It accounts for interregional and foreign trade, showing a strong propensity of the province to intra-industry trade.

We also have to mention the Social Accounting Matrices (SAM) approach. The SAM is a system of national or regional accounts in a matrix form, which represents a development of the Supply and Use Tables. In fact, it includes the inter-industry linkages and the transactions and transfers of income among different institutional sectors, namely households, firms, public sector and the rest of the world. The economic system is divided into seven blocks, which include: productive sectors; primary factors of production; households; corporate sector; government; gross capital formation; resti of the world. Each block can be further disaggregated, according to the aim of the analysis. The economic structure is represented by a matrix, made of rows and columns. It shows the aforementioned blocks as originators and recipients of the transaction flows that enclose the economic activity. The SAM allows considering the socioeconomic effects associated with production and consumption, which in turn determine changes in the distribution of income. The approach has been used, among others, for building a SAM for the economic region of Sardinia (Ferrari et al., 2009) and for evaluating the socio-economic impacts deriving from the oil royalty allocation on the economic regional development of Basilicata (Viccaro et al., 2015).

Finally, there is the spatial modeling developed by IRPET for evaluating territorial and infrastructure policies. It includes: the MOBI-IRPET model for the simulation of the regional transport system (IRPET, 2016); and the LUTI model for estimating the economic and territorial impacts of mobility policies, focusing on the relationship between the spatial distribution of socioeconomic activities and the transport system.

APPENDIX II: MODEL VALIDATION AGAINST HISTORICAL DATA

In this section we show how the model performs in replicating historical data for the simulation sample (2001–2017). Figure AII.1 reports how the model tracks the evolution of GDP (a) and the components of aggregate demand – i.e., households’ consumption (b) and investment in housing (c), firms’ investment (d), net imports from other regions (e) and the rest of the world (f), all expressed in real terms.
Figure A.II.2 reports the evolution in the variables related to labour market, namely, the unemployment rate (a), the average wage (b), the productivity level (c) and the GDP deflator, which corresponds to our price variable (d). As Figure (c) shows, the model overshoots in the first third of the sample, and undershoots in the following years up to 2010, where it aligns again to historical data.

Finally, Figure A.II.3 shows the evolution of the financial side of the model. Figure (A) display the net lending/borrowing position of the aggregated sectors, as percent of GDP. Figures (B) and (C) represent private wealth-to-GDP ratio and loans-to-GDP ratio, respectively.
FIGURE A.II.2 – Labour market. Model and historical values
 FIGURE A.II.3 – Financial markets. Model and historical values

APPENDIX III

Appendix III. A - List of Equation

Gross domestic product

\[ \text{GDP} = (C_h + h) + (l_f + \text{DINV}_f) + (G_g + I_g) - \text{NM}_{or} + E_w - M_w \]  \hfill (1)

Gross domestic product – real value

\[ \text{GDPK} = \frac{\text{GDP}}{p^{\text{gdp}}} \]  \hfill (2)

Value added

\[ \text{VA} = \text{GDP} - \text{NETTAX} \]  \hfill (3)

Net taxes

\[ \text{NETTAX} = \tau^{\text{nettax}} \cdot \text{GDP} \]  \hfill (4)
Value added of private sector

\[ VA_{pvt} = VA - VA_g \]  

Profits

\[ P = GDP - (W + NINDT_g) \]

Profits of firms

\[ P_f = P - P_h \]

Profits of households

\[ P_h = \text{ratio}_P^P \cdot P \]

Wages

\[ W = WAGEU \cdot EMP \]

Wages - private sector

\[ W_{pvt} = W - W_g \]

Total employment

\[ EMP = GDPK / PROD \]

Net indirect taxes - government

\[ NINDT_g = \tau_{\text{indt}} \cdot GDP \]

Household capital incomes paid

\[ KYP_h = INTP_h + TRKP_h \]

Interest paid by household

\[ INTP_h = r^{LC} \cdot LC_{h,t-1} + r^{LMO} \cdot LMO_{h,t-1} + \text{disc}_{hp} \]

Capital incomes received by household

\[ KYR_h = INTR_h + DIVR_h + TRKR_h \]
Interest received by households

\[ \text{INTR}_h = r^D \cdot D_{h,t-1} + r^B \cdot (\text{ratio}_h^B \cdot \text{OFA}_{h,t-1}) + r^F \cdot (\text{ratio}_h^F \cdot \text{OFA}_{h,t-1}) + \text{disc}_{h}^{\text{intr}} \] (16)

Interest received by firms

\[ \text{INTR}_f = r^D \cdot D_{f,t-1} \] (17)

Interest paid by firms

\[ \text{INTP}_t = r^F \cdot L_{f,t-1} \] (18)

Primary income: household

\[ \text{YP}_h = (W + P_h) + \text{KYR}_h - \text{KYP}_h \] (19)

Primary income: firms

\[ \text{YP}_f = P_f + \text{INTR}_f - \text{INTP}_t \] (20)

Primary income: other regions

\[ \text{YP}_{or} = \text{INTP}_h + \text{INTP}_f - (\text{KYR}_h + \text{INTR}_f) \] (21)

Direct tax on households’ primary income

\[ \text{INCTAX} = \tau_{h}^{\text{DT}} \cdot \text{YP}_{h,t-1} \] (22)

Direct tax on firms’ profits

\[ \text{DTAX} = \tau_{f}^{\text{DT}} \cdot P_{f,t-1} \] (23)

Social contributions

\[ \text{SOCCON} = \tau_{h}^{\text{SC}} \cdot (W + P_h) \] (24)

Pension payments

\[ \text{PENS} = \tau_{h}^{\text{PENS}} \cdot (\text{WAGEU}\cdot\text{RETIRED}) \] (25)

Disposable income: households

\[ \text{YD}_h = \text{YP}_h + \text{PENS} - (\text{SOCCON} + \text{INCTAX}) + \text{OCTN} \] (26)
Disposable income: firms

\[ YD_f = P_f + (\text{INTR}_f - \text{INT}_f) - \text{DTAX} \]  (27)

Disposable income: government

\[ YD_g = \text{NINDT}_g + (\text{INCTAX} + \text{DTAX} + \text{SOCCON}) - (\text{PENS} + \text{OCTN}) \]  (28)

Saving: households

\[ SAV_h = YD_h - C_h \]  (29)

Saving: government

\[ SAV_g = YD_g - G_g \]  (30)

Investment of firms – machinery

\[ I_f^m = I_f \cdot \text{ratio}_{f}^m \]  (31)

Investment of firms – non-residential construction

\[ I_f^n = I_f - I_f^m \]  (32)

Investment of government - non-residential construction

\[ I_g^n = I_g \cdot \text{ratio}_{g}^n \]  (33)

Investment of government – machinery

\[ I_g^m = I_g - I_g^n \]  (34)

Net lending position: households

\[ NL_h = SAV_h - I_h \]  (35)

Net lending position: firms

\[ NL_f = YD_f - (I_f + \text{DINV}_f) \]  (36)

Net lending position: private sector

\[ NL_{pvt} = NL_h + NL_f \]  (37)
Net lending position: government

\[ NL_g = YD_g - (G_g + I_g) \] \( (38) \)

Net lending position: rest of the world

\[ NL_w = M_w - X_w \] \( (39) \)

Net lending position: other regions

\[ NL_{or} = -(NL_h + NL_f + NL_g - NL_w) \] \( (40) \)

Stock of real capital: housing

\[ KH = KH_{t-1} + I_h - ccr_h \cdot KH_{t-1} \] \( (41) \)

Stock of real capital: non-residential construction

\[ KNR = KNR_{t-1} + I''_{nr} - ccr_{nr} \cdot KNR_{t-1} \] \( (42) \)

Stock of real capital: machinery

\[ KM = KM_{t-1} + I''_{m} - ccr_{m} \cdot KM_{t-1} \] \( (43) \)

Stock of real capital: public

\[ KG = KG_{t-1} + I_g - ccr_g \cdot KG_{t-1} \] \( (44) \)

Net wealth: households

\[ NW_h = NW_{h,t-1} + NL_h \] \( (45) \)

Net wealth: firms

\[ NW_f = NW_{f,t-1} + NL_f \] \( (46) \)

Net wealth: other regions

\[ NW_{or} = NW_{or,t-1} + NL_{or} + NL_g + NL_w \] \( (47) \)

Change in deposits: households

\[ \Delta(D_h) = ratio^D_h \cdot SAV_h \] \( (48) \)

Other financial assets: households

\[ OFA_h = NW_h - D_h + LMO + LC \] \( (49) \)
Change in deposits: firms

\[ \Delta(D_f) = \text{ratio}_f^D \cdot \text{WAGES} \] (50)

Other financial assets: firms

\[ OFA_f = NW_f - D_f + LF \] (51)

Unemployment

\[ UNEMP = \text{LABFORCE} - \text{EMP} \] (52)

Unemployment rate

\[ UR = \frac{UNEMP}{\text{LABFORCE}} \] (53)

Labour force

\[ \text{LABFORCE} = (1 - \text{PARTRATE}) \cdot \text{pop} \] (54)

Stochastic equations

Consumption

\[ C = f(YD_h; KH_{t-1} + NW_{ht-1}) \] (55)

Investment in housing

\[ \log \left( \frac{l_h}{KH_{t-1}} \right) = f \left( \log \left( \frac{YD_h}{KH_{t-1}} \right), r_L, \text{LMO} \right) \] (56)

Firm's investment

\[ \log \left( \frac{l_f}{KM_{t-1} + KNR_{t-1}} \right) = f \left( \log \left( \frac{YD_f}{KM_{t-1}} \right), \log \left( \frac{\Delta l_f}{KM_{t-1} + KNR_{t-1}} \right) \right) \] (57)

Firms' demand for loans

\[ \frac{\Delta(LF)}{GDP} = f \left( \frac{NL_f}{GDP}, \frac{LF}{GDP} \right) \] (58)

Demand for consumer credit

\[ \Delta \left( \frac{LC}{p_{\text{pop}}} \right) = f \left( \frac{C}{p_{\text{pop}}}, \frac{D_h + OFA_h}{p_{\text{pop}}}, \frac{\Delta C}{\Delta p_{\text{pop}}} \right) \] (59)
Households’ demand for mortgages

$$\frac{\Delta (LMO)}{YD_h} = f\left( \frac{l_h}{YD_h} ; \frac{\Delta (D_h + OFA_h)}{YD_h} ; \mu^{LMO} \right)$$  \hspace{1cm} (60)

Imports from the rest of the world

$$\log(M_w) = f(\log(GDP))$$  \hspace{1cm} (61)

Exports to the rest of the world

$$d\log(X_w) = f(\log(WD);d\log(WD))$$  \hspace{1cm} (62)

GDP deflator

$$\log(p^{pdp}) = f\left( \frac{WAGEU}{PROD} \right)$$  \hspace{1cm} (63)

Productivity level

$$PROD = f\left( \frac{VA_{prod}}{GDP}; \frac{WAGEU}{p^{pdp}} \right)$$  \hspace{1cm} (64)

Average wage

$$\log(WAGEU) = f(\log(p^{pdp});\log(UR);PARTRATE)$$  \hspace{1cm} (65)

Net imports from other Italian regions

$$NM_{or} = f\left( \frac{(C + I)}{GDP} ; \frac{GDP}{GDP_{or}} \right)$$  \hspace{1cm} (66)
### Appendix III. B – List of variables

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EMP</strong></td>
<td>Total employment</td>
</tr>
<tr>
<td><strong>$X_w$</strong></td>
<td>Exports to the rest of the world</td>
</tr>
<tr>
<td><strong>GDP</strong></td>
<td>Gross domestic product</td>
</tr>
<tr>
<td><strong>GDPK</strong></td>
<td>Gross domestic product – real</td>
</tr>
<tr>
<td><strong>$I_{g}^m$</strong></td>
<td>Government investment – machinery</td>
</tr>
<tr>
<td><strong>$I_{g}^{nr}$</strong></td>
<td>Government investment - non-residential construction</td>
</tr>
<tr>
<td><strong>$NL_g$</strong></td>
<td>Net lending – government</td>
</tr>
<tr>
<td><strong>SAV_g</strong></td>
<td>Savings - government</td>
</tr>
<tr>
<td><strong>$YD_f$</strong></td>
<td>Disposable income – government</td>
</tr>
<tr>
<td><strong>LC</strong></td>
<td>Stock of consumer loans</td>
</tr>
<tr>
<td><strong>LMO</strong></td>
<td>Stock of mortgage loans</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Consumption</td>
</tr>
<tr>
<td><strong>$D_h$</strong></td>
<td>Stock of monetary deposits of households</td>
</tr>
<tr>
<td><strong>$I_h$</strong></td>
<td>Investment of households</td>
</tr>
<tr>
<td><strong>INCTAX</strong></td>
<td>Direct tax – households</td>
</tr>
<tr>
<td><strong>$INT_P_h$</strong></td>
<td>Interest paid by households</td>
</tr>
<tr>
<td><strong>$INT_R_h$</strong></td>
<td>Interest received by households</td>
</tr>
<tr>
<td><strong>$KYP_h$</strong></td>
<td>Capital incomes paid by households</td>
</tr>
<tr>
<td><strong>$KYR_h$</strong></td>
<td>Capital incomes received by households</td>
</tr>
<tr>
<td><strong>$NL_h$</strong></td>
<td>Net lending – households</td>
</tr>
<tr>
<td><strong>$NW_h$</strong></td>
<td>Net wealth – households</td>
</tr>
<tr>
<td><strong>$OFA_h$</strong></td>
<td>Stock of other financial assets – households</td>
</tr>
<tr>
<td><strong>$P_h$</strong></td>
<td>Profits of households</td>
</tr>
<tr>
<td><strong>PENS</strong></td>
<td>Pensions</td>
</tr>
<tr>
<td><strong>$SAV_h$</strong></td>
<td>Savings – households</td>
</tr>
<tr>
<td><strong>SOCCON</strong></td>
<td>Social contributions</td>
</tr>
<tr>
<td><strong>$YD_h$</strong></td>
<td>Disposable income – households</td>
</tr>
<tr>
<td><strong>$YP_h$</strong></td>
<td>Primary income – households</td>
</tr>
<tr>
<td><strong>$M_w$</strong></td>
<td>Imports from the rest of the world</td>
</tr>
<tr>
<td><strong>KG</strong></td>
<td>Stock of real capital – public</td>
</tr>
<tr>
<td><strong>KH</strong></td>
<td>Stock of real capital – real estate</td>
</tr>
<tr>
<td><strong>KM</strong></td>
<td>Stock of real capital – machinery</td>
</tr>
<tr>
<td><strong>$KNR$</strong></td>
<td>Stock of real capital – non-residential construction</td>
</tr>
<tr>
<td><strong>LABFORCE</strong></td>
<td>Labour force</td>
</tr>
<tr>
<td><strong>NM_{or}</strong></td>
<td>Net imports from other Italian regions</td>
</tr>
<tr>
<td><strong>NETTAX</strong></td>
<td>Taxes net of subsidies</td>
</tr>
<tr>
<td><strong>$LF_f$</strong></td>
<td>Stock of loans to firms</td>
</tr>
<tr>
<td><strong>$D_f$</strong></td>
<td>Stock of monetary deposits of firms</td>
</tr>
<tr>
<td>VARIABLE</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td>DTAX</td>
<td>Direct tax – firms</td>
</tr>
<tr>
<td>(I_f)</td>
<td>Total investment of firms</td>
</tr>
<tr>
<td>(I^m_f)</td>
<td>Investment of firms – machinery</td>
</tr>
<tr>
<td>(I^n_f)</td>
<td>Investment of firms - non-residential construction</td>
</tr>
<tr>
<td>INT(P_f)</td>
<td>Interest paid by firms</td>
</tr>
<tr>
<td>INT(R_f)</td>
<td>Interest received by firms</td>
</tr>
<tr>
<td>(NL_f)</td>
<td>Net lending – firms</td>
</tr>
<tr>
<td>(NW_f)</td>
<td>Net wealth – firms</td>
</tr>
<tr>
<td>OFA(f)</td>
<td>Stock of other financial assets – firms</td>
</tr>
<tr>
<td>(P_f)</td>
<td>Profits of firms</td>
</tr>
<tr>
<td>(YD_f)</td>
<td>Disposable income of firms</td>
</tr>
<tr>
<td>(YP_f)</td>
<td>Primary income of firms</td>
</tr>
<tr>
<td>(P)</td>
<td>Total profits</td>
</tr>
<tr>
<td>(NL_{or})</td>
<td>Net lending – other regions</td>
</tr>
<tr>
<td>(NW_{or})</td>
<td>Net wealth – other regions</td>
</tr>
<tr>
<td>(YP_{or})</td>
<td>Primary income of other regions</td>
</tr>
<tr>
<td>(p_{gdp})</td>
<td>GDP deflator</td>
</tr>
<tr>
<td>PROD</td>
<td>Productivity</td>
</tr>
<tr>
<td>(NL_{pvt})</td>
<td>Net lending – private sector</td>
</tr>
<tr>
<td>VA(_{pvt})</td>
<td>Value added – private sector</td>
</tr>
<tr>
<td>W(_{pvt})</td>
<td>Wages – private sector</td>
</tr>
<tr>
<td>(NL_w)</td>
<td>Net lending – rest of the world</td>
</tr>
<tr>
<td>UNEMP</td>
<td>Unemployment</td>
</tr>
<tr>
<td>UR</td>
<td>Unemployment rate</td>
</tr>
<tr>
<td>VA</td>
<td>Value added</td>
</tr>
<tr>
<td>W</td>
<td>Wages</td>
</tr>
<tr>
<td>WAGEU</td>
<td>Average wage</td>
</tr>
</tbody>
</table>

Exogenous

<p>| (ccr_g) | Cost of capital replacing – public |
| (ccr_h) | Cost of capital replacing - real estate |
| (ccr_m) | Cost of capital replacing – machinery |
| (ccr_{or}) | Cost of capital replacing - non-residential construction |
| disc(<em>{inta}) | Discrepancy on interest paid by household |
| disc(</em>{intr}) | Discrepancy on interest received by household |
| GDP_{or} | GDP – other regions |
| (G_g) | Government expenditure |
| (l_g) | Government investment |
| VA(_g) | Value added – government |
| W(_g) | Wages – public sector |
| DIV(_h) | Dividends – households |
| OCT(N) | Other net current transfers – households |</p>
<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRKPh</td>
<td>Transactions in capital account paid by households</td>
</tr>
<tr>
<td>TRKRh</td>
<td>Transactions in capital account received by households</td>
</tr>
<tr>
<td>rLC</td>
<td>Interest rate on consumer credit</td>
</tr>
<tr>
<td>rLF</td>
<td>Interest rate on loans of firms</td>
</tr>
<tr>
<td>rLMO</td>
<td>Interest rate on mortgages</td>
</tr>
<tr>
<td>rB</td>
<td>Interest rate on bonds</td>
</tr>
<tr>
<td>rD</td>
<td>Interest rate on deposits</td>
</tr>
<tr>
<td>rF</td>
<td>Interest rate on foreign assets</td>
</tr>
<tr>
<td>WD</td>
<td>World demand</td>
</tr>
<tr>
<td>DINVf</td>
<td>Inventories</td>
</tr>
<tr>
<td>PARTRATE</td>
<td>Participation rate in the labour force</td>
</tr>
<tr>
<td>pop</td>
<td>Population</td>
</tr>
<tr>
<td>ratioBph</td>
<td>Share of Bonds in household portfolio</td>
</tr>
<tr>
<td>ratioFph</td>
<td>Share of Foreign assets in household portfolio</td>
</tr>
<tr>
<td>ratioinfrh</td>
<td>Share of government investment in infrastructures</td>
</tr>
<tr>
<td>ratioImh</td>
<td>Share of firms investment in machinery</td>
</tr>
<tr>
<td>ratioDh</td>
<td>Share of deposits in household savings</td>
</tr>
<tr>
<td>ratioDfh</td>
<td>Share of firms deposits</td>
</tr>
<tr>
<td>ratioPh</td>
<td>Share of household profits</td>
</tr>
<tr>
<td>RETIRED</td>
<td>Retired people</td>
</tr>
<tr>
<td>fnettax</td>
<td>Average tax rate on taxes net of subsidies</td>
</tr>
<tr>
<td>findt</td>
<td>Average tax rate on indirect taxes</td>
</tr>
<tr>
<td>fPENS</td>
<td>Average pension payment</td>
</tr>
<tr>
<td>fSC</td>
<td>Average social contribution</td>
</tr>
<tr>
<td>fDT</td>
<td>Average direct tax rates on household income</td>
</tr>
<tr>
<td>fDF</td>
<td>Average direct tax rate on firms profits</td>
</tr>
</tbody>
</table>