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Energy crisis, economic growth and public finance in Italy

Rosa Canelli[a,*], Giuseppe Fontana[a,b], Riccardo Realfonzo[a], Marco Veronese Passarella[b,c]

[a] Universiy of Sannio, Italy
[b] University of Leeds, UK
[c] University of L'Aquila, Italy

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ABSTRACT

Italy is the third-largest economy in the European Union after Germany and France. Italy has also the second-highest government debt-to-GDP ratio in the EU after Greece. The 2007–2008 Global Financial Crisis first, and the Covid-19 crisis after, have severely weakened its economy, and further deteriorated its government finance. The recent surge of inflation, due to the rising energy costs in 2022, has had an immediate negative impact on the Italian economy. Could the energy crisis also have profound, long-run effects on the Italian economy, threatening the long-run sustainability of both its government debt-to-GDP ratio and economic growth? This paper assesses the impact of the energy crisis on the Italian economy through a medium-scale stock-flow consistent macroeconomic model. Through a rigorous accounting framework, the paper captures the effects of the changes in energy costs and the feedback mechanisms on both real and financial variables, evaluating some of the policy response available to policy authorities in the EU and Italy. The main conclusion of the paper is that the Italian economy is on the edge of a precipice. The soft landing scenario will bring a low inflation environment, but modest growth and dire public finance, which may trigger punitive EU policy measures. The hard landing scenarios may succeed in containing inflation or bringing the government deficit to GDP ratio in line to EU rules, but at the price of a severe recession and a ballooning government debt to GDP ratio.

1. Introduction

Italy is the third-largest economy in the European Union (EU) after Germany and France. Italy has also the second-highest government debt/GDP ratio in the EU after Greece. The 2007–2008 Global Financial Crisis (GFC) first, and the Covid-19 crisis after, have severely weaken its economy. The unexpected surge of inflation, due to the rising energy costs in 2022, has had a negative impact on the Italian economy. This paper explores the possibility that the energy crisis could have profound, long-run effects on the Italian economy, threatening the long-run sustainability of both its government debt/GDP ratio and economic growth.

During the 2008–2019 period and thereafter, Italy has struggled to comply with the budgetary discipline recommended by the European Commission. The debt-to-GDP ratio rose from 106.2% in 2008 to 134.6% in 2019. During the same period, real GDP did not recover its pre-GFC level. The Covid-19 crisis has further weakened the Italian economy. In 2020, GDP dropped 9%, while government deficit and debt/GDP reached 9.6% and 154.9%, respectively (Eurostat, 2023). As many other economies, Italy bounced back in 2021. GDP grew 6.7% and the debt/GDP dropped to 147.1%. This improvement was however short-lived. The energy crisis caused a sharp rise in inflation, which triggered an increase of the policy rate by the ECB. This has produced in Italy an immediate drop in GDP and much uncertainty about the outlook of the debt/GDP ratio.

The current energy crisis poses a particular threat to the Italian economy. Italy has a high energy dependency rate, and hence it is in a highly vulnerable position to energy shocks.[1] For instance, the average annual growth of the Harmonised Consumer Price Indices (HICP) for energy, provided by Eurostat,[2] reached 51.3% (compared to 14.3% in 2021). The monthly change over the previous year reached 71.7% in October 2022, and it declined of 19.9% in October 2023. The annual average index of the HICP for energy rose up to 165.9 in 2022, from 109.6 in 2021 (index 2015 = 100). Monthly data shows that the harmonised index of consumer prices for energy climbed to 209.3 in

* Corresponding author.
E-mail address: rosa.canelli@unisannio.it (R. Canelli).

[1] See e.g., Eurostat data at: https://ec.europa.eu/eurostat/databrowser/view/NRG_IND_ID__custom_3844017/default/table?lang=en.

[2] Eurostat Database, Harmonised Index of Consumer Prices (HICP), https://ec.europa.eu/eurostat/databrowser/explore/all/economy?lang=en&subtheme=prc.prc_hicp&display=list&sort=category&extractionId=prc_hicp_aind.

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November 2022, before slowly starting declining during 2023. It is expected to be at 157.5 in November 2023. This vulnerability to energy shocks together with the need to accelerate the transition to non-fossil fuels has led scholars and practitioners to investigate the current dynamics in the Italian energy sector. The literature has focused, among others, on the interaction between energy use, economic development, and energy policies (Soytas and Sari, 2003; Zachariadis, 2007; Halicioglu, 2009; Lee and Chien, 2010; Bardazzi and Pazienza, 2017; Agovino et al., 2019; Magazzino et al., 2021; Bonaldo et al., 2022; Prontera and Lizzi, 2023; Prontera, 2024); the energy trade balance (Giordano and Tosti, 2022); the consequences of energy transition policies (Campagnolo and De Cian, 2022; Concettini et al., 2022; Xu et al., 2022; Xue et al., 2022); the effects of energy-efficiency incentive programs (Alberini and Bigano, 2015; De Siano and Sapio, 2022; Aydin et al., 2023; Zhang et al., 2021); the impact of energy prices on the firms sector (Bardazzi et al., 2015); the impact of the Covid-19 pandemic on the energy sector (Akyildirim et al., 2022; Szczygielski et al., 2022;); and the spillover effects of oil price changes on the inflation rate CPI (Apostolakis et al., 2021; Elsayed et al., 2021).

This paper contributes to this literature by using an original methodology, namely a medium-scale, stock-flow consistent (SFC), structural macroeconomic model, in order to explore the potential impact of the current energy crisis on the Italian economy. Six macroeconomics sectors are considered: households, non-financial or production firms, banks (and financial intermediaries), the government sector, the central bank (ECB), and the foreign sector. The coefficients of the behavioural equations have been estimated using Eurostat (or ISTAT) data on an annual basis. The considered time span for both estimations and in-sample simulations is the 1995 to 2022 period, whereas (out-of-sample) predictions have been extended up to 2028.[3]

The remainder of the paper is organised as follows. Section 2 describes the main features of stock-flow consistent (SFC) models. Section 3 sets up the modelling framework. Section 4 discusses the main findings. Section 5 provides concluding remarks.

2. Methodological foundations: the SFC approach

Stock-flow consistent (SFC) models have attracted the attention of an increasing number of scholars (Caverzasi and Godin, 2015; Nikiforos and Zezza, 2017) and world-leading institutions (e.g., Burgess et al., 2016; Barbieri Hermitte et al., 2022). In recent years, there has been a growing awareness in recognising the advantages of the SFC modelling approach in proving a detailed representation of accounting relationships, achieving a notable degree of predictive success in identifying early signs of fragility and unsustainable processes (Godley, 1999; Godley and Lavoie, 2007; Bezemer, 2010). The global financial crisis of 2007–2008 has uncovered the weakness and the poorly predictive performance of the standard dynamic stochastic general equilibrium (DSGE) models. DSGE models have been criticised on several accounts, including adopting rational expectations, overlooking the role of banks, money, and financial markets dynamics, and assuming that the evolution of the economic system is driven by exogenous shocks (Mankiw, 2006; Solow, 2008; Caiani et al., 2016; Romer, 2016; Cusbert and Kendall, 2018; Krugman, 2018; Fontana and Veronese Passarella, 2018; Wren-Lewis, 2018;). Differently from DSGEs, which dominated macroeconomics until the late 2000s, the SFC models are able to capture the interconnectedness, endogeneity, and path dependency of macroeconomic variables. They explicitly analyse the monetary and financial dimensions of the economic system, tying together real decisions with monetary and financial consequences (Godley and Lavoie, 2007, p. 47).

[3] A detailed step-by-step description of the model (including the model R code to replicate and assess the model), the scenarios, and the related dataset has now been updated and is available on the following website: https://github.com/marcoverpas/Italy-SFC-Model.

This paper maintains that these features make SFC macroeconomic models well suited for the analysis of energy issues, including the evaluation of an energy price shock, and the policy response to it. Changes in the energy price have a variety of effects on real and financial variables, which, in turn, trigger complex feedback effects, including monetary and fiscal policy responses. SFC macroeconomic models, through their rigorous accounting framework, are able to capture the direct and feedback effects caused by changes in the energy price.

SFC models became increasingly popular after the publication of the seminal book of Godley and Lavoie (2007), which provided a systematic accounting formalisation for complex theoretical models. However, the origins of the approach go back to the independent works of Godley (see Godley and Cripps, 1974, 1983; Cripps et al., 1976; Cripps and Lavoie, 2017) and Nobel prize Tobin (see Brainard and Tobin, 1968; Tobin, 1969, 1982; Backus et al., 1969), in an attempt to combine economic theory and policy, and to build rigorous models that bring together the interdependencies between the real and the financial sides of modern economies. SFC models are built on the following accounting principles (Nikiforos and Zezza, 2017):

1) *flow consistency*: every transaction-monetary flow must come from somewhere and go somewhere (Godley and Lavoie, 2007, p.6).
2) *stock consistency*: financial liabilities issued by a sector are held as financial assets by another sector. The overall net financial wealth of the system sums up to zero.
3) *stock-flow consistency*: flows contribute coherently to the formation of stocks. The end-of-period stocks are given by cumulating flows, including possible capital gains and losses.
4) *quadruple book-keeping*: every transaction requires filling in a quadruple entry (Copeland, 1949); namely every inflow in favour of a unit is matched by the outflow faced by another unit, and a reduction (increase) in assets (liabilities) held by a unit is matched by the increase (reduction) in assets (liabilities) held by the other unit.

These principles ensure the internal logical consistency of the models and are integrated in the balance sheet and the transactions-flow matrix, which provide the accounting framework of SFC models.

The balance sheet includes the allocation of real capital and financial assets among institutional sectors; assets are usually note down using a positive sign, whereas liabilities and net worth are given negative sign. The stock consistency principle entails that each row of the balance sheet sums up to zero. The transaction-flow matrix includes the monetary flows associated with stocks and sectoral budget constraints, for the entire economic system. The matrix registers sources of funds using a positive sign, while uses of funds have a negative sign. The difference between sources and uses of funds gives rise to the net lending of the sector, namely the end-of-period financial position. The horizontal consistency requires that flow and uses of funds for each transaction sum up to zero, whereas vertical consistency entails that each column of the matrix sums up to zero. Balance sheet and transaction flow matrix allow identifying the first set of model equations, namely accounting identities (e.g., national income, net wealth). Identities are then combined with equilibrium conditions (i.e., adjustment mechanisms that equal demand and supply) and behavioural (or stochastic) equations to close the model.

After the GFC, SFC contributions had mainly a theoretical nature (Godley and Lavoie, 2007; Nikiforos and Zezza, 2017), though the early work of Godley's New Cambridge group in the 1960–70s contained the general principles of modern SFC empirical models (e.g., Cripps and Godley, 1976, 1978; Cripps et al., 1976; Godley and Cripps, 1983). Recently, there has been a growing interest toward fully developed empirical models. Canelli et al. (2021) maintain that empirical SFC models can be classified into two main groups, namely theory-to-data (TTD) and data-to-theory (DTT) models. TTD models are built starting from a theoretical model, defining equilibrium conditions and behavioural equations, and then collecting data to estimate in a pragmatic way

Table 1
Balance-sheet matrix of Italian economy, 2021 (million-euro, current prices).

	Households	Firms	Government	Banks	ECB	Foreign	Row total
Cash and reserves	200,683			10,817	−211,500		0
Deposits	1,428,434			−1,428,434			0
Securities	233,263		−2,678,397	1,366,294	868,289	210,551	0
Loans	−763,488	−871,902		1,635,390			0
Shares	1,372,850	−1,372,850					0
Other net FA	1,583,746	284,629	323,282	−1,563,895	−783,662	155,900	0
Net financial wealth	4,055,488	−1,960,123	−2,355,115	20,172	−126,873	366,451	0
Column total	0	0	0	0	0	0	0

Table 2
Transactions-flow matrix of Italian economy, 2021 (million-euro, current prices).

	Households	Firms		Government	Banks	ECB	Foreign	Row total
		Current	Capital					
Consumption	−1,030,124	1,030,124						0
Total investment		357,215	−357,215					0
Government spending		352,718		−352,718				0
Export		582,192					−582,192	0
Energy import		−64,859					64,859	0
Other import		−475,339					475,339	0
[GDP]		1,782,051						
Taxes	−483,366			483,366				0
Transfers	188,601			−188,601				0
Wages	692,915	−692,915						0
Interest payments	10,905	−2326		−60,678	29,134	13,200	9765	0
Corporate profit	738,858	−1,141,970	403,112					0
Bank profit	29,134				−29,134			0
ECB seigniorage				13,199.6451		−13,200		0
Other payments	−60,675	55,160		275,576.588	−151,307	−5171	−113,584	0
Change in cash and reserves	15,250				−657	−14,593		0
Change in deposits	57,376				−57,376			0
Change in securities	−30,072			−105,432	−77,658	103,317	109,845	0
Change in loans	−27,196		169,601		−142,405			0
Change in shares	138,716		−138,716					0
Change in other net FA	−67,825		15,012	275,577	126,789	−93,895	−255,658	0
Change in net wealth	86,249		45,897	170,145	−151,307	−5171	−145,813	0
Column total	0		0	0	0	0	0	0

the coefficients of the model.[4] DTT models are primarily grounded on sectoral balance sheets and flow of funds statistics of the economy under investigation, within a theoretical framework.

Empirical SFC models have been developed for studying national economies, including Argentina (Michelena et al., 2017; Guaita and Michelena, 2019; Valdecantos, 2020), Austria (Miess and Schmelzer, 2016a, 2016b), Denmark (Godley and Zezza, 1992), Greece (Papadimitriou et al., 2013a, 2013b; Pierros, 2020), Ireland (Kinsella and Tiou-Tagba Aliti, 2012), United States (Godley, 1999; Godley et al., 2007; Zezza, 2009; Papadimitriou et al., 2020b), the United Kingdom economy (Cripps and Godley, 1976; Burgess et al., 2016), and Italy (Zezza, 2018; Veronese Passarella, 2019; Papadimitriou et al., 2020a; Zezza and Zezza, 2020; Canelli et al., 2021, 2022). A measure of the growing interest in the SFC methodology is its application to address some of the foremost issues of the current time, e.g. providing innovative contributions to the policy debate on inequality and financialization (Cardaci and Saraceno, 2016; Botta et al., 2021), fiscal policies and debt sustainability (Canelli et al., 2022), climate-related financial issues and environmental policies (Berg et al., 2015; Jackson and Victor, 2015; Naqvi, 2015; Dafermos et al., 2017, 2018; Bovari et al., 2018; Monasterolo and Raberto, 2018; Ponta et al., 2018; Battiston et al., 2021; Yajima, 2021). The model presented in this paper contributes to this literature by developing an empirically calibrated SFC macroeconomic model in order to explore the potential impact of the current energy crisis on the Italian economy under alternative scenarios.

3. The model

3.1. Model setup and data

The model is made up of 101 equations, of which 36 behavioural equations, 49 fundamental identities, and 16 auxiliary equations. Variables are expressed at current prices (euro), unless otherwise stated. Six macro sectors are considered: households, non-financial or production firms, banks (and financial intermediaries), the government sector, the central bank (ECB), and the foreign sector. Coefficients of behavioural equations have been estimated by using Eurostat (or ISTAT) data on an annual basis. Time series have been reclassified in such a way to reduce the density of cross-sector transactions, thus limiting the size of the model. This is shown by Table 1 and Table 2, which display the balance-sheet matrix and the transactions-flow matrix for Italy in 2021.[5] The most apparent amendment compared with the official national accounting is that output is assumed to be produced by non-financial firms only. The same goes for investment (gross fixed capital formation), which is entirely attributed to private firms. Similarly, consumption is entirely attributed to the household sector (which is the final recipient of all incomes distributed by private firms and commercial banks), while wages are entirely paid by the non-financial firms sector. By contrast,

[4] Accordingly, in the model of this paper regressions are not employed to ‘query’ data about the existence of correlations, but rather, building from the theoretical structure, used to ‘calibrate’ the model based on the observed data.

[5] Entries are expressed at current prices, million euro.

there are no major changes concerning balance-sheet entries, except for a higher level of data aggregation. The considered time span for both estimations and in-sample simulations is the 1995 to 2022 period, whereas out-of-sample simulations have been extended up to 2028. All variables have been expressed in real terms and log levels. Equation coefficients have been estimated using ordinary least squares. Lastly, the system of difference equations is solved using an iterative algorithm provided by *Bimets*, an *R* package recently developed by the Bank of Italy.

At this stage, it is worthy to highlight some of the main limitations of the SFC model of this paper. First, the model does not consider cross-industry interdependencies. One potential avenue for the future is the integration of an input-output structure within the production sector. Another limitation lies in the oversight of the role of the functional income distribution, an aspect that warrants more thorough modelling in an advanced version of the model. Additionally, the use of quarterly data, as opposed to annual data, could be recommended for an accurate definition of time lags, albeit this may introduce potential seasonality issues. Furthermore, the use of observed annual time series and the existence of potentially several structural breaks in the period considered (e.g. the launch of the euro, the COVID-19 crisis) make the use of more sophisticated estimation techniques challenging. In principle, the paper could have addressed the stationarity issue by using the first difference of log variables. However, abandoning (log) levels would have implied a further loss of information. Finally, the balance-sheet entry 'Other net financial assets' is currently excessively large. Mitigating this it involves a higher level of disaggregation of model stocks to reduce this residual component. Coupled with a more refined estimation of model coefficients (e.g., via cointegration methods), these future adjustments could enhance the empirical robustness of model predictions.

3.2. Non-financial firms

The national income identity opens the model and identifies Italy's GDP (Y hereafter) as the sum of nominal consumption C, nominal investment (gross capital formation, I), government net expenditure (G), gross export (X), net of import (M):

$$Y = C + I + G + X - M \tag{1}$$

Real investment decisions are driven by the capital to output ratio (which is a proxy for the capacity utilisation of plants), and the average interest rate on Italian securities (which is a proxy for both the country risk and the cost of funding of housing investment). Using $log(\cdot)$ to denote the logarithmic function, the real net investment function is therefore:

$$log\left(\frac{I_n}{p}\right) = \gamma_0 + \gamma_1 \cdot log\left(\frac{Y_{-1}}{K_{-1}}\right) \tag{2}$$

where γ_0 is an autonomous or shock component, p is the average price level (Italy's GDP deflator), and K is the total stock of capital expressed in nominal terms (current prices).

Investment expenditures must cover capital depreciation too. Thus, the gross nominal investment is:

$$I = I_n + \delta \cdot K_{-1} \tag{3}$$

where δ is the annual average depreciation rate of capital.[6]

As a result, the current value of the stock of fixed capital is:

$$K = K_{-1} \cdot (1 - \delta) + I \tag{4}$$

The profit of non-financial firms is calculated as a residual distributive variable:

$$FT_f = Y - INT_f - WB + OP_f \tag{5}$$

where INT_f represents interests on bank loans paid by non-financial firms, WB is the total wage bill, and OP_f is a catch-all entry capturing all other net incomes that firms have received from (paid to) other sectors.

Firms pay interests to commercial banks:

$$INT_f = r_l \cdot L_f \tag{6}$$

where L_f is the stock of loans obtained by non-financial firms and r_l is the related interest rate.

The latter is defined as:

$$r_l = r^* + m_l \tag{7}$$

where r^* is the main refinancing operation rate set by the ECB, and m_l is the mark-up set by commercial banks on loans to firms. The latter is a function of the mark-up of Italian government securities:

$$m_l = \mu_{l0} + \mu_{l1} \cdot m_{b,-1} \tag{8}$$

Undistributed or retained profits of non-financial firms are calculated as a share of total profit:

$$FU_f = \theta \cdot FT_f \tag{9}$$

where θ is the average retention rate on corporate profits.

Dividends payments and other distributed profits of non-financial firms are:

$$FD_f = FT_f - FU_f \tag{10}$$

The change in bank loans at the end of each period matches the part of investment that is not covered by internal funds:

$$L_f = L_{f,-1} + I - FU_f - \Delta E_s - \Delta OA_f \tag{11}$$

where E_s is the nominal stock of shares issued by non-financial firms, and OA_f are other net financial assets held (or liabilities issued) by the corporate sector.

For the sake of simplicity, the total supply of shares is assumed to adjust to the household demand:

$$E_s = E_{s-1} + \Delta E_h \tag{12}$$

The total net wealth accumulated by the firms is:

$$V_f = OA_f - L_f - E_s \tag{13}$$

Its amount contributes to determine the net value of other payments received (or made) by firms to the other sectors (see Appendix A).

3.3. Households

The model defines the disposable income of Italian households as the summation of all private and public incomes, net of taxes:

$$YD = WB + INT_h + FD_f + F_b + OP_h + TR - T \tag{14}$$

where INT_h is net received interest payments, F_b are (distributed) bank profits, OP_h is a composite entry including other net payments to/from households, TR is government transfers (including unemployment benefits), and T is total taxes.

Real consumption depends on both disposable income and the net stock of wealth of households:

$$log\left(\frac{C}{p}\right) = \alpha_1 \cdot log(yd^e) + \alpha_2 \cdot log\left(\frac{V_{h,-1}}{p_{c,-1}}\right) \tag{15}$$

where yd^e is the expected real disposable income, p_c is the consumer price index (see section 3.10). Notice that eq. (15) implies that Italian

[6] Over the 1996–2019 period, the average value of δ is 4.6%.

consumers follow an implicit stock-flow norm, that is, to set a target wealth to disposable income ratio.[7]

Household net wealth increases as households save:

$$V_h = V_{h,-1} + YD - C \tag{16}$$

Mortgages and other loans obtained by Italian households are identified as a percentage of their disposable income:

$$log(L_h) = log(L_{h,-1}) + \phi \cdot \frac{C_{-1}}{YD_{-1}} \tag{17}$$

Households pay interests to banks and financial intermediaries. Total interests are:

$$INT_{lh} = r_{lh} \cdot L_{h,-1} \tag{18}$$

where r_{lh} is the interest rate on personal loans:

$$r_{lh} = r^* + m_{lh} \tag{19}$$

And m_{lh} is the related mark-up:

$$m_{lh} = \mu_{h0} + \mu_{h1} \cdot m_{b,-1} \tag{20}$$

Interest payments received by the households on their holdings of government debt are:

$$INT_{gh} = B_{h,-1} \cdot r_b^h \tag{21}$$

where B_h is the stock of government securities and r_b^h is the average interest rate they yield.

Therefore, the total net interest payments received by households are:

$$INT_h = INT_{gh} + INT_{mh} - INT_{lh} \tag{22}$$

where INT_{mh} is net interest payments from banks to households (including interests on deposits). Notice that the value of INT_h is always positive for the Italian household sector considered as a whole.

3.4. Commercial banks and financial intermediaries

Loans are provided on demand by commercial banks to both non-financial firms and households:

$$L_s = L_f + L_h \tag{23}$$

Correspondingly, deposit accounts are opened on demand by creditworthy households:

$$M_s = M_h \tag{24}$$

For the purpose of simplification, all bank production costs are assumed away. If interest payments on advances and reserves are also negligible, bank profits equal net received interest payments:

$$F_b = INT_b \tag{25}$$

Net interest payments received by the banks are calculated as:

$$INT_b = INT_{gb} + INT_f + INT_{lh} - INT_{mh} \tag{26}$$

where INT_{gb} is interest payments received on government securities holdings, INT_f is interest payments from firms, INT_{lh} is interest payments from households.

Interest payments made by the government sector to the banks are:

$$INT_{gb} = r_b^b \cdot B_{b,-1} \tag{27}$$

The stock of government securities held by the banking sector is modelled as a share of their core assets (that is, loans, reserves, and government securities):

$$log(B_b) = \lambda_b^b \cdot log(L_{s,-1} + H_{b,-1} + B_{b,-1}) \tag{28}$$

The total wealth accumulated by the banks is:

$$V_b = H_b + B_b + L_s + OA_b - M_s \tag{29}$$

where H_b is the stock of reserves and OA_b is the stock of other net financial assets held by the banking sector.

Its amount contributes to determine the value of other payments received (or made) by banks to the other sectors (see Appendix A).

3.5. The government sector

Eq. (30) shows that the dynamic of the Italian government net expenditure:

$$G = \sigma_1 \cdot \left(\frac{G_{,-1}}{p_{,-1}}\right) \cdot p \tag{30}$$

where the component σ_1 is the auto-regressive coefficient of real government spending.

The total tax revenue is:

$$T = \tau_1^T \cdot WB_{-1} + \tau_2^T \cdot (YD_{-1} - WB_{-1}) + \tau_3^T \cdot V_{h,-1} \tag{31}$$

where τ_1^T is the estimated average tax rate on labour incomes, τ_2^T is the average tax rate on other incomes, and τ_3^T is the average tax rate on wealth.

The total amount of transfers and benefits is identified as a function of the value taken in the previous period and (the change in) the unemployment rate:

$$TR = \tau_1^{TR} \cdot TR_{-1} + \tau_2^{TR} \cdot \Delta un \tag{32}$$

Therefore, the government deficit in each period is:

$$DEF = G + TR + INT_g - T - F_{cb} \tag{33}$$

where F_{cb} is the seigniorage income that the ECB returns to the Italian government, through the Bank of Italy.

The net interest payments paid by the government on the national debt are:

$$INT_g = r_b \cdot B_{s,-1} \tag{34}$$

Total issues of government debt are:

$$B_s = B_{s,-1} + DEF \tag{35}$$

which consist of bills, bonds, and all other government securities.

Finally, the net wealth of the government sector is:

$$V_g = -B_s + OA_g \tag{36}$$

where OA_g is the amount of other net financial assets held by the government.

The value of V_g contributes to determine the value of other payments made (or received) by the government to the other sectors (see Appendix A).

3.6. Portfolio decisions

The composition of households' financial holdings is usually determined using Tobinesque portfolio equations (e.g., Godley and Lavoie, 2007). Accordingly, the percentage of corporate shares held by Italian households should be defined as a positive function of the return rate on shares, and a negative function of both households' liquidity preference

[7] Over time, households try to keep their real consumption more stable than their current disposable income. As a result, $yd^e = \psi \cdot Y_{-1}/p_{c,-1}$, where $\psi = E(YD/Y)$ is the average disposable income to GDP ratio over the considered period.

(proxied by the disposable income to wealth ratio), and interest rates accruing on other financial assets. Similarly, the percentage of wealth held in the form of government debt would be defined as a positive function of the interest rate on government securities, a negative function of households' liquidity preference, and so on. However, Tobinesque portfolio equations can make the model rather unstable. Besides, they do not quite fit the available data for the Italian economy. As a result, Eq. (37) shows that households' holdings of corporate shares are a simple function of their total stock of wealth at the beginning of the period:

$$log(E_h) = \lambda_E \cdot log(V_{h,-1}) \tag{37}$$

Similarly, the nominal stock of government securities demanded by households has been defined as:

$$log(B_h) = \lambda_B \cdot log(V_{h,-1}) \tag{38}$$

The demand for banknotes (cash) depends on households' real consumption plans:

$$\Delta \log(H_h) = \lambda_c \cdot log\left(\frac{C}{p_c}\right) \tag{39}$$

Notice that the gross wealth of households includes cash, bank deposits, government securities, shares, and other net financial assets. Bank deposits act as the buffer stock:

$$M_h = V_h + L_h - H_h - B_h - E_h - OA_h \tag{40}$$

When households save more (less) than initially planned, the stock of bank deposits held at the end of the period reduces (increases) compared with its expected value.

3.7. The central bank (ECB)

The ECB purchases government securities from commercial banks and financial intermediaries on the secondary market. At the end of each period, the amount of Italian debt held by the ECB is therefore:

$$B_{cb} = B_s - (B_h + B_b + B_{row}) \tag{41}$$

The supply of cash H_s arises out from the balance-sheet identity, namely *assets* ≡ *liabilities*:

$$H_s = B_{cb} + OA_{cb} - V_{cb} \tag{42}$$

where OA_{cb} are other net financial assets held by the ECB (e.g., advances to commercial banks).

If interest payments on advances and reserves are assumed away, ECB net revenues equal interest payments received on its holdings of Italian government securities:

$$F_{cb} = INT_{cb} = INT_g - INT_{gh} - INT_{gb} - INT_{grow} \tag{43}$$

The reserve requirement for commercial banks is calculated on collected deposits:

$$H_b = \rho \cdot M_s \tag{44}$$

where ρ is the average reserve ratio of Italian banks.

3.8. The foreign sector

Real import increases as domestic income increases and the relative price of import (with respect to the domestic price level) reduces:

$$log\left(\frac{M}{p}\right) = \mu_0 + \mu_1 \cdot log(Y_{-1}) - \mu_2 \cdot \frac{p_{m,-1}}{p_{-1}} \tag{45}$$

Real export grows as foreign income and foreign prices grow, and decreases as the nominal exchange rate and domestic prices increase:

$$log\left(\frac{X}{p}\right) = \varepsilon_0 + \varepsilon_1 \cdot log\left(Y_{-1}^{row}\right) + \varepsilon_2 \cdot exr_{-1} \cdot \frac{p_{-1}}{p_{row,-1}} \tag{46}$$

where *exr* is the euro-US dollar exchange rate (defined as the quantity of US dollars per 1 euro) and p_{row} is the foreign price index.

In turn, foreign income increases following an exogenous rate:

$$Y^{row} = Y_{-1}^{row} \cdot \left(1 + g_y^{row}\right) \tag{47}$$

Net export is:

$$NX = X - IM \tag{48}$$

Foreign investors hold an amount of Italian government securities:

$$B_{row} = \lambda_{row} \cdot B_s \tag{49}$$

where λ_{row} is the estimated share of Italian debt subscribed by the rest of the world.

Therefore, net interests paid by the Italian Treasury to foreign investors amount to:

$$INT_{row} = r_b^{row} \cdot B_{row,-1} \tag{50}$$

At the end of the period, the amount of wealth accumulated by the foreign sector is:

$$V_{row} = B_{row} + OA_{row} \tag{51}$$

where OA_{row} is the value of other Italian net financial assets owned by the rest of the world.

The value of V_{row} contributes to determine the value of other payments received (or made) by foreign agents to Italy's domestic sectors (see section 3.10).

3.9. Interest rates

The model includes eight interest or return rates. Notably, the return rate on equity and shares is endogenously determined as the ratio of corporate distributed profits to the total stock of shares subscribed by the households:

$$r_e = \frac{F_{fd}}{E_{h,-1}} \tag{52}$$

The ECB buys government securities on the secondary market, using a "best bid" rule.[8] The average mark-up on the policy rate is positively associated to the government debt to GDP ratio at the beginning of the period, and negatively linked with the share of securities held by the central bank and the policy rate, since changes in the latter are never fully converted into changes to government bond yields:

$$m_b = \mu_{b1} \cdot \frac{B_{s,-1}}{Y_{-1}} - \mu_{b2} \cdot \frac{B_{cb}}{B_s} - \mu_{b3} \cdot r^* \tag{53}$$

The average interest rate on government securities is therefore:

$$r_b = r^* + m_b \tag{54}$$

However, net received interest rates can vary across sectors, because of the different composition (in terms of maturities) of sector-related holdings of government securities.[9] More precisely, the interest rate on households' holdings of government securities is:

$$r_b^h = r^* + m_b^h \tag{55}$$

The interest rate on banks' holdings of government securities is:

[8] This implies the purchasing of new government securities by the private sector at the beginning of each period, which are then partly sold to the ECB within the same period.

[9] Zezza (2018) offers an alternative accounting for interest rates.

$$r_b^b = r^* + m_b^b \quad (56)$$

Similarly, the interest rate on foreign sector's holdings of government securities is:

$$r_b^{row} = r^* + m_b^{row} \quad (57)$$

In turn, sector-related mark-ups over the policy rate are defined and estimated as positive linear functions of the average premium paid by the Italian Treasury:

$$m_b^h = \mu_{b1}^h \cdot m_{b,-1}^h + \mu_{b2}^h \cdot m_b \quad (58)$$

$$m_b^b = \mu_{b1}^b \cdot m_{b,-1}^b + \mu_{b2}^b \cdot m_b \quad (59)$$

$$m_b^{row} = \mu_{b1}^{row} \cdot m_{b,-1}^{row} + \mu_{b2}^{row} \cdot m_b \quad (60)$$

3.10. Energy imports and the price level

There are two price indexes in the model: the GDP deflator (p) and the consumer price index (p_c). Both are modelled as a linear function of the foreign price index, the energy price index, and the real GDP of Italy[10]:

$$log(p) = \pi_y^1 \cdot log(p_{row,-1}) + \pi_y^2 \cdot log(p_{en,-1}) + \pi_y^3 \cdot log\left(\frac{Y_{-1}}{p_{-1}}\right) \quad (61)$$

$$log(p_c) = \pi_c^1 \cdot log(p_{row,-1}) + \pi_c^2 \cdot log(p_{en,-1}) + \pi_c^3 \cdot log\left(\frac{Y_{-1}}{p_{-1}}\right) \quad (62)$$

Notice that the consumer price index is expected to be more sensitive to energy market conditions, because of the impact of imported consumer goods (Asafu-Adjaye, 2000).

Both the foreign price level and the price of energy are assumed to grow according to an exogenous rate:

$$p_{row} = p_{row,-1} \cdot (1 + \pi_{row}) + p_{row}^0 \quad (63)$$

$$p_{en} = p_{en,-1} \cdot (1 + \pi_{en}) + p_{en}^0 \quad (64)$$

where p_{row}^0 and p_{en}^0 are the respective shock components.

The import of energy products is a share of total import:

$$M_{en} = \mu_{en} \cdot M \quad (65)$$

where:

$$\mu_{en} = \epsilon_1^{en} \cdot log\left(\frac{Y_{-1}}{p_{-1}}\right) - \epsilon_2^{en} \cdot \pi_{en} \quad (66)$$

The nominal share of energy imports to total import (μ_{en}) grows as Italy's real GDP grows (income effect) and falls as the inflation rate energy products (π_{en}) increases (price effect).[11]

3.11. The labour market

In the labour market, the employment level (N_d) and the wage rate (w) determine the wage bill paid by the non-financial firms sector:

$$WB = w \cdot N_d \quad (67)$$

The real value added per employee is defined on basis of the so-called Kaldor-Verdoorn's law or Smith effect, which states that labour productivity grows proportionally to output. It also depends on the real wage rate, since firms are more prone to innovate as the relative and absolute cost of labour increases[12]:

$$\Delta \log(pr) = \nu_0 + \nu_1 \cdot \Delta \log\left(\frac{w}{p}\right) + \nu_2 \cdot \Delta_2 log\left(\frac{Y}{p}\right) \quad (68)$$

Total demand for labour, hence the employment level, are therefore:

$$N_d = \frac{Y/p}{prod} \quad (69)$$

The total available labour force tends to adjust to the demand for labour:

$$log(N_s) = \nu_{s1} \cdot log(N_{s,-1}) + \nu_{s2} \cdot [log(N_d) - log(N_{s,-1})] \quad (70)$$

The percentage change in the nominal wage rate is a function of the change in the unemployment rate and the inflation rate:

$$g_w = \omega_1 \cdot \Delta \log(p) + \omega_2 \cdot \Delta un \quad (71)$$

Therefore, the average nominal wage rate is:

$$w = w_{-1} \cdot (1 + g_w) \quad (72)$$

The rate of unemployment is:

$$un = 1 - \frac{N_d}{N_s} \quad (73)$$

Finally, it is worthy to clarify the impact of the energy inflation rate on real wage and on the wage share of income. A higher price of energy sources is ceteris paribus associated with a higher GDP deflator and a higher CPI, which reduce real wages. A higher price of energy sources also depresses ceteris paribus real consumption, real net investment, real aggregate demand, and output, which in turn negatively affects labour productivity. This means that the fall in real wages coexists with an increase in the wage share to total income. This paradoxical effect is due to labour productivity falling faster than real wages.

4. Findings

Table 3 presents the economic forecasts for Italy made by the Italian government (September 2023), the IMF (October 2023), the European Commission (November 2023), the Bank of Italy (October 2023), the OECD (November 2023), and the Italian National Institute of Statistics (ISTAT, December 2023) during the 2023–2026 period. The forecasts are for the GDP (and some of its main components), the inflation rate (as measured by the Harmonised Index of Consumer Prices (HICP) and the GDP deflator), and two public finance indicators (namely the government deficit to GDP and government debt to GDP ratios). Table 3 also presents similar economic simulations (the baseline scenario) for the Italian economy made by the SFC model of this paper covering the 2023–2028 period. Under the baseline scenario, the energy import price shock picks in 2023, and then gradually fades away. In line with the

[10] There are four theoretical reasons for including real GDP as an explanatory variable in price equations (Stock and Watson, 1999, 2007), namely as a proxy for: (1) the overall volume of activity or income in an economy (changes in income can affect the demand for goods and services, thus indirectly affecting the price level); (2) aggregate demand pressures (changes in aggregate demand can put direct upward pressure on prices, particularly when aggregate supply is constrained); (3) labour market conditions (changes in the employment rate can lead to similar changes in nominal wages and prices); (4) the medium-term trend in the economy (changes in the trend can influence the price level). Please note that in the New Consensus Macroeconomics (NCM), the output gap (namely the difference between current real GDP and its 'natural' value) is used as an explanatory variable in price equations. This paper rejects this NCM practice, since it accepts Keynes' principle of effective demand, namely that aggregate demand can affect both current and potential output (Fontana and Palacio Vera, 2007).

[11] Unsurprisingly, the price effect is not significant, as the Italian demand for energy imports is rigid.

[12] See Kaldor (1961, 1978), Verdoorn (1980), and Sylos-Labini (1983).

Table 3
Economic Forecasts of GDP components, inflation, and government balances in Italy.

	Italian Government September 2023[a]				IMF October 2023[b]		European Commission November 2023[c]			Bank of Italy October 2023[d]			OECD November 2023[e]			ISTAT December 2023[f]		Our Model (Basiline scenario)					
Variable/period	2023	2024	2025	2026	2023	2024	2023	2024	2025	2023	2024	2025	2023	2024	2025	2023	2024	2023	2024	2025	2026	2027	2028
Annual growth rates (%)																							
GDP	0.8	1.2	1.4	1.0	0.7	0.7	0.7	0.9	1.2	0.7	0.8	1.0	0.7	0.7	1.2	0.7	0.7	0.8	0.8	0.9	0.8	1.0	1.2
Consumption	1.3	1.3	1.1	1.0	1.4	1.1	1.3	0.9	1.0	1.3	0.9	1.0	1.2	0.7	1.0	1.4	1.0	1.0	0.7	1.3	0.9	1.0	1.5
Investment	1.0	3.0	2.4	1.9	1.1	2.8	0.5	0.3	1.3	0.5	0.3	1.3	0.8	0.5	1.6	0.6	0.6	0.5	0.8	1.0	1.0	1.0	1.0
Import	0.1	3.3	4.1	3.6	1.7	3.2	1.1	2.3	3.1	1.1	2.3	3.1	1.0	0.9	1.2	0.3	2.0	0.9	2.2	2.6	2.4	2.1	2.0
Export	0.7	2.4	4.3	3.5	2.2	2.8	0.4	2.4	3.1	0.4	2.4	3.1	0.4	1.3	2.0	0.0	2.1	0.7	2.3	2.0	1.9	1.9	1.9
GDP deflator	4.5	2.9	2.1	2.1	6.2	3.6	4.5	2.8	3.7	4.5	2.8	3.7	4.2	2.9	2.6	4.9	2.8	4.3	3.0	2.6	2.2	2.0	1.4
HICP/Consumer price	5.6	2.3	2.0	2.1	6.0	2.6	6.1	2.7	2.3	6.1	2.4	1.9	6.1	2.6	2.3	5.4	2.5	8.8	2.3	2.3	1.2	1.2	1.2
Government balance ratios (%)																							
Deficit to GDP	5.3	4.3	3.6	2.9	5.0	4.0	5.3	4.4	4.3	–	–	–	5.4	4.2	3.6	–	–	6.2	4.9	4.8	5.3	5.7	6.2
Debt to GDP	140.2	140.1	139.9	139.6	143.7	143.2	139.8	140.6	140.9	–	–	–	141.4	141.4	140.5	–	–	144.0	143.6	143.4	144.4	145.8	148.1

[a] NADEF (2023).
[b] IMF (2023b). Please note that in the October 2023 report the IMF has not fully updated all previous forecasts. Therefore, the data in violet indicate the forecasts made in the July 2023 Report (IMF, 2023a).
[c] European Commission (2023).
[d] Bank of Italy (2023).
[e] OEDC (2023).
[f] ISTAT (2023).

Table 4
Simulations results under alternative scenarios (Source: this paper model elaborations on Eurostat data).

BASELINE SCENARIO						
	2023	2024	2025	2026	2027	2028
GDP	0.8	0.8	0.9	0.8	1.0	1.2
Import	0.9	2.2	2.6	2.4	2.1	2.0
Export	0.7	2.3	2.0	1.9	1.9	1.9
GDP deflator	4.3	3.0	2.6	2.2	2.0	1.4
CPI	8.8	2.3	2.3	1.2	1.2	1.2
Deficit to GDP	6.1	4.9	4.8	5.2	5.7	6.2
Debt to GDP	144.0	143.6	143.4	144.3	145.8	148.1
Policy rate	3.8	3.0	2.5	2.5	2.5	2.5
Av. yield on gov. debt	2.7	2.8	3.0	3.2	3.3	3.4
SCENARIO 1: PERSISTENT INFLATION						
	2023	2024	2025	2026	2027	2028
GDP	0.8	0.7	0.1	−0.8	−1.8	−2.5
Import	0.9	2.2	3.2	2.5	1.8	0.9
Export	0.7	2.3	2.1	2.0	2.0	2.0
GDP deflator	4.3	3.9	3.4	3.3	3.0	2.3
CPI	8.8	5.0	5.0	4.9	4.8	4.7
Deficit to GDP	6.1	5.0	5.0	5.8	6.9	8.4
Debt to GDP	144.0	142.7	142.7	145.1	150.4	159.3
Policy rate	3.8	3.0	2.5	2.5	2.5	2.5
Av. yield on gov. debt	2.7	2.8	2.9	3.2	3.3	3.5
SCENARIO 2: PERSISTENT INFLATION + HIGHER POLICY RATE						
	2023	2024	2025	2026	2027	2028
GDP	0.8	−0.4	−1.0	−1.8	−2.4	−2.4
Import	0.9	2.2	2.4	1.7	1.0	0.4
Export	0.7	2.3	2.1	2.0	2.0	2.0
GDP deflator	4.3	3.9	3.3	3.2	2.9	2.3
CPI	8.8	5.0	4.9	4.8	4.7	4.7
Deficit to GDP	6.1	6.4	6.8	7.7	8.8	10.1
Debt to GDP	144.0	145.7	149.3	155.1	163.3	173.8
Policy rate	3.8	4.5	4.5	4.5	4.5	4.5
Av. yield on gov. debt	2.7	3.7	4.1	4.4	4.6	4.7
SCENARIO 3: AUSTERITY (FROM BASELINE)						
	2023	2024	2025	2026	2027	2028
GDP	0.8	−1.4	−2.0	−3.4	−3.9	−3.6
Import	0.9	2.2	1.2	0.3	−0.8	−1.4
Export	0.7	2.3	2.0	1.9	1.9	1.9
GDP deflator	4.3	3.0	2.3	1.9	1.5	0.9
CPI	8.8	2.3	2.1	0.9	0.8	0.7
Deficit to GDP	6.1	3.0	3.0	3.0	3.0	3.0
Debt to GDP	144.0	144.9	147.5	152.9	159.8	167.3
Policy rate	3.8	3.0	2.5	2.5	2.5	2.5
Av. yield on gov. debt	2.7	2.9	3.2	3.5	3.8	4.1

policy recommendation of the dominant New Consensus Macroeconomics theory (see e.g. Fontana and Palacio-Vera, 2007, Fig. 1, p. 275) as the energy price shocks spread to the inflation rate, the ECB first increases the policy rate and then - as inflation slows down - it progressively decreases it. As a result, after reaching 8.8% in 2023, and in line with the economic forecast of national and international institutions, the inflation rate fluctuates around the 2% target in 2024 and 2025.

Table 4 presents three additional scenarios in addition to the baseline scenario. Scenario 1 is the baseline with the assumption that the energy-led price shock has a more persistent effect on inflation, with the inflation rate (CPI) still standing around 5% for the foreseeable years. Scenario 2 builds on the previous scenario. In this case, the baseline is hit by two shocks, namely a persistent inflation rate and a robust policy

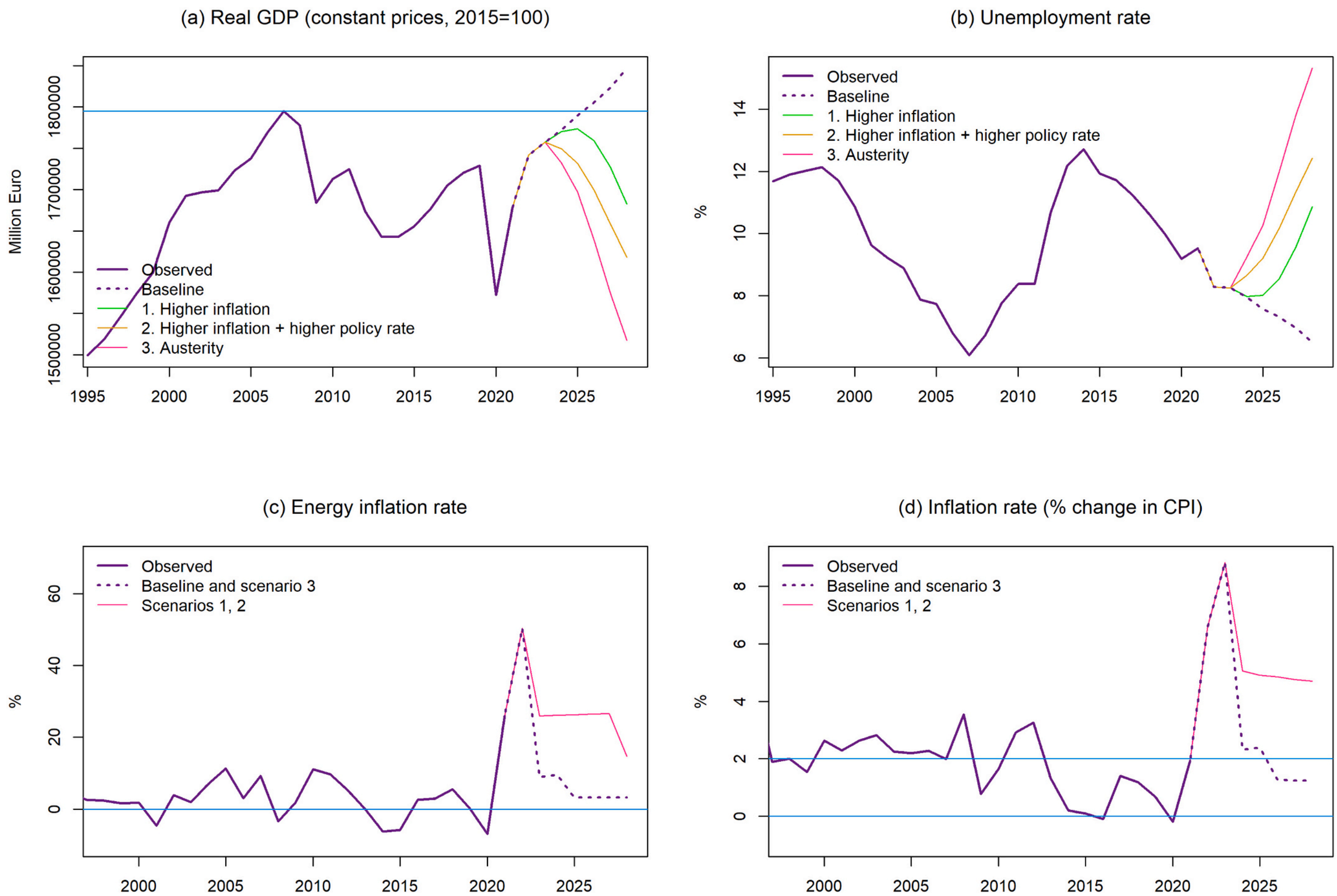

Fig. 1. The dynamics of real GDP, unemployment, and inflation rates in Italy: out-of-sample simulations, alternative scenarios.

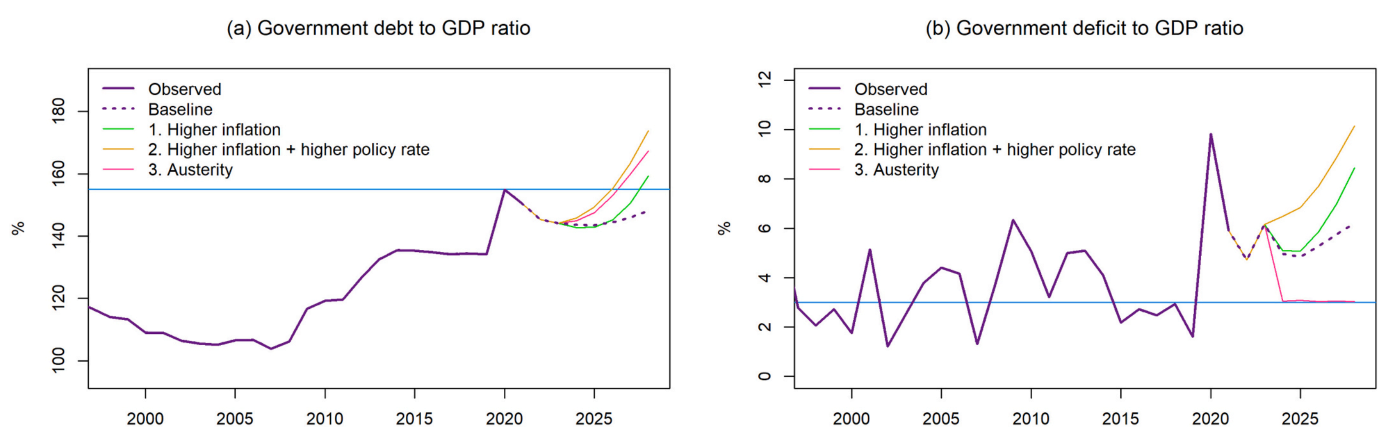

Fig. 2. The dynamics of public finance in Italy: out-of-sample simulations, alternative scenarios.

response by the ECB, which keep the policy rate at 4.5% over the 2024–2026 period. Finally, Scenario 3 simulates policy austerity measures implemented by the fiscal authorities in Italy. According to the official economic forecasts of national and international institutions and the baseline scenario, in 2023 the government deficit and government debt to GDP ratios will be around 5% and 140%, respectively. Concerned by these high public finance ratios, Scenario 3 shows the effects of policy austerity measures which, in accordance with the Maastricht Treaty, bring the government deficit to GDP ratio to 3% in 2024 (and following years). A table of coefficients and a table of shocks, namely Table B1 and Table B2 in the Appendix B, indicate the parameter values and the assumptions made for the projections presented in Table 4.

At this stage, it is worthy to note that Scenarios 1 and 2 are consistent with the main thesis of Goodhart and Pradhan's book *The Great Demographic Reversal* (Goodhart and Pradhan, 2020). Goodhart and Pradhan have been arguing well before the start of the Ukraine-Russia war that inflation is going to be a serious problem in future. They reach this conclusion because of recent major demographic changes. In previous decades, globalisation has allowed millions of low-paid workers from urbanizing China and smaller emerging countries in Eastern Europe and Asia to: (a) enter the global labour force, and (b) increase the production of goods and services for the global markets. This explains the stagnant

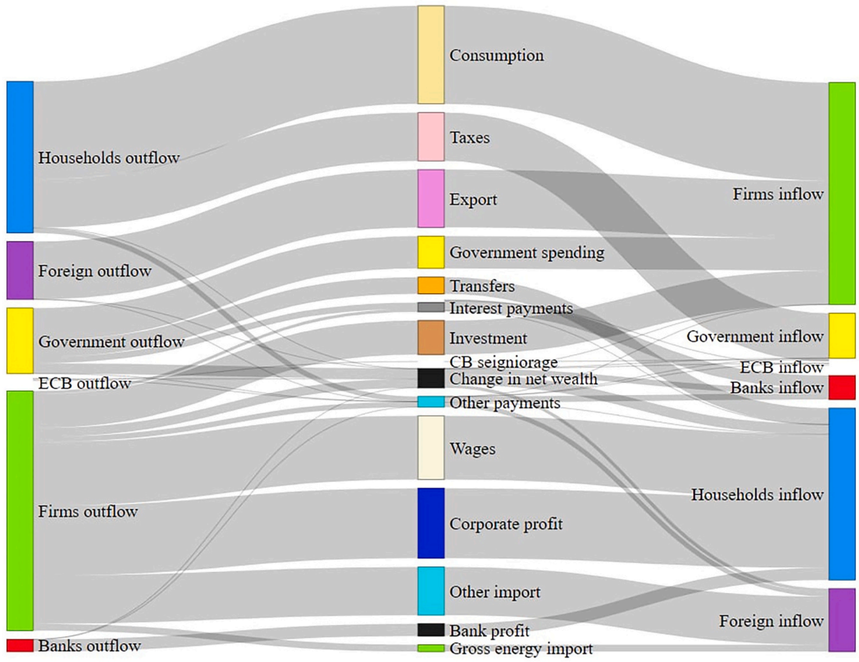

Fig. 3. Sankey diagram.

wages, disinflationary pressures, and low nominal interest rates of the 1990s and 2000s. However, ageing working-age population in China and advanced countries is going to run in reverse the previous trends. Global shortage of low-paid workers will increase the bargaining power of unions just as the production of goods and services for the global markets decreases, and the demand for workers in the care industry increases. According to Goodhart and Pradhan, these new trends will bring a return of inflation and higher nominal interest rates for the next few decades.

Figs. 1(a-d) and 2(a-b) below show the evolution of some of the main macroeconomics variables in Italy during the 1995–2028 period. The purple plain line presents the times series values of those variables during the 1995–2022 period, while the dotted line indicates the SFC model simulations of the variables during the 2023–2028 period, i.e. the baseline scenario. The green, brown, and pink lines represent Scenario 1 (baseline *with* persistent inflation), Scenario 2 (baseline *with* persistent inflation *and with* higher policy rate), and Scenario 3 (baseline *with* austerity policy), respectively.

Fig. 1 indicates the dynamics of real GDP (Fig. 1a), the unemployment rate (1b), the energy inflation rate (1c), and the inflation rate (1d). Fig. 1(a) shows that GDP was hit hard by the Covid-19 pandemic. According to the baseline scenario, GDP will recover through positive though modest annual increases. The main drivers of this trend are the government sector, and in part the foreign sector. Scenarios 1–3 indicate that over the next five years Italy will not be able to escape a significant recession, with an especially significant cumulative decline of over 10% of GDP in Scenario 3. For all four scenarios, by 2025 real GDP is not expected to have recovered the level reached before the 2007–2008 global financial crisis (GFC).

Fig. 1(b) indicates that the unemployment rate increased dramatically after the GFC but has been rapidly declining in the last few years. According to the baseline scenario, the rate will continue to decline, though it will remain well above 6% for the entire simulation period. By contrast, Scenarios 1–3 show that the unemployment rate will rise substantially in future, reaching over 10% by 2025 in the case of Scenario 3. Fig. 1(c) shows that after a period of fluctuations around low levels, in 2022 the energy inflation rate jumped to over 50%, before declining to more moderate historical levels of around 5%, with the exception of Scenarios 2 and 3, due to the imposed persistent energy-led inflation shock. Finally, Fig. 1(d) presents the dynamics of the inflation rate. Fig. 1(d) confirms that from the mid-1990s till the GFC the inflation rate is around the 2% target set by the ECB. From the GFC till the 2022 the inflation rate is mostly below the 2% target. Given the relevance and impact of the energy crisis on the Italian economy, the inflation rate closely follows the energy inflation rate: it reaches 8.8% in 2023 before rapidly declining toward the 2% target. Again, the exceptions are Scenarios 2 and 3 where the imposed persistent energy-led inflation shock keeps the inflation rate above 5%.

Fig. 2 indicates the dynamics of government debt to GDP ratio (Fig. 2a) and the government deficit to GDP ratio (2b). Fig. 2(a) shows that from the mid-1990s the government debt to GDP ratio had been on a moderate downward trajectory, before a large increase due to the GFC first, and the Covid-19 pandemic, later. There was a small reduction in 2021, as a result of the post-Covid-19 rebound of GDP. However, after that, by 2025 all scenarios record a rise in the government debt to GDP ratio, keeping the ratio to over 140% for the foreseeable years, which is more than twice the 60% level prescribed by the Maastricht treaty. There are possibly different reasons for this outcome.

Following Domar (1944) and Pasinetti (1998), the government debt to GDP ratio rises when, ceteris paribus, the average interest rate on government debt is higher than the nominal GDP growth rate (Canelli et al., 2021, 2022). In the SFC model of Italy presented in the paper, the energy crisis and associated high levels of the inflation rate have several and possibly conflicting effects. High levels of inflation are usually associated with restrictive monetary measures, including a high policy rate, in order to curb, among other things, inflation expectations. Then, ceteris paribus, a high policy rate raises the average interest rate on government debt, hence increasing the government debt to GDP ratio. Similarly, a high policy rate negatively affects the interest rate sensitive components of aggregate demand. This, ceteris paribus, leads to a lower nominal GDP, and hence a higher government debt to GDP ratio. Finally, high levels of the inflation rate lift the price of goods and services available in the economy. This boasts the nominal value of GDP, hence lowering the government debt to GDP ratio. Under the assumption that the high policy rate effects dominate the latter nominal GDP effect, it should come as a surprise that the SFC model of this paper predicts a more dramatic rise in the government debt to GDP ratio for Scenario 2 (higher policy rate) and Scenario 3 (austerity measures depressing GDP) reaching by 2028 173% and 167%, respectively.

Fig. 2(b) reinforces the conclusion about the dynamics of the government debt to GDP ratio. Fig. 2(b) shows that the government deficit to GDP ratio first soared as a result of the Covid-19 pandemic, and then dropped significantly due to the post-Covid-19 rebound of GDP. However, by the end of the period the government deficit to GDP ratio will be twice the 3% level prescribed by the Maastricht treaty, and it will keep rising in future in all of the considered scenarios. The only exception is scenario 3 (austerity measures), which by construction was built such that Italy will be able to reach and maintain the 3% Maastricht criteria from 2024.

5. Conclusions

This paper has explored the potential long-run effects of the change in energy prices on the Italian economy. The paper has used a medium-scale, stock-flow consistent (SFC) macroeconomic model. The model has been empirically calibrated using available annual series. Four different alternative scenarios for the period 2023–2028 have been considered and compared. The main conclusion of the paper is that the surge of the inflation rate due to the energy crisis in 2022 is a serious threat for both the long-run sustainability of the government debt to GDP ratio and economic growth.

The SFC simulations show that Italy is on the verge of falling in two different economic paths. The first path is the soft landing represented by the baseline scenario. According to it, everything being equal, in the next five years Italy will experience a return to an average inflation rate of circa 2%, together with an average ECB policy rate of circa 2.5%. This low inflation and moderate ECB policy rate environment will however be characterised by an anaemic growth rate of around 1%, and dire public finance. The government debt to GDP ratio and government deficit to GDP ratio will stabilise just above the current levels at around 145% and 6%, respectively. This is twice or more the public finance levels imposed by EU rules. The EU rules were suspended in 2020 at the beginning of the Covid-19 pandemic and are now in the process of being renegotiated as part of much-debated reforms of the EU fiscal framework. Would Italy be able to secure with EU authorities a long time framework for bringing its public finance to the likely required downward path? Furthermore, what will happen if the much-feared inflation rate remain stubbornly higher than the ECB target of 2%? These two questions lead to the second likely economic path for the Italian economy.

The second path is the hard landing represented, in different ways, by Scenarios 1, 2, and 3. Scenario 1 examines the effects of a persistent inflation rate, as measured by the CPI of around 5%. This is not a particularly high level of inflation. Yet, as a result of it, Italy will face a recession and an increasing level of unemployment, together with a deterioration of the current public finance. In 2028, the economic growth rate will drop to −2.5% and the unemployment rate will be above 10%, whereas the government debt to GDP and government deficit to GDP ratios will reach levels of 159% and 8.4%, respectively. Scenario 2 explores the effects of a persistent inflation rate (like in Scenario 1), together with a robust response by ECB that keeps the policy rate at 4.5% in order to keep inflation expectations at bay. The tight monetary policy will cause an immediate and prolonged economic recession, together with a considerable deterioration of public finance. In 2028, the government debt to GDP and government deficit to GDP ratios will be 173% and 10.1%, respectively. Finally, Scenario 3 shows the effects of a tightening of the EU fiscal rules. The austerity measures introduced in order to bring the government deficit to GDP ratio to the 3% Maastricht rule will cause a severe recession. Over the next foreseeable five-year period, the economic growth rate will drop annually by circa 3% and unemployment will explode, being more than 15% by 2028. It is also worthy to recall that the hard landing path is driven by exogenous shocks, namely a persistent inflation rate (Scenario 1), a persistent inflation rate and a robust ECB policy response (Scenario 2), and austerity measures caused by a tightening of the EU fiscal rules (Scenario 3). Italian authorities will have very little policy space to respond, at least immediately, to the effects of those shocks, and yet those exogenous shocks will have very dramatic impacts on economic growth, the unemployment rate, and public finance in Italy.

In conclusion, because of its structural features and of the 2022 energy crisis, the Italian economy is on the edge of a precipice. The soft landing path will bring a low inflation environment, but at the cost of anaemic growth and dire public finance, which may trigger punitive measures by the EU authorities. The hard landing path may succeed in containing inflation from spiralling out of control (Scenarios 1 and 2) or in bringing the government deficit to GDP ratio to the 3% EU rule (Scenario 3), but at the cost of a severe recession and ballooning government debt to GDP ratio to levels never recorded before.

CRediT authorship contribution statement

Rosa Canelli: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Giuseppe Fontana:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Riccardo Realfonzo:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Marco Veronese Passarella:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

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Appendix A. Vertical constraints and consistency check

One of the most important challenges when developing an empirical stock-flow consistent model is that seldom net flows recorded by non-financial transaction series match changes in stocks as recorded by financial balance sheets (Veronese Passarella, 2019; Zezza and Zezza, 2019). This issue is usually solved by using a variable named 'other payments', which allows each sector (but one) to meet its vertical constraints, that is, to bridge the gap between observed flows and observed changes in stocks:

$$OP_f = \Delta V_f - \left(Y - I - WB - INT_f - FD_f\right) \quad (73)$$

$$OP_b = \Delta V_b - (INT_b - F_b) \quad (74)$$

$$OP_g = \Delta V_g - \left(T + F_{cb} - G - TR - INT_g\right) \quad (75)$$

$$OP_{cb} = \Delta V_{cb} \quad (76)$$

$$OP_{row} = -\left(OP_f + OP_b + OP_{cb} + OP_h + OP_g\right) \quad (77)$$

where:

$$OP_h = OP_h^0 \quad (78)$$

is estimated from observed data.

These payments are due to the fact that each sector holds other net financial assets, in addition to cash, deposits, government securities, and corporate shares.

In addition to sector-related vertical constraints, cross-sector or economy-wide horizontal constraints must be fulfilled. For this purpose, the stock of other net financial assets held by the foreign sector and total net wealth attributed to the ECB are calculated residually:

$$OA_{row} = -\left(V_f + V_b + V_{cb} + V_g + NV_h\right) \quad (79)$$

$$V_{cb} = -\left(V_f + V_b + V_{row} + V_g + V_h\right) \quad (80)$$

Notice that the stocks of other net financial assets held by each domestic sector (and the ECB) are simply defined as AR(1) processes, and they have all been exogenised in out-of-sample simulations:

$$OA_h = \lambda_{h0}^{oa} + \lambda_{h1}^{oa} \cdot OA_{h-1} \quad (81)$$

$$OA_f = \lambda_{f0}^{oa} + \lambda_{f1}^{oa} \cdot OA_{f-1} \quad (82)$$

$$OA_g = \lambda_{g0}^{oa} + \lambda_{g1}^{oa} \cdot OA_{g-1} \quad (83)$$

$$OA_b = \lambda_{b0}^{oa} + \lambda_{b1}^{oa} \cdot OA_{b-1} \quad (84)$$

$$OA_{cb} = \lambda_{cb0}^{oa} + \lambda_{cb1}^{oa} \cdot OA_{cb-1} \quad (85)$$

The model is now complete. Because of the Walras's law, there is a redundant equation, which is the equality between demand and supply of money (including cash and bank reserves):

$$H_s = H_h + H_b \quad (42B)$$

The left-had side of eq. (42B) is determined by eq. (42), whereas the right-hand side is independently defined by Eqs. (39) and (44). This condition is not included in the simulations, as it would over-determine the model. However, it can be used (along with the balance-sheet matrix and the transactions-flow matrix) to double-check the accounting consistency of model simulations over time. Fig. 3 displays the Sankey diagram of transactions and changes in stocks for Italy in 2021. It shows that each payment made by a sector is a receipt for another sector (or sectors). Similarly, each change in the stock of assets owned by a sector implies a change in the liabilities issued by another sector (or sectors). Because of the assumption that domestic output is only produced by non-financial firms, the latter represent the largest sector of the Italian economy, followed by domestic households, the government sector, and the foreign sector.

Appendix B. Tables B1 and B2

Table B1
List of coefficients.

Name	Description	Value
δ	Depreciation rate (average 1996–2019)	0.046
θ	Share of undistributed profits	0.265
ϕ	Elasticity of personal loans to consumption	0.058
μ_{b1}^h	Premium on gov. bills held by households: coefficient 1	0.793
μ_{b2}^h	Premium on gov. bills held by households: coefficient 2	0.804
μ_{l0}	Markup on loans to firms: coefficient 1	−0.014
μ_{l1}	Markup on loans to firms: coefficient 2	0.49
μ_{h0}	Markup on personal loans: coefficient 1	0.029
μ_{h1}	Markup on personal loans: coefficient 2	0.23
λ_{h0}^{oa}	Other financial assets of households: coefficient 1	134,828.967
λ_{h1}^{oa}	Other financial assets of households: coefficient 2	0.908
λ_b^b	Stock of bills held by banks: coefficient 1	0.918
τ_1^T	Average tax rate on labour incomes	0.514
τ_2^T	Average tax rate on non-labour incomes	0.061
τ_3^T	Average tax rate on wealth	0.042

(continued on next page)

Table B1 (*continued*)

Name	Description	Value
τ_1^{TR}	Transfers and benefits: auto-regressive component	1.043
τ_2^{TR}	Transfers and benefits: elasticity to unemployment rate	374,169.858
λ_B	Holdings of government bills: coefficient 1	0.903
λ_E	Holdings of shares as a ratio to total wealth	0.925
λ_c	Elasticity of cash holdings to real consumption	0.006
ρ	Reserve ratio	1.004
g_y^{row}	Foreign growth rate	0.037
exr	Exchange rate coefficient	1
r^*	Policy rate	0.019
μ_{b1}^b	Premium on government bills held by banks: coefficient 1	0.924
μ_{b2}^b	Premium on government bills held by banks: coefficient 2	0.248
μ_{b1}^{row}	Premium on government bills held by RoW: coefficient 1	0.554
μ_{b2}^{row}	Premium on government bills held by RoW: coefficient 2	0.916
ν_0	Labour productivity: autonomous component	−0.004
ν_1	Labour productivity: elasticity to real wage rate	0.397
ν_2	Labour productivity: elasticity to real output	0.183
ν_{s1}	Labour force: auto-regressive component	1.001
ν_{s2}	Labour force: elasticity to labour demand gap	0.031
ω_1	Wage growth rate: elasticity to inflation	0.009
ω_2	Wage growth rate: elasticity to unemployment rate	−0.786
p_{row}^0	Foreign price level: coefficient 1	0.207
p_{row}	Foreign price level: coefficient 2	0.959
ϵ_2^{en}	Share of energy prod. to tot. Import: elasticity to energy inflation	−0.002
ϵ_1^{en}	Share of energy prod. to tot. Import: elasticity to real output	0.013
p_{en}	Energy price coefficient	1.006
λ_{f0}^{oa}	Other financial assets/liabilities of firms: coefficient 1	16,702.341
λ_{f1}^{oa}	Other financial assets/liabilities of firms: coefficient 2	0.897
λ_{g0}^{oa}	Other financial assets/liabilities of government: coefficient 1	86,022.616
λ_{g1}^{oa}	Other financial assets/liabilities of government: coefficient 2	0.583
λ_{b0}^{oa}	Other financial assets held by banks: coefficient 1	−431,517.076
λ_{b1}^{oa}	Other financial assets held by banks: coefficient 2	0.745
λ_{cb0}^{oa}	Other financial assets held by ECB: coefficient 1	−4533.844
λ_{cb1}^{oa}	Other financial assets held by ECB: coefficient 2	1.141
α_1	Marginal propensity to consume out of real income	0.906
α_2	Marginal propensity to consume out of real wealth	0.055
σ_1	Real government spending: auto-regressive coefficient	1.01
γ_0	Real net investment: autonomous component	−117.512
γ_1	Real net investment: elasticity to output to capital ratio	138.616
ε_0	Real export: autonomous component	7.879
ε_1	Real export: elasticity to foreign income	0.512
ε_2	Real export: elasticity to relative price of export	0.08
μ_0	Real import: autonomous component	4.092
μ_1	Real import: elasticity to domestic income	0.633
μ_2	Real import: elasticity to relative price of import	−0.106
π_y^2	GDP deflator: elasticity to energy price level	0.058
π_y^1	GDP deflator: elasticity to foreign price level	0.619
π_y^3	GDP deflator: elasticity to real output	0.104
π_c^2	Consumer price index: elasticity to energy price level	0.182
π_c^1	Consumer price index: elasticity to foreign price level	0.505
π_c^3	Consumer price index: elasticity to real output	0.101
μ_{b1}	Av. premium on gov. bills: elasticity to debt to GDP ratio	0.032
μ_{b2}	Av. premium on gov. bills: elasticity to ECB's holdings	−0.079
μ_{b3}	Av. premium on gov. bills: elasticity to policy rate	−0.422

Table B2
List of assumptions (i.e., shocks) for Scenarios 1–3

	2023	2024	2025	2026	2027	2028
Scenario 1						
Energy price level (log)	+0.14	+0.14	+0.20	+0.20	+0.20	+0.10
Scenario 2						
Adjust. of average policy rate [a]	0	+100	+200	+200	+200	+200
Energy price level (log)	+0.14	+0.14	+0.20	+0.20	+0.20	+0.10
Scenario 3						
Government spending [b]	0	−47	−15	−33	−39	−40

Notes: [a] basis points; [b] billion euros. GDP and main component are calibrated such that the model generates the baseline scenario of Table 4 (based on Economic Commission predictions).

References

Agovino, M., Bartoletto, S., Garofalo, A., 2019. Modelling the relationship between energy intensity and GDP for European countries: an historical perspective (1800–2000). Energy Econ. 82, 114.

Akyildirim, E., Cepni, O., Molnár, P., Uddin, G.S., 2022. Connectedness of energy markets around the world during the COVID-19 pandemic. Energy Econ. 109, 105900.

Alberini, A., Bigano, A., 2015. How effective are energy-efficiency incentive programs? Evidence from Italian homeowners. Energy Econ. 52, S76–S85.

Apostolakis, G.N., Floros, C., Gkillas, K., Wohar, M., 2021. Financial stress, economic policy uncertainty, and oil price uncertainty. Energy Econ. 104, 105686.

Asafu-Adjaye, J., 2000. The relationship between energy consumption, energy prices and economic growth: time series evidence from Asian developing countries. Energy Econ. 22 (6), 615–625.

Aydin, M., Koc, P., Sahpaz, K.I., 2023. Investigating the EKC hypothesis with nanotechnology, renewable energy consumption, economic growth and ecological footprint in G7 countries: panel data analyses with structural breaks. Energy Sources Part B Econ. Plan. Policy 18 (1), 2163724.

Backus, D., Brainard, W.C., Smith, G., Tobin, J., 1969. A Model of U.S. Financial and Nonfinancial Economic Behavior. J. Money Credit Bank 1 (1), 15–29. https://doi.org/10.2307/1992063.

Bank of Italy, 2023. Proiezioni macroeconomiche per l'Italia. October. https://www.bancaditalia.it/pubblicazioni/bollettino-economico/2023-4/boleco-4-2023.pdf.

Barbieri Hermitte, R., Cagnazzo, A., Favero, C.A., Felici, F., Macauda, V., Nucci, F., Tegami, C., 2022. ITFIN: A Stock-flow consistent model for the Italian economy. In: Analisi e Ricerca Economico Finanziaria. Ministry of Economy and Finance. Working Papers 4.

Bardazzi, R., Pazienza, M.G., 2017. Switch off the light, please! Energy use, aging population and consumption habits. Energy Econ. 65, 161–171.

Bardazzi, R., Oropallo, F., Pazienza, M.G., 2015. Do manufacturing firms react to energy prices? Evidence from Italy. Energy Econ. 49, 168–181.

Battiston, S., Dafermos, Y., Monasterolo, I., 2021. Climate risks and financial stability. J. Financ. Stab. 54, 100867.

Berg, M., Hartley, B., Richters, O., 2015. A Stock-flow consistent input-output model with applications to energy Price shocks, interest rates, and heat emissions. New J. Phys. 17 (1), 1–21.

Bezemer, D.J., 2010. Understanding financial crisis through accounting models. Acc. Organ. Soc. 35 (7), 676–688.

Bonaldo, C., Caporin, M., Fontini, F., 2022. The relationship between day-ahead and future prices in electricity markets: an empirical analysis on Italy, France, Germany, and Switzerland. Energy Econ. 110, 105977.

Botta, A., Caverzasi, E., Russo, A., Gallegati, M., Stiglitz, J.E., 2021. Inequality and finance in a rent economy. J. Econ. Behav. Organ. 183, 998–1029.

Bovari, E., Giraud, G., Mc Isaac, F., 2018. Carbon pricing and global warming: a Stock-flow consistent macro-dynamic approach. AFD Res. Pap. Ser. 2018-65 (January), 29.

Brainard, W.C., Tobin, J., 1968. Pitfalls in financial model building. Am. Econ. Rev. 58 (2), 99–122.

Burgess, S., Burrows, O., Godin, A., Kinsella, S., Millard, S., 2016. A Dynamic Model of Financial Balances for the United Kingdom, Bank of England. Working Papers 614.

Caiani, A., Godin, A., Caverzasi, E., Gallegati, M., Kinsella, S., Stiglitz, J.E., 2016. Agent based-Stock flow consistent macroeconomics: towards a benchmark model. J. Econ. Dyn. Control. 69, 375–408.

Campagnolo, L., De Cian, E., 2022. Distributional consequences of climate change impacts on residential energy demand across Italian households. Energy Econ. 110, 106020.

Canelli, R., Fontana, G., Realfonzo, R., Veronese Passarella, M., 2021. Are EU policies effective to tackle the Covid-19 crisis? The case of Italy. Rev. Polit. Econ. 33 (3), 432–461.

Canelli, R., Fontana, G., Realfonzo, R., Veronese Passarella, M., 2022. Is the Italian government debt sustainable? Scenarios after the Covid-19 shock. Camb. J. Econ. 46 (3), 581–587.

Cardaci, A., Saraceno, F., 2016. Inequality, financialisation and credit booms-a model of two crises (No. 2016/2). LUISS School of European Political Economy.

Caverzasi, E., Godin, A., 2015. Post-Keynesian Stock-flow-consistent modelling: a survey. Camb. J. Econ. 39 (1), 157–187.

Concettini, S., Creti, A., Gualdi, S., 2022. Assessing the regional redistributive effect of renewable power production through a spot market algorithm simulator: the case of Italy. Energy Econ. 114, 106225.

Copeland, M.A., 1949. Social accounting for money flows. Account. Rev. 24 (3), 254–264.

Cripps, F., Godley, W., 1976. A formal analysis of the Cambridge economic policy group model. Economica 43 (172), 335–348.

Cripps, F., Godley, W., 1978. Control of imports as a means to full employment and the expansion of world trade: the UK's case. Camb. J. Econ. 2 (3), 327–334.

Cripps, F., Lavoie, M., 2017. Wynne Godley (1926–2010). In: Cord, R. (Ed.), The Palgrave Companion to Cambridge Economics. Palgrave Macmillan, Basingstoke, UK.

Cripps, F., Godley, W., Fetherston, M., 1976. What Is Left of" New Cambridge"?. Economic Policy Review. Department of Applied Economics, University of Cambridge.

Cusbert, T., Kendall, E., 2018. Meet MARTIN, the RBA's new macroeconomic model. Aust. Reserve Bank Bull. 31–44.

Dafermos, Y., Nikolaidi, M., Galanis, G., 2017. A Stock-flow-fund ecological macroeconomic model. Ecol. Econ. 131, 191–207.

Dafermos, Y., Nikolaidi, M., Galanis, G., 2018. Climate change, financial stability and monetary policy. Ecol. Econ. 152, 219–234.

De Siano, R., Sapio, A., 2022. Spatial merit order effects of renewables in the Italian power exchange. Energy Econ. 108, 105827.

Domar, E.D., 1944. The "burden of the debt" and the national income. Am. Econ. Rev. 34 (4), 798–827.

Elsayed, A.H., Hammoudeh, S., Sousa, R.M., 2021. Inflation synchronization among the G7and China: the important role of oil inflation. Energy Econ. 100, 105332.

European Commission, 2023. Economic Forecast for Italy. November. https://economy-finance.ec.europa.eu/economic-surveillance-eu-economies/italy/economic-forecast-italy_en.

Eurostat, 2023. Euroindicators. Provision of Deficit and Debt Data for 2022. https://ec.europa.eu/eurostat/documents/2995521/17724161/2-23102023-AP-EN.pdf/307ffc6e-1bd7-0dbe-337b-7a85645c8e35.

Fontana, G., Palacio-Vera, A., 2007. Are long-run price stability and short-run output stabilization all that monetary policy can aim for? Metroeconomica 58 (2), 269–298.

Fontana, G., Veronese Passarella, M., 2018. The role of commercial banks and financial intermediaries in the new consensus macroeconomics (NCM): A preliminary and critical appraisal of old and new models. In: Arestis, P. (Ed.), Alternative Approaches in Macroeconomics: Essays in Honour of John McCombie. Palgrave Macmillan, Basingstoke, pp. 77–103.

Giordano, C., Tosti, E., 2022. An Assessment of Italy's Energy Trade Balance. Bank of Italy Occasional papers, June, no. 696.

Godley, W., 1999. Seven Unsustainable Processes: Medium-Term Prospects and Policies for the United States and the World. Strategic Analysis. Levy Economics Institute of Bard College, Annandale-on-Hudson, NY. January.

Godley, W., Cripps, F.T., 1974. Demand, inflation and economic policy. Lond. Cambridge Econ. Bull. 84 (1), 22–23.

Godley, W., Cripps, F.T., 1983. Macroeconomics. Oxford University Press, Oxford.

Godley, W., Lavoie, M., 2007. Monetary Economics: An Integrated Approach to Credit, Money, Income, Production and Wealth. Palgrave Macmillan, New York.

Godley, W., Zezza, G., 1992. A simple stock flow model of the Danish economy. In: Themes in modern macroeconomics. Palgrave Macmillan UK, London, pp. 140–179.

Godley, W., Papadimitriou, D.B., Hannsgen, G., Zezza, G., 2007 November. The U.S. Economy: Is There a Way out of the Woods?. Strategic Analysis. Levy Economics Institute, Annandale-on-Hudson, NY.

Goodhart, C., Pradhan, M., 2020. The Great Demographic Reversal: Ageing Societies, Waning Inequality, and an Inflation Revival. Palgrave Macmillan, London, UK.

Guaita, N., Michelena, G., 2019. Implementando un modelo Stock-Flujo Consistente para la economía argentina. Documento de trabajo de la Secretaría para la Transformación Productiva del Ministerio de Producción. Ministerio de Producción, Buenos Aires.

Halicioglu, F., 2009. An econometric study of CO2 emissions, energy consumption, income and foreign trade in Turkey. Energy Policy 37 (3), 1156–1164.

IMF, 2023a. Italy 2023, Article IV Consultation-Press Release, Country Report No. 2023/273. July. https://www.imf.org/en/Publications/CR/Issues/2023/07/25/Italy-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-the-536910.

IMF, 2023b. World Economic Outlook International Monetary Fund. Navigating global divergences, October. https://www.imf.org/en/Publications/WEO/Issues/2023/10/10/world-economic-outlook-october-2023.

ISTAT, 2023. Le prospettive per l'economia italiana nel 2023–2024. December. https://www.istat.it/it/files//2023/12/Prospettive-per-economia-italiana-5-dicembre-2023.pdf.

Jackson, T., Victor, P.A., 2015. Does credit create a 'growth imperative? A quasi-stationary economy with interest-bearing debt. Ecol. Econ. 120, 32–48.

Kaldor, N., 1961. Capital accumulation and economic growth. In: The Theory of capital: proceedings of a conference held by the International Economic Association. Palgrave Macmillan, London,UK.

Kaldor, N., 1978. Further Essays on Applied Economics. London, Duckworth.

Kinsella, S., Tiou-Tagba Aliti, G., 2012. Towards a Stock Flow Consistent Model for Ireland. https://ssrn.com/abstract=2011462.

Krugman, P., 2018. Good enough for government work? Macroeconomics since the crisis. Oxf. Rev. Econ. Policy 34 (1–2), 156–168.

Lee, C.C., Chien, M.S., 2010. Dynamic modelling of energy consumption, capital stock, and real income in G-7 countries. Energy Econ. 32 (3), 564–581.

Magazzino, C., Mutascu, M., Mele, M., Sarkodie, S.A., 2021. Energy consumption and economic growth in Italy: a wavelet analysis. Energy Rep. 7, 1520–1528.

Mankiw, N.G., 2006. The macroeconomist as scientist and engineer. J. Econ. Perspect. 20 (4), 29–46.

Michelena, G., Capobianco, S., Mastronardi, L., Vila, J., 2017. Estimación de una matriz de contabilidad social para argentina 2015 con desagregación exhaustiva de los sectores energéticos. Technical report. Ministerio de Producción, Buenos Aires.

Miess, M.G., Schmelzer, S., 2016a. Stock–flow consistent modelling of real-financial cycles and balance sheet dynamics. In: Paper Presented at the 13th EUROFRAME Conference, Utrecht, Netherlands. June, 10.

Miess, M., Schmelzer, S., 2016b. Extension of the Empirical Stock-Flow Consistent (SFC) Model for Austria: Implementation of Several Asset Classes, a Detailed Tax System and Exploratory Scenarios. Final Report, Study Commissioned by the Austrian Chamber of Labour, Vienna. https://irihs.ihs.ac.at/id/eprint/4135/1/Report_MiessSchmelzer_SFCfinal.pdf.

Monasterolo, I., Raberto, M., 2018. The EIRIN flow-of-funds Behavioural model of green fiscal policies and green sovereign bonds. Ecol. Econ. 144, 228–243.

NADEF, 2023. Nota di aggiornamento del Documento di Economia e Finanza. September. https://www.dt.mef.gov.it/export/sites/sitodt/modules/documenti_it/analisi_progammazione/documenti_programmatici/nadef_2023/NADEF-2023.pdf.

Naqvi, A., 2015. Modeling Growth, Distribution, and the Environment in a Stock-Flow Consistent Framework. Institute for Ecological Economics Working Paper 2/2015, p. 30.

Nikiforos, M., Zezza, G., 2017. Stock-flow consistent macroeconomic models: a survey. J. Econ. Surv. 31 (5), 1204–1239.

OEDC, 2023. Restoring growth, OECD Economic Outlook, Volume 2023 Issue 2. November. https://www.oecd.org/economic-outlook/november-2023/.

Papadimitriou, D.B., Nikiforos, M., Zezza, G., 2013a. The Greek Economic Crisis and the Experience of Austerity: A Strategic Analysis. Levy Economics Institute, July, Strategic Analysis, Annandale-on-Hudson, NY.

Papadimitriou, D.B., Nikiforos, M., Zezza, G., 2013b. A Levy Institute Model for Greece. Levy Economics Institute Technical Report. Levy Economics Institute of Bard College, Annandale-on-Hudson, NY. May.

Papadimitriou, D.B., Zezza, F., Zezza, G., 2020a. When Will Italy Recover?, Strategic Analysis. Levy Economics Institute of Bard College, October, Annandale-on-Hudson, NY.

Papadimitriou, D.B., Nikiforos, M., Zezza, G., 2020b. Prospects and Challenges for the US Economy: 2020 and Beyond. Strategic Analysis. Levy Economics Institute of Bard College, Annandale-on-Hudson, NY. January.

Pasinetti, L., 1998. The myth (or folly) of the 3% deficit/GDP Maastricht "parameter". Camb. J. Econ. 22 (1), 103–116.

Pierros, C., 2020. Income distribution, structural competitiveness and financial fragility of the Greek economy. Int. Rev. Appl. Econ. 34 (1), 50–74.

Ponta, L., Raberto, M., Teglio, A., Cincotti, S., 2018. An agent-based stock-flow consistent model of the sustainable transition in the energy sector. Ecol. Econ. 145, 274–300.

Prontera, A., 2024. Winter is coming: Russian gas, Italy and the post-war European politics of energy security. West Eur. Polit. 47 (2), 382–407.

Prontera, A., Lizzi, R., 2023. The necessary reorientation of Italian energy policy. Contemp. Ital. Politics 15 (2), 252–268.

Romer, P., 2016. The trouble with macroeconomics. Available at. https://paulromer.net/the-trouble-with-macro/WP-Trouble.pdf.

Solow, R., 2008. The state of macroeconomics. J. Econ. Perspect. 22 (1), 243–246.

Soytas, U., Sari, R., 2003. Energy consumption and GDP: causality relationship in G-7 countries and emerging markets. Energy Econ. 25 (1), 33–37.

Stock, J.H., Watson, M.W., 1999. Forecasting inflation. J. Monet. Econ. 44 (2), 293–335.

Stock, J.H., Watson, M.W., 2007. Why has US inflation become harder to forecast? J. Money Credit Bank. 39 (1), 3–33.

Sylos-Labini, P., 1983. Factors affecting changes in productivity. Journal of Post Keynesian Economics 6 (2), 161–179.

Szczygielski, J.J., Brzeszczyński, J., Charteris, A., Bwanya, P.R., 2022. The COVID-19 storm and the energy sector: the impact and role of uncertainty. Energy Econ. 109, 105258.

Tobin, J., 1969. A general equilibrium approach to monetary analysis. J. Money Credit Bank. 1 (1), 15–29. https://doi.org/10.2307/1991374.

Tobin, J., 1982. Money and finance in the macroeconomic process. J. Money Credit Bank. 14 (2), 171–2014. https://doi.org/10.2307/1991638.

Valdecantos, S., 2020. Argentina's (Macroeconomic?) Trap. Some Insights from an Empirical Stock-Flow Consistent Model. Levy Institute Working Paper No. 975. Levy Economics Institute of Bard College, Annandale-on- Hudson, NY.

Verdoorn, P.J., 1980. Verdoorn's law in retrospect: A comment. Econ. J. 90 (358), 382–385.

Veronese Passarella, M., 2019. From abstract to concrete: some tips for developing an empirical stock–flow consistent model. Eur. J. Econ. Econ. Pol. Intervent. 16 (1), 55–93.

Wren-Lewis, S., 2018. Ending the microfoundations hegemony. Oxf. Rev. Econ. Policy 34 (1–2), 55–69.

Xu, D., Sheraz, M., Hassan, A., Sinha, A., Ullah, S., 2022. Financial development, renewable energy and CO2 emission in G7 countries: new evidence from non-linear and asymmetric analysis. Energy Econ. 109, 105994.

Xue, C., Shahbaz, M., Ahmed, Z., Ahmad, M., Sinha, A., 2022. Clean energy consumption, economic growth, and environmental sustainability: what is the role of economic policy uncertainty? Renew. Energy 184, 899–907.

Yajima, G.T., 2021. The Employer of Last Resort Scheme and the Energy Transition: A Stock-Flow Consistent Analysis. Levy Economics Institute. Working Papers Series.

Zachariadis, T., 2007. Exploring the relationship between energy use and economic growth with bivariate models: new evidence from G-7 countries. Energy Econ. 29 (6), 1233–1253.

Zezza, G., 2009. Fiscal policy and the economics of financial balances. Eur. J. Econ. Econ. Pol. Intervent. 6 (2), 289–310.

Zezza, F., 2018. Stock–Flow Consistent Macroeconomic Models: Theory, Practice and Application. PhD Thesis. University of Siena.

Zezza, G., Zezza, F., 2019. On the design of empirical stock–flow consistent models. Eur. J. Econ. Econ. Pol. Intervent. 16 (1), 134–158.

Zezza, F., Zezza, G., 2020. A Stock-Flow Consistent Quarterly Model of the Italian Economy. Levy Institute Working Paper No. 958. Levy Economics Institute of Bard College, Annandale-on-Hudson, NY.

Zhang, D., Mohsin, M., Rasheed, A.K., Chang, Y., Taghizadeh-Hesary, F., 2021. Public spending and green economic growth in BRI region: mediating role of green finance. Energy Policy 153, 112256.