Stock-Flow Consistent Macroeconomic Models: *Theory, Practice and Applications*

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To my Father,
my Mentor, Guide and Inspiration

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Contents

List of Figures

List of Tables

Introduction

The Great Recession made even clearer the need for a deep reassessment of the economic profession. Mainstream macroeconomic models (both DSGE and CGE types) failed at predicting both the financial crash and the effects of the policies put in place afterwards, in particular with respect to the effects of austerity and the increase of Financial Fragility. Broadly speaking, this was so because of the absence, in most of these models, of relevant aspects of the existing economic systems.

In particular, endogenous growth models suffer from major shortcomings: i.e., General *Equilibrium* framework, unreliable/untestable micro-foundations, not *really* endogenous growth models, no *real* endogenous money, no clear treatment of banks and of financial sector (and so on). In a period that has been labeled as "Financialization" (Stockhammer, 2012), where the role and power of the financial sector has increased exponentially (which has contributed to the huge rise in income and wealth inequality highlighted by the works of Piketty and Saez (2010)), while the rest of the economy is facing "Secular Stagnation" (i.e. declining growth rates since the late 80s for output, productivity, wages), not to treat these issues means missing a big part of the picture.

However, there are alternatives. Stock-Flow Consistent (SFC henceforth) macroeconomic models, in turn, *do* pay a lot of attention to the financial side of the system and on the interdependencies that connect the balance sheets of the various institutional sectors to their *real* transactions in a monetary production economy. This, coupled with the fact that there has been a wide recognition, from both the press and academics (Chancellor, 2010; Wolf, 2012; Schlefer, 2013; Bezemer, 2010), that Godley and applied models based on the SFC approach have been between the few that correctly predicted both the 2001 and the 2007-08 crisis (Godley, 1999; Godley et al. (2007)), caused a renewed interest in the approach in both its theoretical and empirical aspects, being it the perfect roof to host various heterodox views and to discuss how modern capitalist financialized systems works.

The aim of this work is threefold.

The first, carried out in Part I, is to provide an overview of the SFC approach to macroeconomic modelling from a theoretical/methodological perspective. In this regard, in Chapter 1 we present a SFC neo-Kaleckian Supermultiplier model that deals with the dynamics of government Deficits and Debt within a five-sector closed-economy with three types of assets. After discussing the structure of the model, the second part of the Chapter provides a methodological discussion of how the current SFC literature deals with these models. In particular, this is done by solving the model using the two different approaches (Marshall-Keynes vs Godley-Lavoie) and comparing the results. We will then present, in Chapter 2, Godely's Financial Balances model and discuss the Fundamental Identity and, more generally, how the SFC literature deals with Open Economy issues.

The second, dealt with in Part II , is how to make the step from a theoretical to an empirical model. Chapter 3 and 4 are indeed devoted to show how to build an applied SFC Macroeconomic Model, starting from the appropriate data sources, and how to deal with all the technical and practical issues that emerges when dealing with such models. We will guide the reader through all the steps needed to build a sound accounting structure, in Chapter 3, while Chapter 4 describes how to reconcile Stocks&Flows.

Finally, in Part III, we will show some application of the model developed in previous Chapters for forecasting the effects of Monetary and Fiscal economic policies over the medium-run. Contrary to the standard macroeconometric models, our SFC framework will make sure that all relevant real-financial connections would not get lost, to possibly detect increasing financial fragility and better evaluate the *system wide* effects of different regimes. In Chapter 5, we will report the full model developed in the Second Part of the work, "close" the Financial Accounts for each sector, defining the buffer stocks for each asset class and sector and, finally, detail the estimation of the stochastic equations of the model. We will close this work in Chapter 6, where we will perform some Economic Policy simulation on our model, to ascertain the effect and outcomes of different expansionary fiscal policies, the interest rate transmission mechanism and, more generally, the system-wide effect on growth, distribution and Financial Stability.

Part I

Theory

Chapter 1

An *Intrinsically Dynamic* SFC Neo-Kaleckian Growth Model: *Contrasting Modeling Approaches*

This work builds upon the new strand of post-Keynesian Kaleckian Growth and Distribution Supermultiplier models. The aim of the paper is twofold. The first is to present a *fully coherent* Stock-Flow Consistent post-Keynesian Kaleckian Supermultiplier model and expose the novelties of the model with respect to standard post-Keynesian Growth & Distribution literature. The second task, then, is to solve the model applying the two main different methodological approaches used in the literature, the comparative-dynamics (Keynes-Marshall) and the dynamic simulations (Godley-Lavoie), and compare the differences on model behavior. While the long-run positions identified by the two models may well be similar, the *traverse* towards them will be different, in terms of both modeling and exercises one can do with them. This will allow us to shed light on the relative merits (and drawbacks) of the two approaches and to implement the discussion between heterodox economists on a topic which is of the utmost importance in terms of both theory and policy making.

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1.1 Introduction

The Great Recession reminded the economic profession how active fiscal policies and Big Government are of primary importance for *Stabilizing an Unstable Economy* (Minsky, (1986)). The evident failure of New Consensus Macroeconomics and its economic policies in the management of the Crisis, in particular in the Eurozone, with its reliance on monetary policy interventions combined with fiscal austerity, is overwhelming. We wish to contribute to finding an alternative using a methodology that can be accepted by researchers from different traditions. But how shall this alternative look like?

In his Nobel Prize lecture (1982), James Tobin delineates the main features needed to properly construct the framework of a macroeconomic model:

1. Tracking of stocks and precision regarding time;
2. several assets and rates of return;
3. modeling of financial and monetary policy operations;
4. the *budget constraint* and the *adding-up constraint*.

Feature one states that one has to adopt a stock-flow coherent modeling. While (current) flows imply (end of period) stocks (e.g. positive saving implies an increase in net wealth), is also true that (end of previous period) stocks feed back on (current) flows (e.g. higher debt implies higher future interest payments; higher wealth allows for higher spending etc.). This implies, as Turnovsky pointed out, the existence of intrinsic dynamics reflecting "the dynamic behavior stemming from certain logical relationships which constrain the system; specifically the relationships between stocks and flows" (Turnovsky, 1977:3). The short-run determination of macroeconomic variables is thus just a photogram of the movie representing the dynamic process of growth.

Feature two and three, claiming that there must be several assets and rates of return and that the monetary and financial operations shall be made explicit, is self-explanatory. In an economic environment which has been labeled Finance Dominated accumulation regime (Stockhammer, 2012), the neglect in theoretical and applied models of a complex financial system interacting with the production sectors and the related monetary operations would imply, nowadays, to miss a big portion of the overall picture.

Finally, there is feature four. That agents must respect their budget constraints means that "everything comes from somewhere and goes somewhere" (Godley and Lavoie, 2007:6). As stated by Godley and Cripps, "the fact that money stocks and flows must satisfy accounting identities in individual budgets and in an economy as a whole provides a fundamental law of macroeconomics analogous to the principle of conservation of energy in physics" (Godley and Cripps, 1983:18), i.e. there cannot be any *black hole* in the model structure.

To find the first proponents of a Stock-Flow Consistent (SFC from now on) approach[1] to macroeconomics one has to go back to the 70s and 80s. Broadly speaking, there were two major schools of thought, the New Haven School (Tobin, 1982) and the New Cambridge School (Godley and Cripps, 1983), both of which have been using and advocating SFC models independently, the former for analyzing portfolio choices from a neoclassical standpoint, the latter for forecasting the sustainability of macroeconomic policies from an heterodox one. Needless to say, agreement on the method does not imply agreement on the model. Different closures and causalities, indeed, will bear different results on the model behavior. Alongside these authors, also worth mentioning are the major individual contribution to the approach of Turnovsky (1977) and Fair (1984). Both schools faded in the 80s due to lack of financing, but there has been a revival of interest for the approach.

1.1.1 Demand-led Heterodox growth models: Integrating neo-Kaleckian, SFC and Sraffian Supermultiplier models

Inside the heterodox camp, post-Keynesian Kaleckian (PKK from now on) models have always focused on the stabilizing role of fiscal policy, government deficits and debt as fundamental policy tools in both medium and long-run (Arestis 2013, Hein and Stockhammer 2011, Lavoie 2014, Lavoie and Stockhammer 2013, Setterfield 2007). However, these models, and especially the literature following the work of Bhaduri and Marglin (1990), have been criticized by a number of heterodox economists as not *really* being growth models suitable for long-run analysis on various grounds: from not tackling Harrodian instability adequately, to the absence of an autonomous growth component determining long-run positions and the lack of appropriate dynamics in the theoretical structure (see Dos Santos and Macedo e Silva 2009, Pariboni 2015, Shaikh 2016 and Skott 2008, among others).

As we mentioned, in recent years there has been a renewed interest in the heterodox field over the Stock-Flow Consistent (SFC from now on) approach to macroeconomic modeling[2], in particular after the major contribution of Godley and Lavoie (2007) who provided a detailed account of the SFC approach to modeling economic system as a whole within a coherent SFC framework, more on which will be said later. These models are institutionally rich, and provide a detailed account of the real-financial interactions of the economic system in a dynamic framework. However, complexity comes at a cost. The problem with the Godley-Lavoie SFC approach is, in a nutshell, that these models "tend to be somewhat labyrinthine, [since] the urge for realism has fostered the development of very large models that can only be analyzed with relatively complex computer simulations" (Dos Santos and Macedo e Silva, 2009:2). Moeover, "some of the results could be, and in many cases certainly are, sensitive to the values taken by

[1]For a comprehensive survey on the SFC method, history and applications, see Dos Santos (2006), Godin and Caverzasi (2015) and Nikiforos and Zezza (2017a).

[2]See Dos Santos (2005), Dos Santos and Zezza (2008), Foley and Taylor (2006), Godley and Lavoie (2007), Lavoie and Godley (2001-2002), Taylor (2004) and Zezza and Dos Santos (2004), among others.

the assumed parameters" (Lavoie, 2008:2) and, finally, their "inner complexity" (Dos Santos and Macedo e Silva, 2009:8) has made the diffusion of the approach and the discussion among heterodox people of different persuasions less fruitful. However, there have been various efforts to integrate the SFC approach to the standard PKK models of growth and distribution.

On the European side, a first integration of the SFC framework to the standard post-Keynesian Kaleckian models has been conducted by Hein (2008, 2014), who "systematically introduced a monetary interest rate, credit and debt finance step by step into the basic post-Keynesian distribution and growth models" (Hein, 2014:338). On the other shore of the Atlantic, in turn, the first to integrate SFC and PKK models were Godley and Lavoie themselves (2001-2002; 2007, ch. 11) and Taylor (2004, ch. 8). Finally, Dos Santos and Zezza (2008, DSZ from now on) presented a simplified version of Lavoie and Godley (2001) which was intended to provide a "benchmark" SFC Kaleckian model. However, the DSZ model was still far too distant in structure from the "standard" PKK Growth and Distribution model[3], thus making a direct comparison tricky, to say the least.

Albeit the integration of the standard PKK models within a SFC structure improved their complexity and consistency, however, most of these models still suffered from the same theoretical critiques of their predecessors. As Harrod (1939) showed long ago, deviations of the steady growth path from the warranted one, generated by reactions of firms to discrepancies between the actual and normal rate of capacity utilization, would be self-reinforcing, generating instability[4]. Since it is the rate of utilization that adjusts, some Sraffians says, it can well be that in the long run this is lower (or higher) than the *normal* or desired one, which would imply an ever decreasing (or increasing) accumulation rate that would lead back to Harrod instability problem.

In the mid-90s, indeed, some authors (Serrano, 1995 and Bortis, 1997) proposed, as an alternative to the PKK model, the *Sraffian Supermultiplier*. The claim was that the so called Keynesian Hypothesis[5], which was traditionally justified through the endogeneity of either the rate of utilization (as in Kaleckian models) or income distribution (as in Cambridge models of the 60s), could be sustained instead with the endogeneity, this time, of the share in GDP of an autonomous component of aggregate expenditure. The Sraffian Supermultiplier, thus, allowed to reconcile both an exogenous distribution and the Keynesian Hypothesis, but also overcome the *Harrodian instability* puzzle through the trend towards normal rates of capacity utilization, as Cesaratto (2015) correctly pointed out. Still, as highlighted by Lavoie (2010b), these models lacked finacial complexity, having usually only two or three sectors and only dealing, *at most*, with two kinds of stocks (capital and government debt), in contrast to the now widespread PKK models of financialization, not to mention the SFC models of the Godley-Lavoie type.

[3] As can be found in Lavoie (2014) or Hein (2014), for example.

[4] See Nikiforos 2013, 2016 for a discussion of the rate of utilization over the long-run.

[5] "In the long period, in which productive capacity changes, no less than in the short period analyzed by Keynes, it is an independently determined level of investment that generates the corresponding amount of savings" (Garegnani, 1992:47).

Starting with Allain (2015), there has been a recovered concern in the integration of the Supermultiplier within a post-Keynesian Kaleckian framework, in order to overcome the critiques coming from both sides. This new line of research has been fostered by the successive works of Dutt (2015), Freitas and Serrano (2015), Hein (2016), Lavoie (2016), Nah and Lavoie (2016) and Riccardo Pariboni (2015). Both Allain (2014) and Lavoie (2016) have shown that in these models not only Harrodian instability will be tamed, but also the main features of the Kaleckian model, the Paradoxes of Saving and Costs, remain valid in terms of level effects in the long-run.

In a similar vein, Hein (2016) proposed a simple SFC neo-Kaleckian supermultiplier model with an autonomous growth component which tackles both debt dynamics and distribution issues. Albeit not addressing Harrodian instability[6], this model represents, as far as we know, the most complex attempt in terms of interactions between the real and financial sides of the economy within this new line of PKK Supermultiplier models. Only Dutt (2015), indeed, also tackles government debt dynamics (but not firms equities), while the models from Allain (2014), Freitas and Serrano (2015), Lavoie (2016) and Nah and Lavoie (2016) are mainly flow models[7].

However, a closer look at Hein's (2016) model reveals that feature (1) of Tobin's list is not completely satisfied, for two orders of reason. First, the omission of a consumption out of wealth component in the (implied) consumption function takes in part away the *intrinsic dynamics* of the system behavior (the feed backs of stocks on flows) which are crucial for equilibrium determination. Secondly, all models in this new line of research adopt what we may label as the standard Marshall-Keynes method to proceed in the analysis, more on which will be said later[8].

The aim of this work, hence, is twofold. The first is to build a fully coherent SFC PKK Supermultiplier model structure, using a modified version of Hein (2016). Secondly, we will apply the two different modeling approaches (Marshall-Keynes vs Godley-Lavoie) on the common SFC structure and compare the related results with respect to both debt and distribution dynamics. This will allow us to shed light on the relative merits (and drawbacks) of the two approaches and to implement the discussion between heterodox economists on a topic which is of the utmost importance in terms of both theory and policy making.

The rest of the work will be organized as follows. In Section 2, we will describe the common structure of the model, presenting the related Balance

[6] Hein uses indeed, as we do here, a simple Neo-Kaleckian investment function, assuming that "the target or normal rate of capacity utilization is either not precisely defined in a world dominated by Keynesian fundamental uncertainty or that there are forces at work which adjust the normal rate of utilization to the actual rate in the medium to long run" (Hein, 2016:3-4).

[7] With the lack of financial complexity of this second group of models being somewhat counterbalanced by the presence of an Harrodian investment function instead.

[8] In a more recent version of his work, Hein extends the model to include consumption out of wealth.

Sheet and Transaction-Flow matrices, which records the stocks and flows of the economic system studied. In Section 3, after a brief introduction on the Marshall-Keynes methodology, we will solve the model for the short, medium and long-run, and discuss the stability of the system and the dynamics of government debt and deficits alongside with functional distribution. In Section 4 we will, first, present the SFC approach of Godley-Lavoie and, second, provide solutions and simulations for the respective equilibria and discuss the related stability and dynamics. Finally, Section 5 concludes.

1.2 Structure of the Model

The economy assumed here is a standard neo-Kaleckian closed economy model[9] with a private sector made up of workers, rentiers and firms, the latter producing a single good using labor and (non-depreciating) capital stock with a fixed coefficient technology, and the government. Firms operate in monopolistic markets where they set prices as a mark-up on unit labor cost, which are thought to be constant up to full capacity. The mark-up is determined by the degree of price competition in the goods market and the bargaining power of labor unions and are exogenously given (as in Kalecki, 2013). Hence, prices are inelastic with respect to demand and, thus, changes in demand are accommodated by changes in output through changes in the rate of capacity utilization. Given this, the price level may then be treated as constant.

We start with the description of the sectoral balance sheet of the model economy, which depicts the opening stocks of asset (+) and liabilities (-) of the different sectors at some given point of time. Reading each column, the sum of all components represents the net worth of the sector, so that by entering it with a negative signs must yield a zero result.

Table 1.1: Balance Sheet Matrix

	Households				
	Workers	Rentiers	Firms	Gvt	Tot
Bonds		+L		-L	0
Equities		+E	-E		0
Capital			+K		K
Net Wealth		-NW_h	NW_f=0	+NW_g	K
Tot	0	0	0	0	

In Table 1.1, several simplifying assumption are made. Workers do not save while rentiers households hold their wealth (NW_h) in the form of government bonds (L) and equities issued by firms (E). All profits are distributed so the net worth of firms is nil ($NW_f = 0$). Moreover, final finance of investment and the capital stock only consist of issued equities ($K = E$). Regarding the government sector, we will work with the case in which the government is in debt ($NW_g > 0$). We will assume that government expenditures are financed

[9]For a comprehensive account of Kaleckian growth and distribution models, see Hein (2014).

by debt emissions, with the interest rate (i) being under control of the C.B. and assumed to be constant.

Table 1.2 describes the "current transaction flows" associated with the stocks above.

Table 1.2: Transaction-Flow Matrix

	Households		Firms			
	Workers	Rentiers	CA	KA	Gov	Tot
Cons	$-C_w$	$-C_r$	$+C_T = C_w + C_r$			0
Inv			$+I$	$-I$		0
Gov Exp			+G		-G	0
Wages	$+W$		$-W$			0
Profits		$+P$	$-P$			0
Interest Income		$+iL_{t-1}$			$-iL_{t-1}$	0
=Savings	0	S_r	0	$-I$	$-S_g$	0
Flow of Funds						
dL		$-dL$			$+dL$	0
dE		$-dE$		$+dE$		0
Total	0	0	0	0	0	0

Starting with the upper part of the matrix, workers receive wages (W) from firms and spend it entirely for consumption ($C_w = W$). Rentiers receive profits (P) from firms and interest on the accumulated stock of government bonds (iL_{t-1}) held at beginning of the production period, i.e. at time t-1, and consume a fraction of their (lagged) wealth according to their propensity. Firms obtain profits as the difference between the value of sales ($C_T + I + G$) and wages paid to workers. The government, in turn, buys goods and services from firms and pays out interest to households. As it is clear, in this system every money flow has to "come from somewhere and go somewhere" (Godley, 1999), which is reflected in the fact that all rows in table 2 sum to zero. Moreover, it is worth mentioning that firms investment in real capital implies a change in their assets, thus entering as a *capital* transaction. However, to get the values for the end of period stocks, we need to take into account the changes in the financial positions of the various sectors which take place during the production period.

While the upper part of Table 1.2 shows that beginning of period stock affects income flows, "it is also true that saving flows and capital gains *necessarily affect end of period stocks*, which, in turn, will affect next period's income flows" (DSZ, 2007:7, emphasis added). This *intrinsic SFC dynamics* is shown in the lower part of Table 1.2, which describes the Flows of Funds in the economy. If households save (i.e. they have positive S_r), this necessarily imply a change in their financial holdings (dL and dE). In turn, firms investment are financed by equity emissions ($dE = dK$) while government debt increases (dL) to cover the sum (S_g) of government expenditures and interest payments on the stock of debt.

It is thus the sum of the *flows* in Table 1.2, given the *inherited stocks* in Table 1.1, that determines the *end of period stocks.*

From the first two columns of Table 1.2, we get total disposable income (Y) as the sum of income from production (Y_P), i.e. the sum of wages (W) and profits (P), and financial income (Y_F), i.e. the flow of interest payments on the accumulated stock of debt (iL_{t-1}):

$$Y = Y_P + Y_F = W + P + iL_{t-1}. \tag{1.1}$$

The share of profits in production, determined by firms mark-up pricing and treated as exogenous, is:

$$h = \frac{P}{Y_P}. \tag{1.2}$$

The financial income/production income ratio is:

$$\Psi = \frac{Y_F}{Y_P} = \frac{iL_{t-1}}{Y_P} = \frac{iL_{t-1}/K_{t-1}}{Y_P/K_{t-1}} = \frac{i\lambda}{u}, \tag{1.3}$$

and is an endogenous variable determined by the rate of interest (i), the government debt-capital ratio ($\lambda = \frac{L}{K}$) and the rate of capacity utilization ($u = \frac{Y_P}{K_{t-1}}$)[10].

Given the definitions above, we may describe functional distribution as follows. The wage share in total income is given by:

$$\omega = \frac{W}{Y} = \frac{(1-h)Y_P}{(1+\Psi)Y_P} = \frac{1-h}{1+\Psi}, \tag{1.4}$$

while the profit share in total income is:

$$\pi = \frac{P}{Y} = \frac{hY_P}{(1+\Psi)Y_P} = \frac{h}{1+\Psi}, \tag{1.5}$$

the share of financial income in total income is, in turn:

$$\varphi = \frac{Y_F}{Y} = \frac{\Psi Y_P}{(1+\Psi)Y_P} = \frac{\Psi}{1+\Psi}, \tag{1.6}$$

[10] We assume, following DSZ "that the stock of capital available in any given "short period" is predetermined, i.e., that investment does not translate into capital instantaneously. We thus normalize all flows by the opening stock of capital and stocks by the current stock of capital" (DSZ, 2007:10).

while for the capital income share of total income we have:

$$1 - \omega = \frac{P + Y_F}{Y} = \frac{h + \Psi}{(1 + \Psi)Y_P} = \pi + \varphi. \tag{1.7}$$

Regarding accumulation, we assume a neo-Kaleckian investment function as originally developed by Amadeo [11], according to which investments decisions are determined by animal spirits (α) and capacity utilization. Hence, the rate of capital accumulation is:

$$g = \frac{I}{K_{t-1}} = \alpha + \beta u \qquad where \qquad \beta > 0. \tag{1.8}$$

Now we need an expression for the saving rate which, together with the short-run equilibrium condition, a stability condition and an expression for the government expenditures-capital ratio, will 'close' the model.

From Table 1.2 and eq. (1.1), we may express savings (S) as the difference between disposable income and total consumption (C_T). Assuming a classical savings hypothesis, private savings (S_r) consists only of saving out of rentiers' profits and interest income:

$$S_r = Y - C_T = Y - (C_w + C_r) \tag{1.9}$$

where

$$C_w = W \tag{1.10}$$

and

$$C_r = c_1(P + iL_{t-1}) + c_2(NW_H)_{t-1} = c_1(P + iL_{t-1}) + c_2(L + E)_{t-1}, \tag{1.11}$$

where $0 < c_2 < c_1 < 1$.

Equation (1.11) respects the cornerstone principle of the SFC approach pioneered by the New Cambridge School (Godley and Cripps, 1983), which requires that expenditure decisions imply a stable stock.flow *norm.* It says that rentiers' spend a fraction (c_1) of their disposable income and a smaller fraction (c_2) of their previous period stock of wealth (NW_H). In this way, we have established a link between periods, which is crucial for the dynamics of the system. Moreover, the model is now fully SFC in the spirit of Godley-Lavoie (2007).

[11] Which is a simplified version of the one developed by Rowthorn (1981) and Dutt (1987)

Plugging (1.10) and (1.11) and into (1.9) and normalizing for the (lagged) capital stock yields, after rearrangements, the expression for the saving rate[12]:

$$\sigma = \frac{S_r}{K_{t-1}} = s_r(hu + i\lambda) - c_2(\lambda + 1). \tag{1.12}$$

Finally, government expenditures (G) are assumed to be given and growing at a constant rate ($\gamma = \frac{dG}{G}$), as in Allain (2015). The government expenditure-(lagged) capital ratio, which may also be seen as the primary deficit- capital ratio (as it is financed by debt emissions in our model economy) is then:

$$b = \frac{G}{K_{t-1}} = \frac{G_{t-1}(1+\gamma)}{K_{t-1}}. \tag{1.13}$$

1.3 Modeling procedure I (Keynes-Marshall method)

As already pointed out in the introduction, the standard PKK model, as can be found in Hein (2014) or Lavoie (2014), make use of what may be called as the standard "Marshall-Keynes" method to proceed in the analysis. This means making use of comparative dynamic models based on linear equations, usually written in continuous time, from which equilibrium growth rates will be derived together with equilibrium distribution and utilization rates (when possible), given the assumptions one makes about equilibrium determination. However, some methodological remarks are in order.

First, working in continuous time, although simplifying the math, prevents from the possibility of analyzing the feedback effects of *inherited stocks* on current flows which, as we said earlier when discussing the consumption function in eq. (11), are the crucial link between periods that generates Stock-Flow dynamics. Secondly, regarding equilibrium determination, we follow Kalecki (1968) in saying that the long-run is nothing but a sequence of short-runs, which have to be precisely constructed. Third, the effects of changes in exogenous variables on the equilibrium values of the endogenous are calculated as their first derivatives, i.e. *keeping everything else constant.* This, in the words of Harcourt (2001:277), "consists at looking at parts of the economy in sequence, holding constant or abstracting from what is going on, or at least the effects of what is going on elsewhere, for the moment [hoping that it will be possible] to bring all our results together to give a full, overall picture". Finally, changes in parameters, in behavioral equations' coefficients and in initial conditions would generate new dynamic equilibrium positions. "The most we can do with this method is checking the stability of the respective equilibria. However, a detailed analysis of the transition from one equilibrium growth path to another, provided the equilibrium is stable, and thus tracing the disequilibrium or out-of-equilibrium processes, is well beyond the scope of this method" (Hein, 2014:20-21). The justification for the use of the method follows Dutt (2011) who stated that in

[12] where $s_r = (1 - c_1)$ and is assumed to be constant.

this class of models equilibrium shall be thought of as theoretical tool of analysis and, hence, “the method of comparative dynamics can be considered as a useful *first step* in modeling distribution and growth issues” (Hein, 2014:21, emphasis added).

In what follows we will apply the standard method leaving further discussion on methodology for the conclusions.

Given the simple framework above, the method to proceed in the analysis will go as follows. In the “short-run” output is thought to adjust to demand through changes in the rate of capacity utilization, assuming the primary deficit-capital ratio to be constant (somewhat unrealistically). In the next step, that we label “medium-run” for convenience, government expenditures grow at a rate (γ), implemented by policy authorities. We will analyze the response of the model towards this autonomous growth rate and determine the medium-run equilibrium values for the endogenous variables. For both the short and the medium-run, the government debt-capital ratio (λ) is assumed to be constant. Finally, when moving to the long-run, we will tackle the dynamics of this latter ratio and determine long-run equilibrium values for the endogenous variables. For each run, which has to be regarded as an analytical device, we will analyze the effects of changes in exogenous variables on the respective equilibrium values for the endogenous variables in turn, as well as the stability conditions of the system.

1.3.1 Short-Run Equilibrium

In the short-run, the goods market equilibrium condition requires that saving have to be equal to private investment plus government expenditures and interest payments to rentiers:

$$\sigma = g + b + i\lambda. \tag{1.14}$$

In the short-run, the goods market is tought to clear through changes in output via capacity utilization. For the adjustment to be stable, savings need to respond more strongly than investment to changes in capacity. From (1.8) and (1.12), we get:

$$\frac{\partial \sigma}{\partial u} - \frac{\partial g}{\partial u} > 0 \rightarrow s_r h - \beta u > 0. \tag{1.15}$$

We will assume throughout that the stability condition in (1.15) is fulfilled. Plugging (1.8), (1.12) and (1.13) into (1.14), and solving for (u) gives the equilibrium rate of capacity utilization:

$$u^* = \frac{\alpha + b + c_2 + \lambda[i(1 - s_r) + c_2]}{s_r h - \beta}. \tag{1.16}$$

Inserting this equilibrium rate of capacity into (1.8) yields the equilibrium rate of accumulation:

$$g^* = \frac{\alpha s_r h + \beta\{b + c_2 + \lambda[i(1 - s_r) + c_2]\}}{s_r h - \beta}, \tag{1.17}$$

which, with constant technical production coefficients and a constant rate of utilization in equilibrium, is also the rate of growth of output and income.

Since in the short-run the primary deficit-capital ratio (b) is constant, (u^*) also uniquely determines, given (h) and (i), the equilibrium values for functional income shares in equations (1.4 - 1.6):

$$\omega^* = \frac{1-h}{1+\Psi} = \frac{1-h}{1+\frac{i\lambda}{u^*}}, \qquad \frac{\partial \omega^*}{\partial u^*} > 0, \tag{1.18}$$

$$\pi^* = \frac{h}{1+\Psi} = \frac{h}{1+\frac{i\lambda}{u^*}}, \qquad \frac{\partial \pi^*}{\partial u^*} > 0, \tag{1.19}$$

$$\varphi^* = \frac{\Psi}{1+\Psi} = \frac{i\lambda/u^*}{1+\frac{i\lambda}{u^*}} = \frac{1}{\frac{u^*}{i\lambda}+1}, \qquad \frac{\partial \varphi^*}{\partial u^*} < 0, \tag{1.20}$$

The comparative dynamics of the short-run equilibrium are shown in Table 1.3.

Table 1.3: Comparative Dynamics S-R Eq.

	u^*	g^*	ω^*	π^*	φ^*
α	+	+	+	+	-
s_r	-	-	-	-	+
h	-	-	-	+/-	+
b	+	+	+	+	-
i	+	+	+/-	+/-	+/-
λ	+	+	+/-	+/-	+/-
c_2	+	+	+	+	-

Improved animal spirits have direct positive effect on capacity, accumulation and growth (through eqs. 1.16 and 1.17), and thus positive indirect effect on the wage share and profit share and negative for the financial income share (via the positive effect on utilization).

An higher propensity to save leads to lower utilization, accumulation and growth, i.e. the so-called *Paradox of Thrift*, while the indirect effect on functional distribution via capacity utilization is negative for wage and profit share and positive for the financial income share.

An higher profit share in production lowers the equilibrium values for utilization, accumulation and growth, i.e. the *Paradox of Costs* is valid and the economy is wage-led in the short-run. Higher profit share in production also have direct negative effect on the wage share in total income, while the overall effect on profit share in total income is ambiguous, due to the direct positive effect in (1.19) and the negative one through lower equilibrium capacity. Finally, the effect of improved profit share in production has unambiguously positive effects on the financial income share via the indirect negative effect on capacity.

Changes in the government primary deficit- capital ratio have positive direct effects on capacity, accumulation and growth, while the indirect effects in functional income distribution are positive for wage and profit share and negative for the financial income share.

A rise in interest rate or in the government debt-capital ratio will have direct positive effects on capacity, accumulation and growth, while the effects on functional income shares are ambiguous. While increases in interest rate or in the government debt-capital ratio will have direct negative effects on the profit and wage share in total income, which are counterbalanced by the indirect positive effects via capacity, the opposite may be said with respect to the financial income share in total income. However, it shall be noted that the model does not contain any direct negative effect of the interest rate on consumption and investments, neither indirectly through the indebtedness level, since investments are financed by equity emissions.

Finally, an higher rentiers' propensity to consume will have positive effects on all endogenous variables but the financial income share in total income, via the indirect positive effect on capacity utilization.

1.3.2 Medium-Run Equilibrium

In the medium-run of the model, government expenditures grow at a constant rate (γ), implemented by policy authorities. We will, first, examine the effects of these expenditures on the primary deficit-capital ratio. From equation (1.13) we get the growth rate:

$$\widehat{b} = \widehat{G} - \widehat{K} = \gamma - g. \tag{1.21}$$

The medium-run equilibrium is defined as the situation where the government expenditure-capital ratio is constant, and therefore ($\widehat{b} = 0$). Hence, making use of the equilibrium growth rate in (1.17) into (1.21) yields:

$$g^* = \gamma = \frac{\alpha s_r h + \beta\{b + c_2 + \lambda[i(1 - s_r) + c_2]\}}{s_r h - \beta}, \tag{1.22}$$

from which we obtain the equilibrium values for the endogenous:

$$b^{**} = \frac{s_r h(\gamma - \alpha) - \beta[\gamma + c_2 + \lambda(i - s_r i + c_2)]}{\beta}, \tag{1.23}$$

$$g^{**} = \gamma, \tag{1.24}$$

$$u^{**} = \frac{\gamma - \alpha}{\beta}. \tag{1.25}$$

In order to give meaningful economic values, we will assume the numerator in (1.25) to be positive. In the medium-run equilibrium, the rate of accumulation and growth will be equal to the rate of growth of government expenditures, and the process will be stable if $\frac{\partial \widehat{b}}{\partial b} < 0$.

From (1.17) and (1.21), we get:

$$\widehat{b} = \gamma - g^* = \frac{\gamma(s_r h - \beta) - \left\{\alpha s_r h + \beta\{b + c_2 + \lambda[i(1 - s_r) + c_2]\}\right\}}{s_r h - \beta}, \tag{1.26}$$

which implies that:

$$\frac{\partial \widehat{b}}{\partial b} = \frac{-\beta}{s_r h - \beta} < 0. \tag{1.27}$$

Hence this medium-run equilibrium is stable and the system will adjust towards the equilibrium determined by the growth of the autonomous government expenditures. Moreover, recalling that in the medium-run the government debt-capital ratio is constant, the medium-run equilibrium rate of accumulation also uniquely determines the equilibrium values for functional distribution, as in equations (1.18 - 1.20).

The comparative dynamics for the medium-run equilibrium are given in Table 1.4.

A rise in animal spirits has no effect on accumulation and growth (which is determined by the autonomous component), but it lowers the medium-run equilibrium deficit-capital ratio (1.23) and the medium-run equilibrium rate of capacity utilization (1.25) and, indirectly through the latter, negatively the wage and profit shares and positively the financial income share. Increasing rentiers' propensity to save has no direct effects on either equilibrium accumulation or capacity (and thus no indirect effect on functional distribution) while it has a positive effect on (b^{**}), since we are assuming ($\gamma - \alpha > 0$).

Table 1.4: Comparative Dynamics M-R

	u^*	g^*	b^*	ω^*	π^*	φ^*
α	-	0	-	-	-	+
s_r	0	0	+	0	0	0
h	0	0	+	-	+	0
γ	+	+	+	+	+	-
i	0	0	-	-	-	+
λ	0	0	-	-	-	+
c_2	0	0	-	0	0	0

A higher profit share in production, without affecting accumulation and capacity, only positively affects the medium-run equilibrium deficit-capital ratio . With respect to distribution, rising profit share in production lowers the wage share in total income (and the opposite for the profit share) leaving the financial income share unaffected. A rise in the rate of growth of government expenditures has expanding effects on the equilibrium values of utilization, growth and accumulation and, through the former, positively affects the profit and wage share in total income and negatively the financial income one.

Increasing the interest rate or the government debt-capital ratio has no effect on accumulation and utilization and a detrimental one on the primary deficit-capital ratio[13]. Regarding distribution, it lowers the wage and profit share and expands the financial income share in total income. Finally, an higher propensity to consume out of wealth only affects, negatively, the primary deficit-capital ratio (1.23).

1.3.3 Long-Run Equilibrium

We finally arrived at the determination of long-run equilibrium positions. In what follows, we will tackle the dynamics of the government debt-capital ratio and its feedback effects on the endogenous variables.

As mentioned in Section 2, the government debt increases (dL) every period to cover the sum (S_g) of government expenditures and interest payments on the existing stock of debt:

$$dL = S_g = G + iL_{t-1}. \tag{1.28}$$

We thus get, for the growth rate of government debt:

$$\widehat{L} = \frac{dL}{L_{t-1}} = \frac{G}{L_{t-1}} + i = \frac{b}{\lambda_{t-1}} + i, \tag{1.29}$$

while for the government debt-capital ratio($\lambda = \frac{L}{K}$) we have:

[13]Given the standard assumption that $(1 - s_R) > c_2$, i.e. that the rentiers' propensity to consume out of income is greater than their propensity to consume out of wealth.

$$\widehat{\lambda} = \widehat{L} - \widehat{K} = \frac{b}{\lambda_{t-1}} + i - \gamma. \tag{1.30}$$

The long-run equilibrium is defined, in turn, as the situation where the endogenously determined debt-capital ratio is constant, i.e. $(\widehat{\lambda} = 0)$. Making use of the equilibrium value of the government primary deficit-capital ratio in (1.23), we get the long-run equilibrium values for the endogenous variables of the model:

$$\lambda^{***} = \frac{b}{\gamma - i} = \frac{s_r h(\gamma - \alpha) - \beta(\gamma + c_2)}{\beta(\gamma - s_r i + c_2)} \tag{1.31}$$

$$b^{***} = (\gamma - i)\lambda^{***} = \frac{(\gamma - i)(s_r h(\gamma - \alpha) - \beta(\gamma + c_2)}{\beta(\gamma - s_r i + c_2)} \tag{1.32}$$

$$g^{***} = \gamma \tag{1.33}$$

$$u^{***} = \frac{\gamma - \alpha}{\beta} \tag{1.34}$$

With (γ) positive and constant, and a positive primary deficit-capital ratio from equation (1.23), the numerator in (1.32) is positive. We can therefore distinguish three different parameter constellations:

1. if $\gamma > i$, we have that $\gamma > s_r i - c_2$, and thus we get a positive long-run equilibrium government debt-capital ratio associated with a positive long-run primary deficit-capital ratio;
2. if $\gamma < i$ but $\gamma > s_r i - c_2$, λ^{***} will still be positive, but associated this time with a negative b^{***}, which would require the introduction of taxes into the model to finance the primary surplus in the long-run;
3. finally, if $\gamma < i$, $\gamma < s_r i - c_2$, λ^{***} will have to be negative and associated with a positive b^{***}. This constellation is unfeasible in the model and, thus, unstable.

In what follows, thus, we will only analyze constellation (1), with positive long-run equilibrium government deficit-capital and debt-capital ratio. This equilibrium will only be stable if $\frac{\partial \widehat{\lambda}}{\partial \lambda}$.

From (1.32), making use of the medium-run equilibrium deficit-capital ratio in (1.23), we get:

$$\frac{\partial \widehat{\lambda}}{\partial \lambda} = \frac{-(i - s_r + c_2)}{\lambda} - \frac{b}{\lambda^2} = \frac{-\lambda(i - s_r + c_2) - b}{\lambda^2} < 0 \tag{1.35}$$

from which is clear that this parameter constellation is stable and requires that the interest rate falls short of the rate of growth of the autonomous component of demand (γ) and, furthermore, that $\gamma > s_r i - c_2$. It should be noted, that the introduction of rentier's consumption out of wealth has made the long-run stability condition more general, with respect to both Domar (1944) and Hein's (2016) original model, a result which is in line with Lavoie (2014, ch.5.6).

The comparative dynamics regarding the long-run equilibrium positions are presented in Table 1.5.

Table 1.5: Comparative Dynamics L-R

	u^{***}	g^{***}	b^{***}	λ^{***}	ω^{***}	π^{***}	φ^{***}
α	-	0	-	-	+	+	-
s_r	0	0	+	+	-	-	+
h	0	0	+	+	-	+/-	+
γ	+	+	+/-	+/-	+/-	+/-	+/-
i	0	0	-	+	-	-	+
c_2	0	0	-	-	+	+	-

The effects of changes in the exogenous variables on long-run equilibrium capacity, accumulation and growth are the same as for the medium-run. A rise in animal spirits only affects, negatively, equilibrium utilization. As for the medium-run, if accumulation is driven by an autonomous component of demand and not by increased sales expectations, it implies that productive capacity grows more than proportionally with respect to output, thus lowering the long-run equilibrium rate of capacity utilization. An increase in the rate of growth of the autonomous component of expenditures, in turn, has expanding effect on both utilization, accumulation and growth. Changes in the propensity to save, in the profit share in production, in the interest rate or the propensity to consume out of wealth have no effect whatsoever on utilization, accumulation and growth.

Turning to the government deficit-capital and debt-capital ratios, a rise in animal spirits or in the propensity to consume out of wealth will reduce both ratios, while changes in the propensity to save or in the profit share in production will all have expansionary effects on both ratios. A rise in interest rate will bring about a lower government debt-capital and an higher expenditures-capital ratios. Finally, an increase in the rate of growth of the autonomous expenditure component, has ambiguous effects. Concerning the debt-capital ratio, in fact, the model displays the possibility of a *Paradox of Debt*:

$$\frac{\partial \lambda^{***}}{\partial \gamma} = \frac{s_r h - \lambda \beta}{\beta(\gamma - s_r i + c_2)} \tag{1.36}$$

so that

$$\frac{\partial \lambda^{***}}{\partial \gamma} > 0 \qquad if \qquad \frac{s_r h}{\beta} > \lambda. \tag{1.37}$$

If the condition in (1.37) is fulfilled, a higher rate of growth of government expenditures will bring about a higher long-run government debt-capital ratio.

Regarding equilibrium functional distribution, in the long-run any change in exogenous variables will affect distribution through changes in both long-run equilibrium capacity utilization and the government debt-capital ratio:

$$\omega^{***} = \frac{1-h}{1+\Psi} = \frac{1-h}{1+\frac{i\lambda^{***}}{u^{***}}}, \qquad \frac{\partial \omega^{***}}{\partial u^{***}} > 0, \frac{\partial \omega^{***}}{\partial \lambda^{***}} < 0 \tag{1.38}$$

$$\pi^{***} = \frac{h}{1+\Psi} = \frac{h}{1+\frac{i\lambda^{***}}{u^{***}}}, \qquad \frac{\partial \pi^{***}}{\partial u^{***}} > 0, \frac{\partial \pi^{***}}{\partial \lambda^{***}} < 0 \tag{1.39}$$

$$\varphi^{***} = \frac{\Psi}{1+\Psi} = \frac{i\lambda^{***}/u^{***}}{1+\frac{i\lambda^{***}}{u^{***}}} = \frac{1}{\frac{u^{***}}{i\lambda^{***}}+1}, \qquad \frac{\partial \varphi^{***}}{\partial u^{***}} < 0, \frac{\partial \varphi^{***}}{\partial \lambda^{***}} > 0 \tag{1.40}$$

Rising animal spirits will lower both the long-run equilibrium values for capacity utilization and the debt-capital ratio, which have opposite effects on functional distribution. However, the overall effect will be positive on wage and profit share in total income (i.e. the production income shares) and negative for the financial income share. Changes in the propensity to save will have no effect on accumulation, growth and utilization, but will imply an higher debt-capital ratio. It will therefore have depressing effects on the production income shares and a positive one on the financial income one. Increasing profit shares in production will bear no effect on accumulation nor utilization, but it will raise the long-run debt-capital ratio. Thus it will have unambiguously negative effect on the wage share and a positive one on the financial income one. Regarding the profit share in Total income, however, the effect is ambiguous, and depends on the relative strength of redistribution and the magnitude of the effect on the debt-capital ratio. We may therefore recover a version of the *Paradox of Costs* also in the long-run.

Higher growth rate of government expenditures will have expansionary effect on utilization but, as we mentioned, the effect on the debt-capital ratio may well be positive or negative depending on the condition in (1.37). The overall effect on distribution is thus ambiguous and will depend on the magnitudes of the relative changes in u^{***} and λ^{***}. Rising interest rates, which bear no changes on utilization but increase the long-run debt-capital ratio, will univocally have depressing effects on the production income and a positive one on the financial income shares. In contrast, an increase in the propensity to consume out of wealth, which in this case does not affect utilization but lowers the debt-capital ratio, has unambiguously positive effect on the production income shares and negative on the financial income.

1.4 Modeling Procedure II (Godley- Lavoie method)

In this Section, we will apply to the structure delineated in Section 2 the methodology proposed by Godley-Lavoie (2007) to analyze the model. We are going to define a model describing an economy which "moves forward non-ergodically in historic time" (2007:7). The model will account for each and every entry in Tables 1-2 *simultaneously*. In sharp contrast with the Marshall-Keynes method, thus, we will be exploring the properties of a *complete system*, never assuming (nor hoping) that one can look at a small piece at a time while the rest stays in place.

The method consists in writing down a system of equations and accounting identities, attribute initial values to all stocks, flows and parameters of the system and then use computer simulations to check the accounting and obtain a steady state for the system. Finally, we will shock the system and explore the consequences. As pointed out by Godley-Lavoie, "the use of logically complete accounts has strong implications for the dynamics of the system *as a whole*" (2007:9, emphasis added). This is related to feature 4 of Tobin's recipe. In this water-tight accounting framework, the transaction flows of the ultimate sector are entirely determined by the transactions flows of *all other sectors*, i.e. once $n-1$ equations are satisfied, then the n^{th} equation will be satisfied as well. Hence, there will always be a *redundant identity* that needs to be dropped off the simulation in order to avoid over-determination.

Since we are interested in a comparison of the contrasting methodologies, we will recover equations (1-13) and (28) from Section 2 and apply the new method to solve the model and explore the different results. In order to do it, we need to add to this list four new equations, which may be defined as *Rules of Stock Accumulation*, which are crucial for building the computer simulations since, here, the long-run is constructed as a *sequence* of short periods.

$$K = K_{t-1}(1+g), \tag{1.41}$$

$$NW_H = NW_{H,t-1} + S, \tag{1.42}$$

$$E = E_{t-1} + I, \tag{1.43}$$

$$L = NW_H - E. \tag{1.44}$$

As we said, in this kind of models, one needs to drop an equation from the simulation in order to avoid overdetermination. This is called the *redundant identity* and has everything to do with Tobin's 'adding-up constraint'(i.e. feature 4 of *Tobin's recipe*). In the case of this simple model economy, this will be Eq. 1.44, which states that the supply of new government debt will always be equal to its demand.

1.4.1 Building the Steady State

As we mentioned, the first step needed is to attribute numerical values to all variables and parameters in the model and obtain a Steady State for the system. But how do we obtain a Steady State?

Parameters such as the propensities to consume and to save can be taken by empirical analysis or from "reasonable" values, verifying that they imply realistic stock-flow ratios, say between net household wealth and income or capital to output. Recall that we need to provide values for the parameters in the consumption function, in the accumulation function and for income distribution. The Government has thus to set the interest rate (via the CB) and its target rate of growth for the system (given by the autonomous component), recalling that the constraints in (1.15), (1.27) and (1.37) have to hold. Here we will define three possible steady states for the system, all lying inside parameter constellation 1. This is to show, first, how we can "play" with these models, either to replicate features of the economy (i.e. big government, high debt/GDP vs low debt/GDP, different distribution regimes etc.), or to simulate shocks and their system-wide effects on the economy studied and, secondly, how *every* changes in parameter affects the behavior of the system. The parameters we obtained are displayed in the upper part of Table 1.6.

The first is computed by setting the interest rate i strictly lower than γ. In the second one we lower the interest rate to 3.5%. Finally, in the third one, we check the results for a different functional distribution. Table 1.6 summarizes the build up of the different Steady States.

Table 1.6: Building the Steady States

Parameters		SS1	SS2	SS3
	α	0.3	0.3	0.3
	β	0.2	0,2	0.2
	$c1$	0.25	0,25	0.25
	$c2$	0.005	0.005	0.005
	h	0.4	0.4	0.6
	γ	0.04	0.04	0.04
	i	0.039	0.035	0.035
Resulting :				
Long-run equilibrium Gvt.Debt To Capital ratio (31)	λ^{***}	6.6666666667	5.6	9.6
Long-run equilibrium Gvt.Exp. To Capital ratio (32)	$b^{***} = (\gamma - i)\lambda^{***}$	0.0066666667	0.028	0.048
Long-run equilibrium Accumulation (33)	$g^{***} = \gamma$	0.04	0.04	0.04
Long-run equilibrium Rate of Capacity utilisation (34)	$u^{***} = (\gamma - \alpha)/\beta$	0.5	0.5	0.5
Short-Run Stability Condition (15)	$s_r h - \beta u > 0$	0.29	0.29	0.44
From Eq. (25)	$\gamma - \alpha > 0$	0.01	0.01	0.01
Medium-Run Stability Condition	$\frac{\partial \hat{b}}{\partial b} < 0$	-0.0714285714	-0.0714285714	-0.0465116279
Parameter constellation 1	$\gamma - i > 0$	0.001	0.005	0.005
- cont'd	$i - s_r i + c2 > 0$	0.03425	0.00375	0.03125
Long-Run Stability Condition (35)	$\frac{\partial \hat{\lambda}}{\partial \lambda} < 0$	-0.0008625	-0.0015625	-0.0009114583
From Eq. (37)	$s_r h/\beta > \lambda$	15	15	22.5

1.4.2 Simulations

Finally, here we come to the bulk of the analysis. As for Section 3, and since we are interested in a comparison of the two methods, we will run different simulation exercises on the Steady Growth State to check the long-run features of the model, namely: 1) an increase in the propensity to save and 2) a decrease in the mark-up (i.e. an increase in the wage share in production), to check if the results regarding the Kaleckian paradoxes hold in this framework, 3) an increase in the autonomous component of expenditures and, finally, 4) an increase in animal spirits. The difference is that, while when using the standard solution method the most one can do is to take first derivatives, i.e. to see the effects of changes in exogenous on equilibrium values of endogenous variables *keeping everything else constant* (in fact, only in the long-run equilibrium, with the endogeneization of *all* relevant variables, this is not so), here the use of computer simulations allows us to see the *system-wide effects*. As will be clear from the following Figures, which describe thee effects on the endogenous of shocks on exogenous parameters, not all the results of Section 3 will apply.

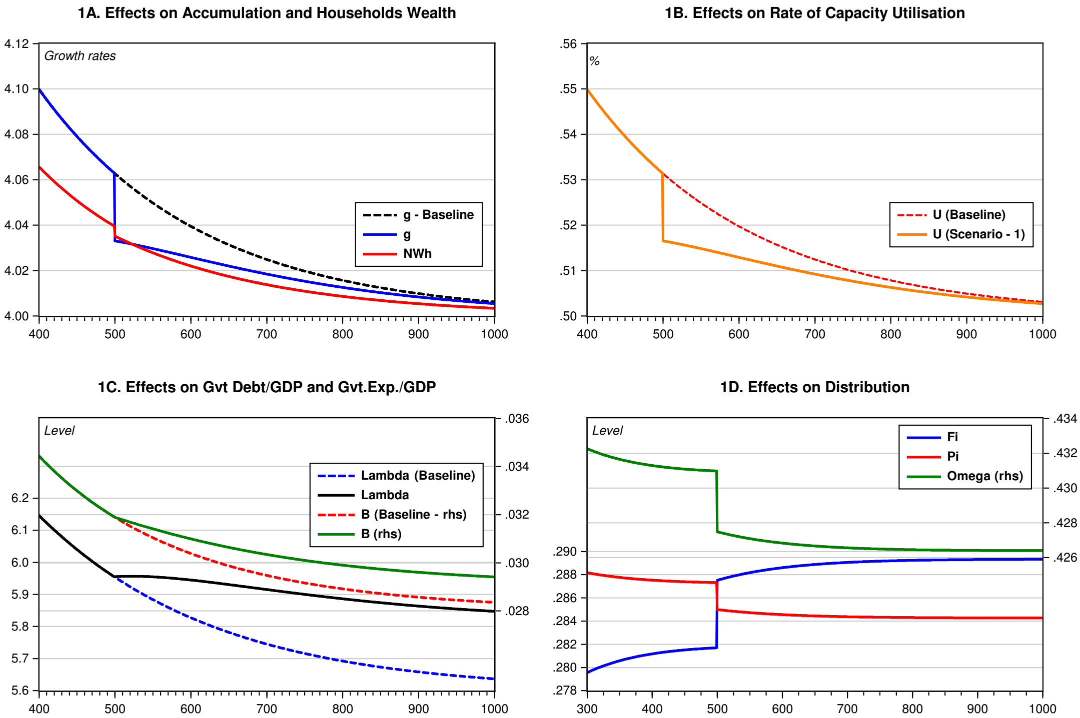
In Scenario 1, displayed in Figure 1.1 (A-D) we simulate the effects of a 1% increase in rentier's Propensity to save (i.e. we negatively shock $c1$). As for Section 3, increasing the Propensity to Save leads to lower capital and wealth accumulation in the short-run. As the shock passes, however, they both converge back to their long-run equilibrium values determined by the autonomous rate of growth (1A). The lower capital accumulation is reflected in the dynamics of the rate of Capacity Utilization, which goes down by 1.2% and then converges back (1B). Regarding the effects on Deficit and Debt to Capital ratio, both are positively affected and will reach higher levels in the long run with respect to the Baseline (1C). Finally, looking at functional distribution (1D), the positive effect on the share of Financial income in Total Income more than offset the negative one on the Profit share, thus lowering the Wage share in Total Income. However, the effects are small (minus .4 for ω). We thus recover, as for Section 3, the Paradox of Saving only in the short-run.

In Scenario 2, we simulate a decrease in the mark-up of firms, which translates into an higher wage share in production. This is shown in Figure 1.2 (A-D). The higher consumption generated by the increased wage share boosts accumulation and utilization up in the short-run (Figures 2A-2B), i.e. the Paradox of Costs is valid. However, in line with Section 3, nothing happens to their long-run value, which will converge back to their steady state as the shock is absorbed. Both Government Debt to Capital and Expenditure to Capital ratios are negatively affected by the increase in mark-up and will converge toward lower long-run values with respect to the baseline (2C). Finally, both φ and π are negatively affected, thus ω will go up by 1.5% (2D).

In Scenario 3, displayed in Figure 1.3 (A-D), we simulate an increase in the rate of growth of the autonomous component of expenditures, shown in Figure 3 A-D. As expected, the whole system converges towards the new rate of growth, determined, as before, by γ. Government Debt to Capital and Government Expenditure to Capital ratios both reach an higher level (3C), pumped up by the increasing deficit. Regarding functional distribution (3D), the drop in the Financial share in total income more than offsets the rise in the Profit share, so that overall the wage share increases by 3%.

One of the strengths of the SFC approach also consist in the possibility of simulating a wide arrange of shocks, that can be either permanent, as in the cases above, or temporary. In Figure 1.4 we simulate the effects of a temporary

Figure 1.1: Increasing Propensity to Save

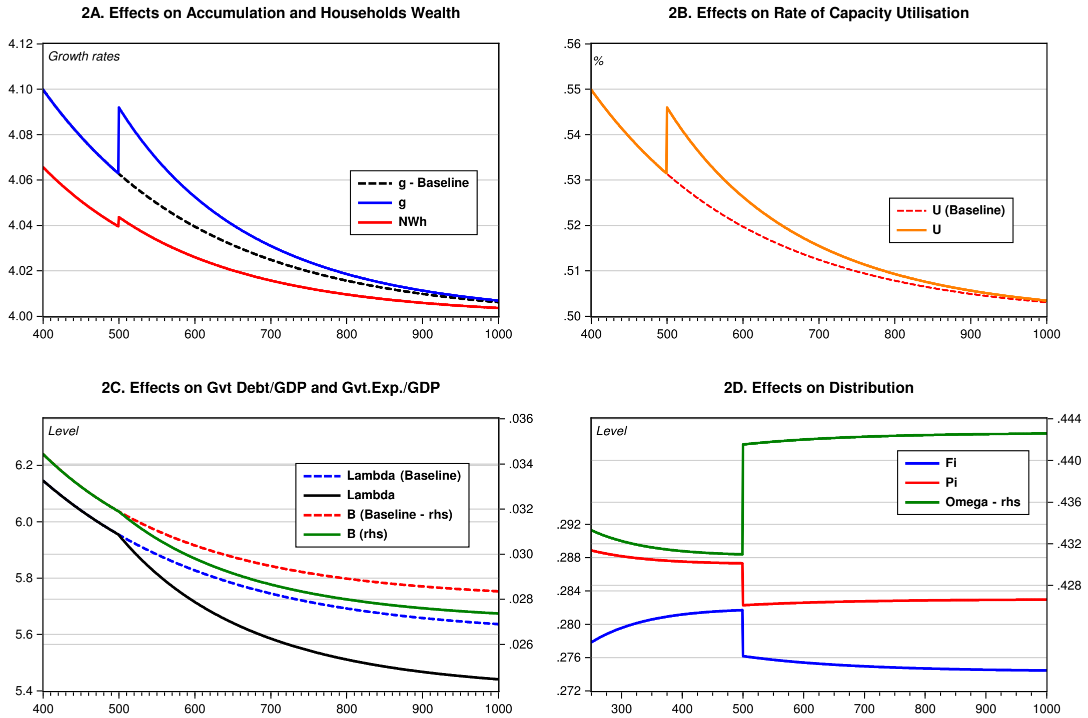


increase in the rate of growth of autonomous expenditures (i.e. an increase of .05% that only lasts for 4 production periods). Households Wealth rises here more than accumulation (4A), pumped up by the increasing deficit that translates into an higher lambda (4C). The increase in the growth rate of Government Expenditures also displays its effects on the rate of capacity utilization (4B), which rises and then starts to converge back tho its steady state value. Regarding functional distribution, the negative effect on the financial income share more than outweighs the positive one the profit share, so that the overall effect on ω in positive. However, the effects of this temporary increase in γ do not last, with all converging back to their steady state values. It is worth noting that, albeit the shock only lasts four production periods, the system does not completely converge back to its steady state after 500 simulation periods. This means that, at this stage, the model need some further adjusting mechanism.

1.5 Conclusions

The aim of this work was to provide a simple framework for analyzing growth, distribution and debt dynamics in a SFC-PKK setting. In Section 2, we presented the structure of the model, which is an extension of Hein (2016). The model developed here is a neo-Kaleckian SFC supermultiplier growth and dis-

Figure 1.2: Increasing Wage Share in Production

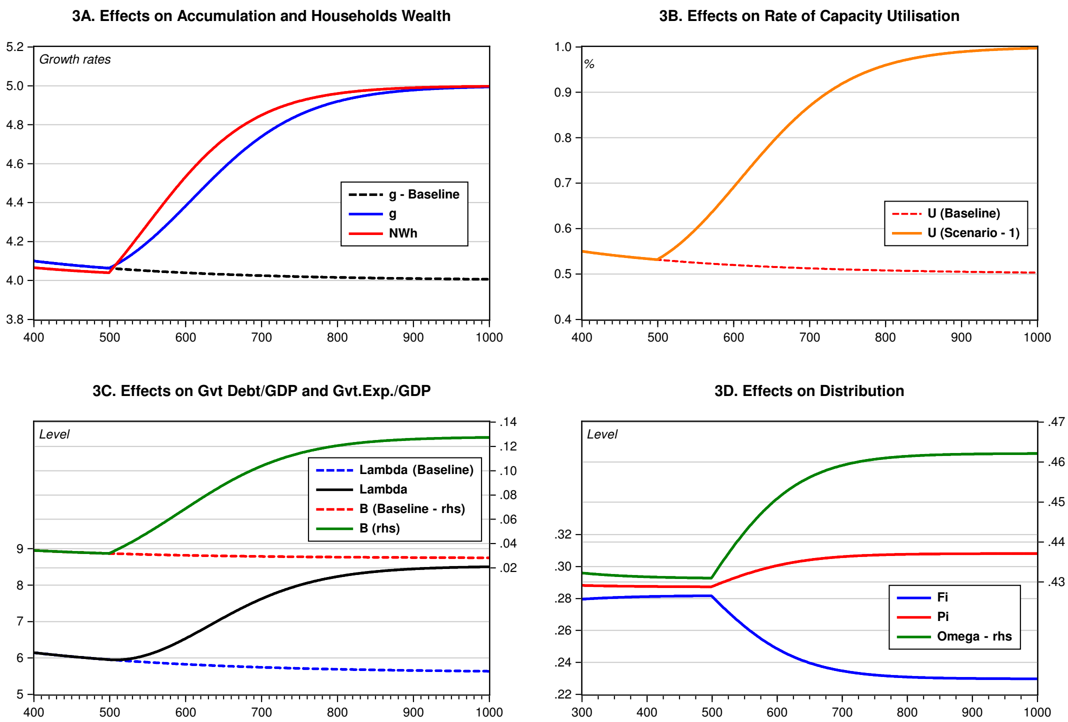


tribution model with an autonomous component of expenditures, namely an exogenous growth rate for government expenditures. In Section 3 and 4, we solved the model following, first, the standard analytical Marshall-Keynes method and, then, using the Godley-Lavoie approach instead. The former consist in calculating short-to-long-run equilibrium values for the endogenous variables, analyze the stability of the system and, finally, compute the effects of changes in exogenous parameters on these equilibrium values. The latter method, in turn, consists of solving the model numerically. This is usually done, as in the present case, in three steps: 1) assign values to parameters, stocks and flows so as to replicate stylized facts or some analytical findings, 2) compute a steady state for the system and, 3) run simulations on the model, e.g. shocks to exogenous/endogenous variables or parameters, allowing one to see how the economy *as a whole* reacts to the shock.

The simple model developed here already contains some valuable insights in terms of both economic policies and methodology. Albeit the extension made, we have not only recovered all the findings of this new line of literature, but also some new ones:

1. A constant medium- to long-run growth rate of autonomous expenditures will provide a stable medium-to-long-run growth rate for the system, toward which capital stock, output and income growth will converge. More-

Figure 1.3: Increasing Autonomous Expenditures



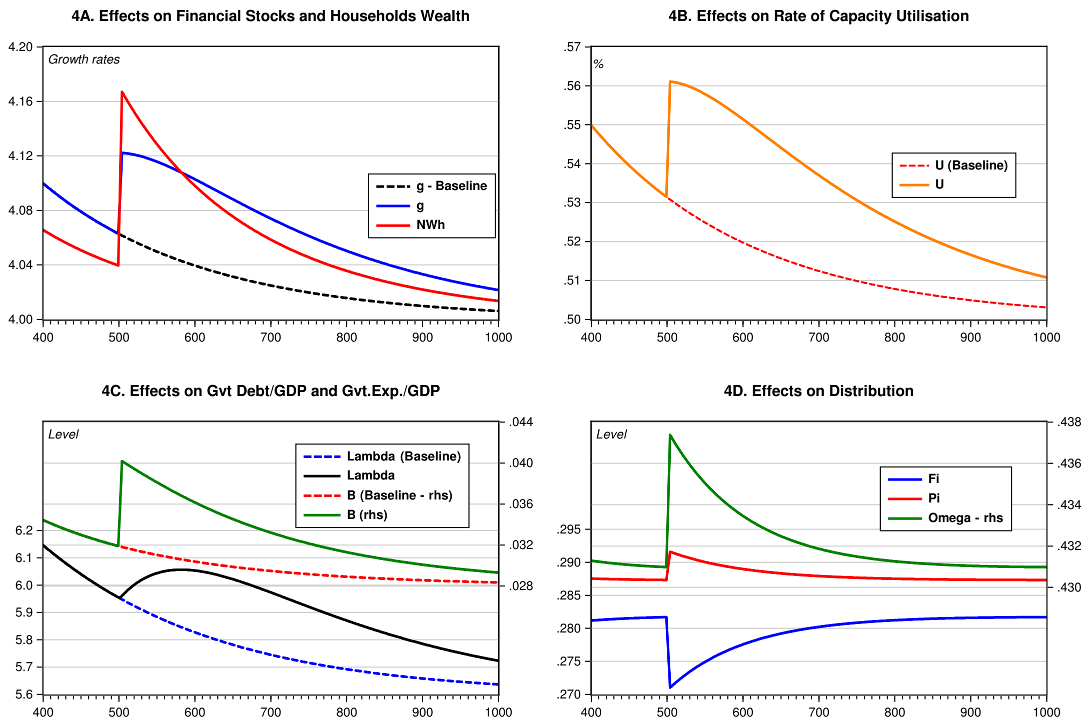
over, the model displays the well known Kaleckian short-run features of the *Paradox of Costs* and the *Paradox of Savings*, as can be ascertained by looking at both Table 3 in Section 3 and Figures 1A-1B and 2A-2B in Section 4. However, in line with the findings of this surgent literature, these disappear as growth effects in the Long-run, and only remain valid for the levels.

2. the growth rate of the autonomous component also implies that the government debt-capital and deficit-capital ratios will converge towards definite values in the long-run. For this to be true, however, γ not only has to be greater than the interest rate i but also of the difference $s_r i - c_2$, which implies that, apart from giving the model a *full SFC flavor*, the introduction of consumption out of wealth has made the condition for long-run stability tighter with respect to both Domar (1944) and Hein (2016).

3. interestingly enough, the model displays the possibility of the *Paradox of Debt* and the recovery of a version of the *Paradox of Costs* in the long-run, the former depending on the value of the debt-capital ratio in condition (39), the latter on the relative strength of redistribution and the magnitude of the effect on the debt-capital ratio.

4. A striking result of the model is that, whatever happens to the public debt

Figure 1.4: Temporary Increase in Autonomous Expenditures



does not change in any way the behavior of the model. This is so because the increasing stock of debt always creates the necessary savings needed to absorb it. While this may well be theoretically (and also practically!) sound, it is often the case that countries do have, for example, a debt-ceiling (as for the U.S, or the EU countries, among others), which will trigger, when the debt exceeds a certain amount, austerity policies. Given that this could well be (and it certainly is, in most cases) a purely political matter, not driven by any economic rationale, it may however cause a behavioral change in, say, government expenditures, which will then cause deeper changes in the whole dynamics of the system.

5. As revealed by Figure 4, if we simulate a temporary shock to the rate of growth of the autonomous component of expenditures the model does not converge back to its steady state value after 500 simulation periods. This implies that the model still needs some further adjusting mechanism. At first glance, we may identify this as the missing Harrodian mechanism in the investment function, but for this to be proven some further complications have to be added to the model.

Finally, it come without saying that the model would benefit from the introduction of taxes, the foreign sector, and more assets. Most important, the exclusion of monetary deposits from the available stocks creates a missing and important feature from the model. An important implication (but also one of the main contributions towards a *Monetary Theory of Production*) of the Godley-Lavoie models with money deposits is that they act as a buffer, e.g they are determined residually in the investment decisions of households. This implies that money act as the link between succeeding periods, recovering the Keynesian notion of money as the link between the past and the (uncertain) future. However, as we said before, every entry in the Transaction and Balance sheet matrices needs an accounting identity and/or a behavioral equation. We are always playing, thus, on the edge between realism and tractability.

Regarding the two methodologies used, however, some general considerations may be given. It is in fact clear that this kind of models, as long as they are *only* dealt with as in Section 3, may only give a snapshot of *the dynamic process of growth*. This is so for two order of reasons. First, following Kalecki (1968), the long-run is nothing but a sequence of short-runs, which have to be precisely constructed. Furthermore, as Dos Santos and Silva puts it "just as we cannot make a movie out of two photograms, we cannot derive a growth regime from such a short-run exercise" (2008:5), like the one assumed in the standard solution method to the PKK growth and distribution models. In fact, the only exercise one can do with such models is to calculate the effects of changes in exogenous variables on the equilibrium values for the endogenous, *keeping everything else constant*. Moreover, nothing can be said in terms of the *duration* of the processes at work. While it is true that the standard solution method brings important insights about the long-run behavior of the economy (in addition to the simplicity of handling and make sense of this class of models), it is also true that it does not give any clue about the duration of the traverse toward this equilibrium.

As we showed in Section 4, indeed, even temporary shocks are not completely absorbed over a long simulation period, meaning that the *traverse* toward the long-run may be well too long for assuming, first, that some further changes in the structure will not appear in the meantime (which is implied by the constant parameters over the whole simulation period) and, secondly, that any politician would care about such a long time-span. In conclusion, while the standard solution method may be a good *starting point* for analyzing economic growth, one must make use of the simulation method to have a broader, and more consistent, discussion of the dynamic process of growth, especially now that we have all the tools (both theoretical and practical) to construct these models.

Chapter 2

SFC Macromodels: the Open Economy and the Fundamental Identity

2.1 Introduction

Among the various causes that led to the failure of new Classical macroeconometric models (both DSGE and CGE types) in predicting the financial crisis, a prominent role was played by the lack of an appropriate modelling of the financial sector and of its interactions with the real economy. The dissatisfaction towards standard mainstream macroeconomic models came from both orthodox and heterodox authors and practitioners: "standard macroeconomics as practiced up to 2008 had failed to understand the interactions between the financial sector and the real economy and so failed to grasp the potential for financial instability" (Duca and Muellbauer, 2014:1); "both the New Classical and New Keynesian complete markets macroeconomic theories [...] did not allow the [key] questions to be asked. *A new paradigm is needed*" (Buiter, 2009:1, emphasis added); "DSGE [models] [...] seem to perform well in fitting past data or in predicting the very near future. However, with the advent of the financial crisis, these models turned out to be completely useless" (Lavoie, 2014:90).

Stock-Flow Consistent (SFC henceforth) macroeconomic models, in turn, do pay a lot of attention to the financial side of the system and on the interdependencies that connect the balance sheets of the various institutional sectors to their real transactions in a monetary production economy. This, coupled with the fact that there has been a wide recognition, from both the press and academics (Chancellor, 2010; Wolf, 2012; Schlefer, 2013; Bezemer, 2010), that Godley and applied models based on the SFC approach have been between the few that correctly predicted both the 2001 and the 2007-08 crisis (Godley, 1999; Godley et al., 2007), caused a renewed interest in the approach in both its theoretical and empirical aspects, being it the perfect roof to host various heterodox views and to discuss how modern capitalist financialized systems works[1].

[1]The SFC approach has indeed been used to cover a broad variety of issues in post-

With the advent of the Great Recession and the publication of "Monetary Economics" from Godley and Lavoie (2007), a book that covered all the basic principles and modelling procedures of the approach, thus, an increasing number of researchers in macroeconomics has started to adopt the SFC approach to model whole economic systems. To move from a theoretical to an empirical model, however, is not always so simple. Still, SFC models *do* allow for a systematic treatment of whole economies, and indeed this has already been done. Pioneered by Wynne Godley and later developed at the Levy Economics Institute, the Levy SFC Macroeconometric model is the most advanced fully-empirical national accounts-based model, with a post-Keynesian *closure* and a Minskian approach to Finance. This model performed quite well in predicting the last major financial crises of the last decade and is currently used to make strategic policy analyses for the US and Greek economy (see Papadimitriou, Nikiforos, and Zezza, 2013, 2016; Nikiforos and Zezza, 2017b).

2.2 The SFC Approach: History and Principles

The basic principles of the SFC 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.

After a long experience ad the UK Treasury, Godley became the director of the Department of Applied Economics at Cambridge University[2], where he established the Cambridge Economic Policy Group (CEPG) together with Francis Cripps. Together, they published "Macroeconomics" (1983), a textbook where one can already find all the early principles and ideas of the SFC approach. It was Kaldor however, among the Cambridgeans, the one who had the greatest influence on Godley during their long lasting friendship. As Godley himself stated in the preface of his *Monetary Economics* "I remember a damascene moment when, in early 1974 (after playing round with concepts devised in conversation with Nicky Kaldor and Robert Neild), I first apprehended the strategic importance of the [Fundamental Identity]" (Godley and Lavoie, 2007:xxxvi). Godley's efforts were always pointed towards a twofold goal, the first being to reconcile economic theory with policy advises, the second to build sound accounting models that integrates the "real" and the "financial" sides of the economy and their interplay. After moving to the Levy Economics Institute, in 1994, Godley started to develop a "simple stock-flow consistent" model for the US economy, a work culminated with the establishment of the Godley-Levy Macroeconometric SFC model.

On the other hand, one can find the works of James Tobin and the New

Keynesian economics, such as financialization, monetary circuits, income and wealth distribution and ecological economics. For a detailed survey, see Dos Santos (2006), Caverzasi and Godin (2015) and Nikiforos and Zezza (2017a).

[2] A position previously occupied by Richard Stone, whose work on the National Accounts also had a huge impact on the SFC approach later developed by Godley.

Haven School. Contrary to Godley, Tobin was using a similar approach, which came to be known as the "pitfalls approach", to analyse portfolio choice from a more orthodox perspective (Brainard and Tobin, 1968; Tobin, 1969; Backus, Brainard, Smith, and Tobin, 1980). His works were aimed at carefully modeling the interdependencies between the prices and interest rates determined in financial markets and their *real* counterparts, which he thought as being the major deficiency (or, to be more precise, the *pitfall*) of the state-of-art macroeconomic models of the time.

However, both schools somewhat faded in the 80's, because of both lack of funding, the failure to interpret the inflation pressures of the oil crisis (a theme that, anyway, nobody at that time got right) and the rise of the representative agent approach embedded in New Classical and New Keynesian theory. But now, luckily enough, time has come for a come back.

Nikiforos and Zezza (2017) identify four basic principles in SFC macroeconomic modelling[3]:

1. *Flow Consistency.* "Everything comes from somewhere and goes somewhere" (Godley and Lavoie, 2007:6), i.e. there cannot be any black hole. As stated by Godley and Cripps, "the fact that money stocks and owes must satisfy accounting identities in individual budgets and in an economy as a whole provides a fundamental law of macroeconomics analogous to the principle of conservation of energy in physics" (Godley and Cripps, 1983:18). This implies that any *source of funds* for a sector is a *use of funds* of another (households receive profits and wages from firms, which in turn receive funds from households when they purchase their products), that any surplus of a sector is the deficit of another or that the imports of a country are the exports of others. This is referred to as "horizontal" consistency in the System of National Accounts terminology (EC *et al.*,(2009)). "Vertical" consistency, in turn, means that every transaction leads, at least, to a double accounting entries within each agent (usually referred to as credit and debit);

2. *Stock Consistency.* The liabilities of a sector are the asset of another. This means that the overall net wealth of the system sums up to zero;

3. *Stock-Flow Consistency.* Every flow implies a change in one or more stocks. Thus, in order to get the *end-of-period* stocks, one has to take into account the *accumulation* of the relevant flows, plus the possible capital gains. Positive net savings, thus, leads to an increase in net wealth;

4. *Quadruple Entry.* Finally, the three preceding principles lead to a fourth one: that every transaction implies a quadruple entry in the accounting structure. Introduced by Copeland (1947), quadruple-entry bookkeeping is now embedded in the System of National Accounts (EC *et al.*, 2009), assuring the accounting consistency of the whole system.

[3]These principles also shows that the basic accounting structures of SFC models follows that of the System of National Accounts.

Stock-Flow relations have long-lasting ties with Post-Keynesian theory[4], letting Chick (1995) to state that stock-flow analysis stands among its achievements.

She refers not only to the works of Godley, but also to the contributions of Hyman Minsky and Paul Davidson. This was surely the case for Minsky, since he related the fact that stocks of assets and debts led to cash flows and debt payments through time. He indeed stated that "the structure of an economic model that is relevant to a capitalist economy needs to include the interrelated balance sheets and income statements of the units of the economy. The principle of double entry bookkeeping, where financial assets and liabilities on another balance sheet and where every entry on a balance sheet has a dual in another entry on the same balance sheet, means that every transaction in assets requires four entries" (Minsky 1996: 77). As for Davidson, in another article Chick points toward two works, which shows a substantial concern for stock-flow consistency. In the first one (Davidson, 1968a), the author provides a critique of Tobin's growth model and portfolio analysis, underlining the fact that Tobin, since he does not introduce an independent investment function so as to avoid Say's law, assumes that households choose between money balances and real capital, whereas their choice ought to be between money balances and placements, that is, securities or equities. In the second one, in turn, Davidson (1968b) criticizes Kaldor (1966) for omitting money balances in his version of the neo-Pasinetti growth model with a stock equities[5].

Among post-Keynesian economists whit a concern toward stock-flow consistency we must mention Alfred Eichner ((1987)). He presents the endogeneity of money, the creation of loans, as well as clearinghouse and central bank operations through a balance-sheet approach, and explicitly tying this to the flow-of-funds approach of Jacob Cohen ((1986)) and to the work of Godley and Cripps (1983). Another post-Keynesian whose analysis integrates the flow-of-funds approach is Alan Roe (1973), who also worked with Richard Stone in the early 1970s to establish flow-of-funds measures of financial interdependence. He "believes that individuals and institutions generally follow *stock-flow norms* related to their assets, liabilities, income or sales, but that *during expansion, because of improved expectations, they may agree to let standards deteriorate*" (Godley and Lavoie, 2007:22, emphasis added), which shows a clear tie with Minsky's Financial Fragility hypothesis.

Of course, the degree of detail of the model depends on the research question at hand. We saw, in Tables 1 and 2 in Chapter 1, the basic accounting structure of a theoretical closed-economy SFC model consisting of four sectors (workers, rentiers, firms and the government) and three assets (equities, bonds and capital stock). In the next Section we will see how the SFC approach deals with Open Economy models.

[4]For a detailed discussion see, as usual, Godley and Lavoie (2007) and Dos Santos (2005).

[5]Which, in turn, was at the hearth of the successful attempt by Peter Skott (1989) at integrating growth of output flows and portfolio analysis.

2.3 From Closed to Open Economy

The usual textbook approach to deal with open economy issues, according to which models of individual closed economies are eventually "opened", usually do not give any consideration to what other countries must be held to be doing and how a full set of interactions between all countries might be characterized. The underlying assumption is that the open economy under study is smal enough, compared to the rest of the world, so that the feedback effects can be assumed to negligible. This approach, however, restricts our possibilities of analyzing, for example, the US, the Eurozone nor the Asian block, the sizes of which cannot be assumed not to have feedback effects on the Rest of the World. Instead, "we shall discuss open economy macro-economics using models of an economic system which, taken as a whole, is closed, with all flows and all stocks fully accounted for wherever they arise" (Godley and Lavoie, 2007:170), in accordance with the basic principles enunciated above.

As Nikiforos and Zezza (2017:23) detail, "introducing the open economy in a consistent way means that one needs to specify the structure of the domestic *and* the foreign economy, as well as the interactions between them". As was the case in the closed economy setting, also when modelling the Open Economy accounting consistency implies that the financial assets of an agent are the liabilities of others, so that all rows (adjusted for the exchange rate) in the Transaction Matrix sum to zero, as well as the overall Net Financial Asset position of the system.

Thi implies, of course, that if the NFA of one country is positive, then the other *must* be negative, i.e. the first country is a net creditor of the latter. In the same way, accounting consistency assures that the imports of country A are the exports of country B and vice-versa. Moreover, now the different sectors of the two countries receive and pay capital incomes abroad based on the respective foreign-denominated assets and liabilities they hold. These flows of capital incomes, together with the trade balance, determine the Current Account Balance, i.e. the net lending position of the foreign sector. All these points may look trivial, but are often neglected in Policy recommendations.

Since the focus of this work is on empirical SFC models, we refer the reader toward the cited surveys of the SFC literature for a detailed account of Open Economy models.

2.3.1 Empirical SFC models for whole countries

As already said, a big part of the recent resurgence of the SFC approach is due to the recognition, widely shared both in the press and in academia (see Bezemer, 2010), that models based on this framework where between the few that correctly saw the financial crisis coming.

Godley's works at the CEPR in the 1970's already contained all of the general principles of modern SFC empirical models (see Godley and Cripps, 1983; Cripps and Godley, 1976; Cripps, Godley, and Fetherston, 1976). He was attempting at ascertaining the determinants of the "Fundamental Identity" (more on which will be said later on), by building a set of accounting identities linking the monetary transactions between the sectors balance sheets and estimating econometrically the components of aggregate demand, trade and prices. This approach, which come to be known as "New Cambridge", followed the "Cowles Commission" fashion of that time (Fair, 1984).

The same approach has led to the development of models for Denmark (Godley and Zezza, 1992) and, later on at the Levy Institute, for US (Godley, 1999; Nikiforos and Zezza, 2017) and Greece (Papadimitriou et al., 2013, 2016).
Between the principal hallmarks of these models (LMM from now on), of the upmost importance is the implied stock-flow norm toward which the economy converges in the long-run[6], which is attained by modelling real private sector demand as a function of real disposable wealth and of the (lagged) stocks of real financial wealth. The introduction of variables related to capital gains and credit streams creates divergences from the stock-flow norm, which may well have hysteresis patterns. These models thus attempt at modelling the main channels linking the real and the financial side of the economy. In particular, the effect of stocks of assets on future capital income flows (from debtors to creditors), the effects of new credit on expenditure decisions and the effects of end-of-period stock of net wealth on future savings and expenditures decisions. In contrast to many theoretical models, though, the portfolio analysis is kept to a minimum (or absent), so that the effects of shifts in portfolios are neglected. Finally, it is worth noting that, to overcome the Lucas Critique (1976), models parameters are estimated by means of cointegration analysis, so as to (at least partially) assure that they will be stable over a prolonged simulation period. The Levy Institute, however, is not anymore the only place where these empirical SFC are developed.

Kinsella and Tiou-Tagba Aliti (2012) built a model for Ireland. Their modelling methodology, however, was somewhat different. Given the incompleteness of data for Ireland, they propose a calibration method for parameters values, where the latter may vary. This analysis may still give some important insights on the structure of the system, but would be highly limited for forecasts and projections. A similar methodology has been applied by Miess and Schmelzer (2016) in their works on Austria. They propose a model with a very detailed financial sector, where parameters are calibrated over the observed time series and then projected afterwards.The model is then used to compare this baseline scenario with different policy proposals.

In a recent work, the Bank of England (Burgess, Burrows, Godin, Kinsella, and Millard, 2016) produced the most advanced and institutionally rich applied SFC model derived from national-accounts data. In contrast from the Levy model, this model for UK is much more disaggregated and has a wide arrays of financial assets. Regarding parameters values calibration, however, these are determined through a mix of econometric estimations, calibration and arbitrary coefficients restrictions. The model is based on ONS database, using quarterly data.

[6]Given the absence of external shocks.

The same model[7] is applied by Veronese Passarella (2017) on Italian data. However, the model, albeit only being a first draft, already shows some weaknesses relatively to the one developed here. While the structure of the model with respect to the "real" economy looks similar to the one proposed here, albeit oversimplified, the "financial" side is definitely less modeled. Moreover, while EuroStat only publishes annual data, the model developed here is constructed upon quarterly data by ISTAT and BoI, which will of course give more accurate estimations.

Recently, the Department for Production Development (DEDP), under the supervision of the Minister of Production of Argentina (MIPROD), developed "the first version of a Stock-Flow Consistent model for the analysis of macroeconomic variables in Argentina (SFARG)." (Michelena and Guaita., 2017:1). At a first glance (and because the publication is still only available in Spanish!) the model make use of a SAM, extended as to include the financial side, to calibrate parameters and produce medium-term simulations for policy analysis. However, it seems to us that the *method* to proceed is somewhat different from the one we propose. Instead of going *from* the data *to* the model, as we propose, the SFARG *starts* from a theoretical model and *then* use data to calibrate parameters. Moreover, it seems that the neo-Kaleckian investment function they use is far too simple for a model of this sort, apart from having some theoretical weaknesses[8].

Another working group has recently published a new empirical model for South Africa (Makrelov, Arndt, Davies, Harris, et al., 2018). This model, however, differs somewhat from the others presented above. The model is, in fact, a mixture of a DSGE type (even though it is not stochastic), within a SFC accounting framework. Behavioral equations for consumption and investments are micro-funded in agents inter-temporal optimization, the Central Bank follows a Taylor rule and so on. Moreover, regarding the data used to calibrate the model, the authors built SAM for the period 2001-2012, adding capital and financial blocks. Due to the absence of appropriately detailed flow-of-funds and balance sheets data, however, balance sheets are then constructed by combining this two different sources but, as the authors acknowledges, the procedures they follow create large discrepancies between the model variables and the official statistics.

Finally, Antoine Godin, who recently moved to the Agence Francaise du Development (AFD), is now developing new models for developing countries using GEMMES, partially based on Goodwin-Keen (1995).

Albeit the rapid increase in empirical models based on the SFC approach, it seems to us that there is still a lot of work to do in this area, in terms of both methodology, theory and empirical work. First, regarding the method, practitioners worldwide would benefit from a detailed account on how to build this sort of models, starting from *appropriate* data sources. Secondly, the most

[7]With, of course, some differences stemming out of the Italian case with respect to the Financial side.

[8]See Shaikh (2016) and Lavoie (2014) for a discussion of heterodox views on the Investment function.

advanced models in this area either deal only with a three-sector economy (as the LMM) or do not provide robust parameters (as for the UK model from BoE). We think, however, that both these issues may well be addressed, and these are indeed the tasks we set to ourselves in this work.

2.4 The "*Fundamental Identity*"

During his time at the CEPG, Godley put forward a three-sector financial balances model, derived from a simple flow-of-funds accounting identity, that formed the basis for all his future research, in particular for the Levy Economics Institute. Albeit simple, this simple model helps "to provide some rigor in what can or cannot be said. Once we know the financial position of the private sector, there is a constraint on what the external and government deficit can be" (Lavoie, 2014:259).

The three balances are usually portrayed as:

$$(S - I) = (G - T) + CAB \tag{2.1}$$

where S and I stands for, respectively, private sector (households and firms) savings and non-financial investment in tangible fixed capital and inventories, G and T are government expenditures and taxes while CAB is the current account balance (with all terms expressed in nominal terms). $(S - I)$ is, in Godley's words, the Net Accumulation of Financial Assets of the private sector (NAFA), $(G - T)$ is the government deficit and CAB is the external balance. Godley's interpretation of (1) is that "public deficits and balance of payments surpluses create income and financial assets for the private sector whereas budget surpluses and balance of payments deficits withdraw income and destroy financial assets" (Godley, 1999:8).

One may also rewrite (1) in a more standard, national accounts fashion:

$$(S - I) + (T - G) - CAB = 0 \tag{2.2}$$

Equation (2) says that the net lending of private $(S - I)$, public $(T - G)$ and foreign sectors (CAB) *must* sum up to zero. Indeed, when something is saved and not used to purchase new tangible capital goods, it *must* have been used to purchase financial assets. $(S - I)$ may be thus viewed, when positive, as the "net financial investment" of the private sector (i.e. the amount lent to the other two sectors) and, when negative, as its "net borrowing". Similarly, $(T - G)$ and (CAB) may be viewed as "domestic public lending/borrowing" (i.e. the government surplus/deficit or, as it used to be called, the "Public Sector Borrowing Requirements") and "current account deficit/surplus". This implies that, whenever the domestic sectors cannot fund their own expenditures, they *must borrow those funds from foreigners.*

Both equations (1) and (2) are useful by themselves, since they clearly depict the constraints any economy faces. Moreover, as wonderfully put by Lavoie, "this is not a matter of opinion. The equation, or rather the fundamental identity, is derived from national accounts identity. *It is a matter of accounting,* *not economics*" (Lavoie, 2014:260. emphasis added). To see this, consider the following notation:

- PYF = net private income received from abroad;
- T = tax receipts;
- NTR_{GP} = net transfers from the government to the private sector;
- NTR_{GF} = net transfers from the government sector to foreigners;
- NTR_{PF} = net transfers from the private sector to foreigners.

Now note that:

$$GDP = PE + G + X - M \tag{2.3}$$

which implies,

$$GDP - T - PE = G - T + X - M \tag{2.4}$$

and that:

$$\begin{aligned} &GDP + PYF + NTR_{GP} - NTR_{PF} - T - PE = \\ &G + NTR_{GP} + NTR_{GF} - T + X - M + PYF - NTR_{GF} - NTR_{PF} \end{aligned} \tag{2.5}$$

Now, using the following notation,

- PDY = Private Disposable Income = $GDP + PYF + NTR_{GP} - NTR_{PF} - T$
- PFB = Private Financial Balance = $PDY - PE$
- $PSBR$ = Public Sector Borrowing Requirements = Government Deficit = $G + NTR_{GP} + NTR_{GF} - T$
- BP = Current Account Balance of the Balance of Payments = $X - M + PYF - NTR_{GF} - NTR_{PF}$

and we are back to the fundamental identity:

$$PFB = PSBR + BP. \tag{2.6}$$

Again, it is very helpful to understand what these balances imply. Starting with the public sector, a positive $PSBR$ means the government is running a deficit (i.e. spends more than it gets) and needs therefore to issue debt to finance the gap. Thus, the stock of government net debt is given by:

$$GD = GD_{t-1} + PSBR \tag{2.7}$$

what (7) tells us is that the government debt this quarter is given by last quarter's stock plus the current deficit. Thus, today's deficit feeds tomorrow's stock of debt, which in turn will increase tomorrow's interest payments (i.e. increasing NTr_{GP}). Similarly, the CAB surplus (deficit) may be seen as the net accumulation of foreign-denominated assets by the private sector. Thus, denoting VFN

the stock of net private financial assets denominated in foreign currency, we can write:

$$VFN = VFN_{t-1} + BP \tag{2.8}$$

which implies that the private financial balance can be interpreted as the sum of the private accumulation of government debt and foreigners' debt - and, hence, the acronym NAFA, i.e "net accumulation of financial assets". Denoting VN as the "stock of private financial assets" we can therefore, write the following stock identity:

$$VN = GD + VFN = VN_{t-1} + PFB = VN - t - 1 + NAFA \tag{2.9}$$

The dynamics of the three-balances model, thus, work as follows. At the beginning of the period, the inherited stocks of VN, VFN and GD affect the net transfers (given by NTr_{GP}, Ntr_{GF} and NTr_{PF}) via their interest burden and, combined with the usual Keynesian variables in (3) determine GDP. The latter, together with the other determinants of the transfers' variables will in turn feed the end-of-period stock, thus generating an *intrinsic stock-flow dynamics.*

Finally, worth noting are the links between what has been said above and the Minskyan insight of *Financial Fragility* (1986). When a sector has negative net lending, its debt-to-income ratio will tend to increase[9]. If there is a negative CAB and the government is trying to achieve a balanced budget, it must be that the private sector is running a deficit to fill the gap, thus increasing its debt-to-income ratio (in this case increasing its foreign indebtedness). If this situation persists for a prolonged period of time, it may lead the private sector from a hedge, to a speculative and finally a ponzi position, increasing the total financial fragility of the system and, possibly, to a financial crisis[10].

2.4.1 Some "special cases" of the *Fundamental Identity*

Some special cases may be drawn from equations (1) and (2):

- *The "Twin Deficits"*. The first one, which is at the core of the Washington Consensus and forms the basis for the IMF "restructuring" programs, is known as the "Twin Deficit Hypothesis". Assuming away private net lending, (1) reduces to

  $$(G - T) = -CAB \tag{2.10}$$

  thus, imposing austerity policies and restraining the budget deficit, the IMF says, will improve the external competitiveness of the country and hence decrease the CAB deficit, "killing two birds with one stone" (Lavoie, 2014:262). However, it is now clear that the underlying assumption that there will be no impact on the growth rate of the economy has been proved,

[9] This is not necessarily true in a growing economy.

[10] As was the case in the run-up to the financial crisis in both U.S and some peripheral countries of the Eurozone.

at least, flawed[11]. While, in fact, there has been a decrease in both public and external deficits, it is also true that the adjustment has taken place through a steep reduction in output.

- *The "Balanced Budget Puzzle"*. The second special case focuses on the domestic economy. Assuming $CAB = 0$, (1) reduces to

  $$(S - I) = (G - T) \tag{2.11}$$

  In this second case the public sector deficit is therefore the mirror image of private sector surplus. As we will see in greater detail later on, when looked at as a share of GDP, if the CAB is stable enough these balances will move together. Globally, where CAB are nil by definition, this implies that to any private sector financial surplus must correspond a government deficit.

  However, it is also true that there is no need of a budget deficit for the private sector to acaccumulate financial assets. This may be seen by assuming away also the public deficit, i.e. $(G - T) = CAB = 0$, and by splitting the private sector between firms and households (with the subscripts f and h, respectively). we may then rewrite (1), after rearranging, as:

  $$(S_{NFC} - I_{NFC}) + (S_{HH} - I_{HH}) = 0 \tag{2.12}$$

  finally, assuming away households investment ($I_{HH} = 0$) so that now S_{HH} represents both households' savings and the their net lending, the above reduces to

  $$S_{HH} = I_{NFC} - S_{NFC} \tag{2.13}$$

  It is clear, then, that the private sector can still have a positive financial balance and acaccumulate new financial assets, even if the government is not running a deficit, given that firms have investment expenditures. The reverse is also true. For a given amount of investment, indeed, any increase in households saving will be matched by a decrease in firms' saving (i.e. their retained earnings), reminding us of the "Flow consistency" implication that any use of funds from a sector is a source of funds from some other.

2.5 *Closures*

While accounting consistency is important for building a sound macroeconomic model, since it decreases the degrees of freedom of the model and provides some important insights about the constraints faced by any economic system, it is not enough. As shown by Taylor and Lysy (1979), indeed, 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

[11] The assumption being that increases in domestic net lending its inflationary, thus reducing the external competitiveness of the country. As in most Neo Classical models, the demand side only plays a role in the short-to-medium run, while the long-run is supply-side determined.

standpoint, the SFC literature has always found itself within the boundaries of Post-Keynesian economics (see Godley and Lavoie, 2007; Lavoie, 2014). Thus, it is effective demand demand that drives economic growth both in the short *and* in the long-run[12].

The previous discussion of the "Fundamental Identity" and its special cases, for example, revolves around the direction of causalities imposed on the net lending of the various sectors. As the attentive reader may have imagined when discussing the Twin Deficits case, for mainstream authors the causality runs from the domestic (with the government playing the major role) to the external sector while the economy is supply-led. In "Seven Unsustainable Processes" (1999), in turn, Godley assumes a demand-led system where, due to the successful expansion of foreign goods in US markets, the trade deficit is treated as exogenous, with the causality going from the external to the domestic sector. This, coupled with the fact that the government was at that time achieving a budget surplus (for the first time in the post-WWII era), made clear to him that the only way for the US economy to sustain those growth rates was trough an increasing indebtedness of the private sector. This led to increased systemic Financial Fragility and, ultimately, to the dot.com financial crisis in 2001. The same kind of analysis is still at the core of the policy research analysis of the Levy Institute, where extension to the first Godley model has led to the development of macroeconometric models for the US and Greece, for which Strategic Analyses are published on a routinely basis.

Finally, to close the model, one has to make *behavioral* specifications. Given the k accounting identities that come out of the Transactions and Balance-sheets matrices[13], if we want to determine n endogenous variables we need $n-k$ additional equations. These are given by specifying how the agents and the different sectors behave in the system.

Broadly speaking, we need to specify how:

- *agents make their expenditures* - i.e. consumption, investment, government expenditures in goods and service;
- *agents finance their expenditures* - i.e. how the government finances its deficit (with short term Bills or long-term Bonds), how many more loans households will take on, how firms react to discrepancies between their investments and retained earnings;
- *agents allocate their wealth* - this is done with a "Tobinesque" approach. If there are m assets, one needs to specify $m-1$ demand function (the last one being implied by the rest), thus assuring that any increase in a stock implies a corresponding decrease in some other;
- *productivity growth, wages and inflation are determined* - while there is little work in the related literature on productivity growth, which is thus

[12] With output driving the adjustment and inflation being the result of wage-bargaining struggles of the workers as in Kalecki (1971).

[13] Recall 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".

usually taken as constant or to grow at an exogenous rate, inflation is assumed to be determined by the struggle between workers and employers. The nominal wage reacts to close the gap between workers targeted and actual real wage, with the price level determined as a mark-up on unit production cost (as in Kalecki).

- *the financial sector acts/reacts* - i.e. how the Central Bank reacts to inflation or unemployment pressures, how banks provide credit and so on.

It is thus the joint analysis of this accounting skeleton, given the demand-led closure, the behavioral specifications and the presence of multiple assets that allows for an *integrated* analysis of a modern monetary capitalist systems.

A sort of short-run "equilibrium" for the system is guaranteed through price changes in financial markets and output adjusting to make savings equal to investments. However, if expectations driving expenditures or portfolio decisions are not fulfilled or some stock or whatever other variable is not at its target level at the end of the period, this will cause further changes in subsequent periods.

The long-run, in turn, is defined as a state in which stocks and flows grow at the same rate, i.e. *the stock-flow ratios are stable.* This, as in Kalecki, is achieved through a sequence of short-run (dis) equilibria. The adjustment takes place in the single short periods because agents reacts to changes in stocks and stock-flow ratios, thus affecting next periods capital income streams, transactions and asset allocation that in turn will affect next period decisions and so on. From this point of view, the sort of short-run equilibrium applied in simulated SFC models is more similar to Shaikh's *Turbulent Gravitation* than to the usual post-Keynesian description, i.e. as a trial-and-error dynamic or dis-equilibrium approach. From a practical point of view, the long-run defined as above acts as a *benchmark* for the system, since an ever-increasing (or decreasing) stock-flow ratio would be unsustainable, if holding for prolonged periods.

2.6 Conclusions

In this First part of the Thesis we have dealt with the major theoretical and methodological innovations of the SFC approach. In Chapter 1, we have shown how the recent Growth&Distribution post-Keynesian literature deals with closed-economy and Deficit and Debt dynamics, developing a SFC Supermultiplier model and comparing the different solution methods usually applied, stressing that only with the use of numerical computer simulation we can depict the system-wide effects of shocks, which needs hysteresis mechanisms and feed-back effects to be modeled correctly. In Chapter 2, in turn, we detailed how the discussion changes when dealing with open economy, both theoretically and through applied models.

The next Part of this work is indeed devoted to show how to get from *Theory to Practice.* In the next two Chapters we will build the accounting structure for an applied SFC model, based on the appropriate data for Italy. In Chapter 3 we will present the two main database used, which consists of the Non-Financial

Accounts from ISTAT and the Financial Accounts from Bank of Italy, and discuss how to appropriately treat all the issues and problems that will emerge when using such data. In Chapter 4, in turn, we will show how to correctly merge the two sets of data.

Part II

Practice

Chapter 3

Data and Model Accounting

3.1 Introduction

This second Part of the work is devoted to the construction of the basic structure for an applied SFC macroeconomic model for Italy. In Chapter 3, after introducing the data and the related issues, we will set up the accounting structure of the model, based on the aforementioned data sources, for both the "real" transactions and "financial" stocks&flows, and present the (reduced-form) Transaction and Balance Sheet Matrices. In Chapter 4, we will show how to merge the two databases, start to introduce the Behavioral Transaction Matrix and assess what are the next steps to be made to get to the final model. These will be carried out in the last Part of the Thesis, especially in Chapter 5, where we will "close" the model, define portfolio behavior and estimate the structural equations.

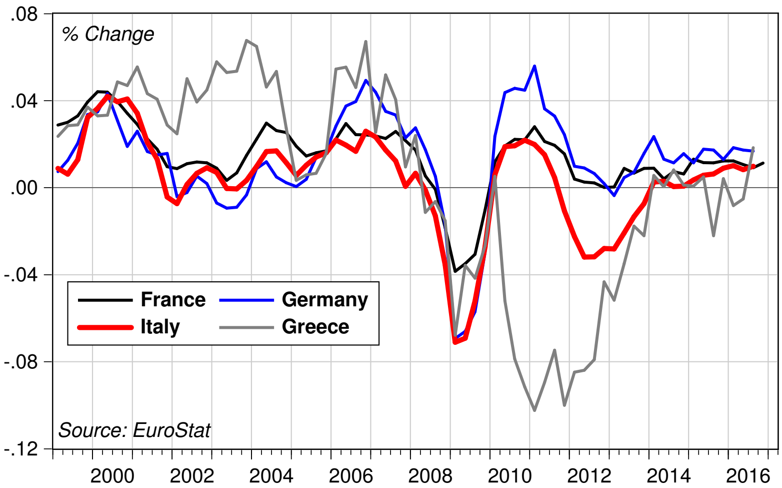
Before starting these discussions, it would be useful to give a snapshot of the Italian economy in the last two decades.

3.1.1 Why Italy?

Apart from all the announcements about the end of the recession coming out of the press and the EU and Italian Government, Italy looks far from a serious recovery. Figure 3.1 shows the rates of growth for France, Germany, Italy and Greece, from 1999 to 2016. Italy, who had suffered the most, alongside Greece, from the double-dip recessions, despite eight consecutive years of *Structural Reforms* (i.e. of *Austerity*), still experiences rates of growth of the economy lower than those of his EZ partners and well below its pre-crisis period (which was labeled, in any case, as the Great Moderation, i.e. a slowdown in growth rates for the Western Economies).

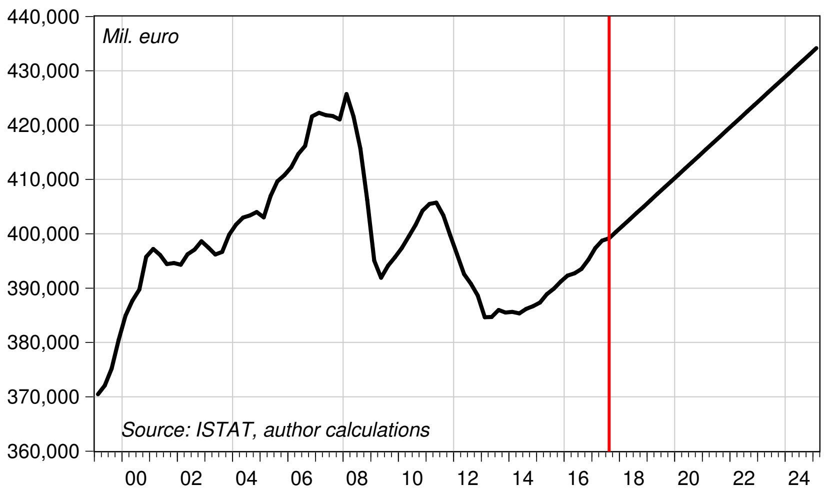
To better "appreciate" the effects of the crisis, Figure 3.2 displays Italy's real GDP in the same period. It is clear the steep increase in the pre-crisis period as well as the double jump down, that took the country back to 2001 levels. The red solid line, in turn, denotes the end of the sample. The trend dynamics afterwards is calculated as a linear projection of the recent (2014q4-2017q2) trend in real GDP growth. It's quite shocking to notice that, *without*

Figure 3.1: Real GDP and Recessions. Selected EZ Countries



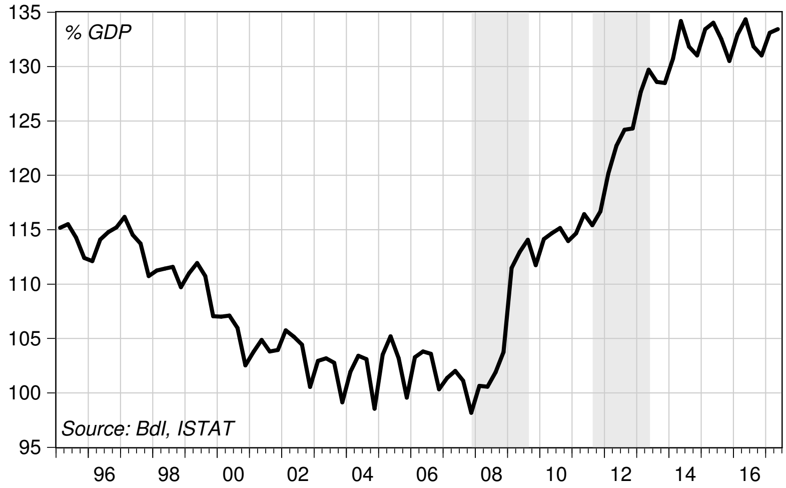
new external shocks, Italy will met the pre-crisis peak only in 2023!

Figure 3.2: Italy. Real GDP



Both Crisis, fueled by the austerity measures, had a deep impact on Italy's Public Debt to GDP ratio, even if the opposite was the clear intention of both the EU commission and Italian Governments. Figure 3.3 shows Italy's public debt in recent years as percent of GDP, with the shaded areas corresponding to the Great Recession and the Sovereign Debt Crisis. While the ratio was declining prior to the full entry of the country in the EZ (from 116% in 1995 to 106% in 1999), from 2000 to 2008 it stabilized (at 100-106%) to finally explode, up to 137% in 2017.

Figure 3.3: Italy. Debt to GDP



After the obvious rise in the Deficit to GDP ratio with the 2008 crisis, in fact, the Government proudly achieved its reduction via the mentioned austerity measures back inside the limits imposed in the Maastricht Treaty and in the Stability and Growth Pact. This, as we said in the previous discussion on the Fundamental identity, according the the so-called Washington Consensus and the Troika, would have helped to improve the CAB, which in fact happened. Figure 3.4 displays Public Deficit and CAB as percent of GDP.

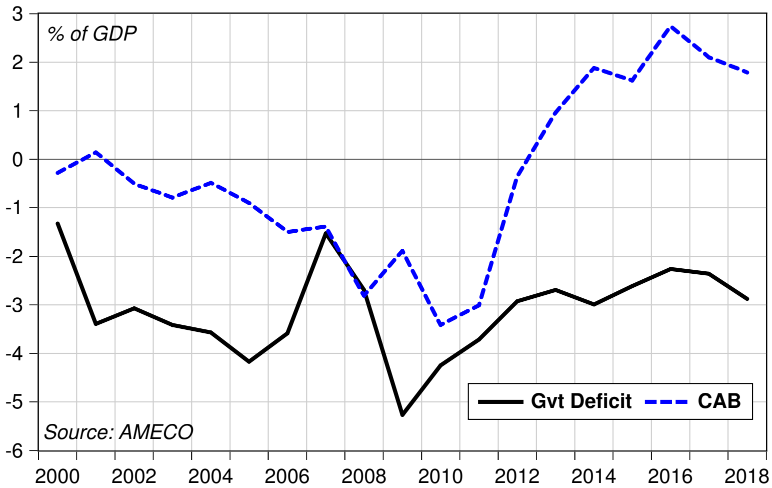
However, as we will see in greater detail later on, the weight of the adjustment has all been put on the shoulders of the Private sector. For the moment, however, Figures 3.5 and 3.6 sketches two sides of this adjustment.

The former displays two measures for the Unemployment Rate. This, together with real GDP growth, is often considered as the other major indicator for the health of the economy. While the black solid line portrays the standard U3 measure of the unemployment rate ($\frac{unemployed}{labor force}$, where the labor force is the sum of employed and unemployed[1]), the blue dotted line displays the augmented U6 measure[2]. For now, it may be enough to say that, beside the U3 already showing a terrible figure, for the decline experienced in the last three years is still far too slow and we are still above 10%, the UR6, which peaked at 30%

[1]We will discuss the labor market in more detail later on in this work.

[2]This measure, which follows the one already published by BLS for US, is calculated by adding to both the numerator and denominator the "potential labor force" and adding, to the numerator only, those who are in "Involuntary part-time".

Figure 3.4: Italy. Public Deficit and CAB



in 2017, is striking. Since the Great Recession[3] the number of "Unemployed" grew by *just* 1,8 million units against the 4,2 million rise in "non-employed" that come out of the extended definition.

Figure 3.5: Italy. Unemployment Rate(s)

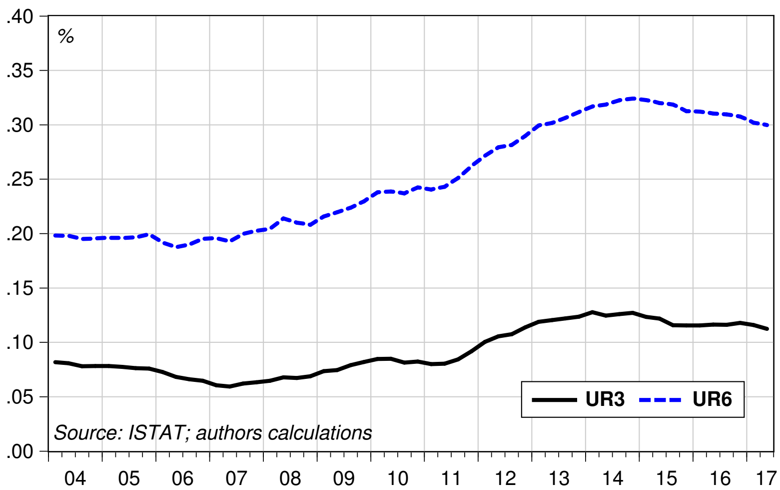
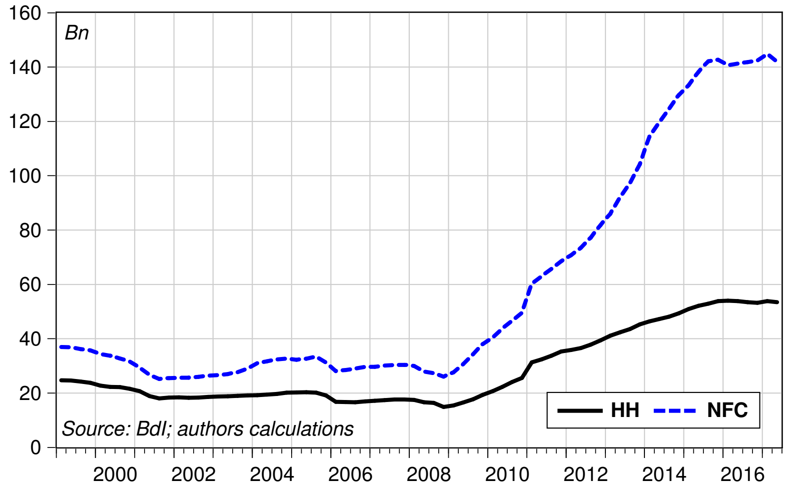


Figure 3.6, in turn, displays Banks Non-Performing Loans to private domestic sector. NPL to domestic non financial firms rose from 26 Billion in 2008

[3]From 2007q2 to 2014q4.

to 140 Billion in 2015, where they stabilized. The great exposure of the Italy's banking sector, which was historically composed of small and medium banks lending to local businesses and households, found itself in great trouble following the Great Recession. This was partly due to bad governance that led small banks to lend freely to leveraged clients, as recent investigations show, but primarily given by the structure of the banking sector itself, centered as it was on private small and medium firms.

Figure 3.6: Italy. Bank NPL vs. Private Domestic Sector



3.2 The Data: sources and reconciliation problems

Needless to say, in theoretical models the researcher has far more liberty on the decisions to make about the number of sectors and assets to include, on the closures and the behavioral specifications, all choices that may lead to a wide arrange of different models, suited for the question at hand. When building an empirical model, in contrast, the first constraint everyone faces is related to the availability and structure of the appropriate data, from which all other decisions will follow.

In order to build a model which respects the theoretical requirements of the SFC approach, the core of the statistics must be the Non-Financial Accounts of Institutional Sectors (NFA from now on) - published in Italy by ISTAT at quarterly frequency from 1999 to present - and the Financial Accounts (FAIS from now on) - published by the Bank of Italy at quarterly frequency from 1995 to present[4].

[4]The complete list of data sources is reported in Table A.1 in Appendix A.

Five main problems arise when using these data sources:

- The first one is that they are not necessarily consistent with each other: NFA detail the sources of income for each sector, and the expenditure on current and capital account, ultimately determining saving and net lending. FAIS provide the detail on how net lending can be broken down as changes in financial assets and liabilities. However, since the two sets of statistics come from different data sources, with the former being based on surveys on income and expenditure, and the latter on balance sheet statistics and other sources from the financial sector, the measures of net lending for each sector do not necessarily match.

  Figures 3.7 report net lending/borrowing for all sectors as percent of GDP. The upper part of the figure depicts net lending from the two different sources, while the lower part records the discrepancies between the two series.

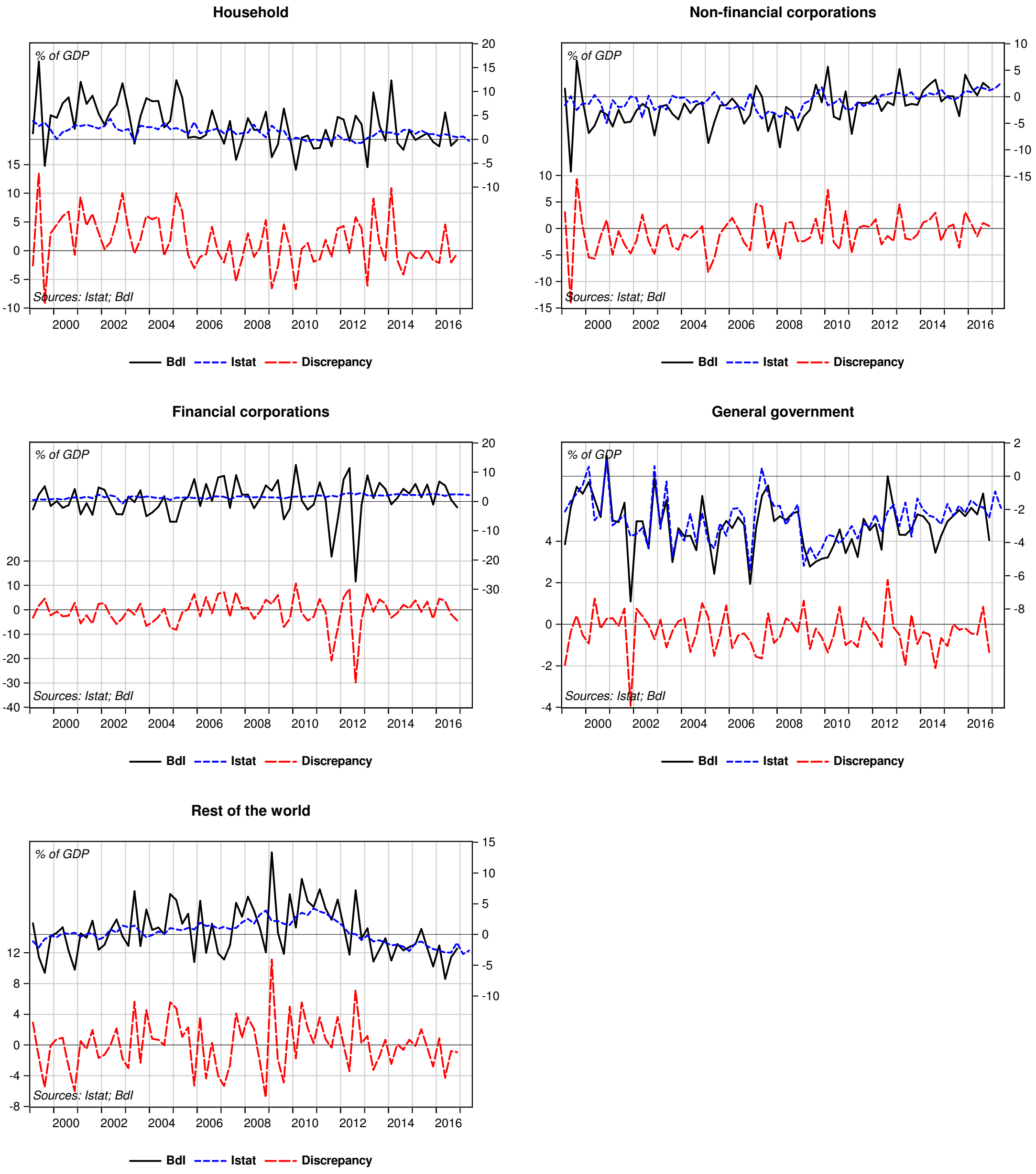
  The series from FAIS display much higher volatility than the measure taken from NFA, due to the different data collection procedures, sources and characteristics of the series. Nevertheless, one can still get some interesting information by looking at the individual sectoral balances.

  Starting with the upper-left figure, which depicts the households sector, one may note a worsening of its financial position in the run-up to the financial crisis of 2008 and, between 2010-2012 (in concomitance with the European debt crisis), the balance goes into negative territory, meaning households have been deleveraging. Moreover, one may notice that more recently the balance has stabilized at a lower level. The upper-right figure shows net lending of Non-Financial Corporations. Firms are usually expected to display negative net lending, since investments are financed through issues of shares, retained earnings and bank credit. While households have experienced a worsening of their financial position, the opposite is true with respect to the non-financial sector that, starting from 2008, has experienced a drop in its deficit, with the balance going positive in the last years of the sample, reflecting a drop in investment. Moreover, it seems that the discrepancies are becoming smaller by the end of the sample. Financial corporations, presented in the mid-left figure, show a relatively stable positive, and increasingly positive, trend around 1-2 percent of GDP for all the period under examination. The peaks 2011-2013, in turn, are related, again, with the debt crisis.

  Moving to the government sector, this is the only case in which the two measures move together, with the higher discrepancy between the series in 2008-9, again associated with the financial crisis. The effect of austerity policies is clearly depicted in the trajectory of the deficit/GDP, which passes from 4,5-5 percent to a mere 2 percent in recent years[5]. Finally,

[5] In line with what expected from both the Maastricht Treaty and its 3% Golden rule and the

Figure 3.7: Discrepancies in Net lending



the bottom-left figure displays the net lending of the external sector. To-

"suggestions" coming from the EU Commission and the Growth and Stability Pact. It is worth noting, however, that the concept of "Deficit" used in the EU treaties does not correspond to either the deficit stemming out from NFA nor that of FAIS. It would be interesting, in future releases of the model, to include these details.

gether with households, the RoW shows the higher discrepancies between the two series (from minus 5 to plus 12 percent of GDP). The increase in the surplus after the financial crisis may well be related to the drop in GDP and therefore, the drop in imports caused by austerity.

To achieve consistency between the two data sources for model purposes, two strategies may be adopted. One could (a) assume that financial data are measured more accurately than income and expenditure data, and add the discrepancy to one of the determinants of saving for each sector (income or expenditure), or (b) one could treat the discrepancies as unexplained exogenous variables. The former strategy would make model simulations for consumption, income or saving systematically different from data published in the national accounts, so the latter strategy is to be preferred. This strategy, however, implies that such exogenously given discrepancies be projected into the future for model simulations, increasing the degree of arbitrariness of model projections.

- The second problem in statistics for sectoral accounts is that they are not seasonally adjusted, and data exploration shows that - when adjusted with the X12 procedure - they produce series which have some discrepancy with data published in the national accounts. This discrepancy is not large (for GDP is between -0.8 and +0.8 percent) but will nonetheless imply additional exogenous variables to take the discrepancies into account, as well as introducing further discrepancies in model accounting. As an example, while the sum of interest paid out in the whole economy (including the rest of the world) is equal to the sum of interest income received (in the originally non-seasonally adjusted data), when each flow is seasonally adjusted, the accounting identity will register a discrepancy.

- The third problem which needs to be addressed is that NFA do not provide who-to-whom detail for a number of flows, which include:
  - Direct taxes (some of which are paid to foreign institutions)
  - Interest and dividends paid/received
  - Social benefits other than government individual consumption expenditure
  - Other transfers on current accounts
  - Transfers on capital account

  To address this problem, three solutions are at hand:
  - the first is to assume, given the trends in the data, how to allocate these payments. However, this increases the arbitrariness of the model and has to be grounded on data exploration;
  - the second is to resort to additional data sources which provide more detail, namely:
    * Balance of payments statistics

    * Other financial statistics on holders of public debt
    * Other financial statistics providing details of the balance sheets of financial institutions

  - finally, if both the previous solutions are inapplicable, one may add an additional *Pool* column to the Transactions and Balance sheet matrices. In this case, all sectors will receive/pay from/to the Pool.

- The fourth problem is that if the model wants to address monetary policy, the Central Bank should be explicitly represented. This is the case for FAIS, which provides details on assets and liabilities of the Bank of Italy, but not for NFA. Using data on the balance sheet of the Bank of Italy, we can separate income flows and expenditure flows of the CB from income and payments of other Monetary Financial Institutions (MFI). Since the adoption of the Euro, the BoI has become part of the system of European Central Banks, while the ECB is the (foreign) institution actively running monetary policy. To model financial transactions between domestic institutions and the ECB, we have to identify how and where such transactions are registered in both financial accounts, balance of payment statistics, and other financial statistics which are available.

- The fifth (and final!) problem is that Italian statistics are available only for a relatively short period of time at quarterly frequency, since the strategy adopted by ISTAT, contrary to other national statistical institutes, is not to revise backwards statistical information when a change in methodology is adopted, and the additional information to revise the data backwards are not available. Model development would benefit from the ability to compare data related to the period of flexible exchange rates, which started in 1971, to the period of managed exchange rates to the common currency. However, we defer to future research the expansion of the model backwards, which requires appropriate procedures to infer quarterly data from available annual data, and estimation for variables of interest for which no information is available.

3.2.1 The level of detail

Available data from NFA allow to decompose the economy into five institutional sectors:

1. Households and non-profit institutions serving households
2. Non-financial corporations
3. Financial corporations
4. Public sector
5. Rest of the World

While data from FAIS provide more disaggregated data for Financial corporations, which are split among:

1. Monetary Financial Institution

  - Central bank
  - Banks

2. Other Financial Institution
   - Mutual Funds
   - Other

3. Financial auxiliaries

4. Insurance companies and Pension Funds
   - Insurance companies
   - Pension Funds

As well as information on the public sector, which is disaggregated into Central government, Local governments and the Italian pension fund (INPS). It is therefore relatively easy to obtain statistical information to separate the Central Bank from the rest of the Financial sector, since sources of revenue and expenditure for the CB are easy to identify. This would allow to build a model with six sectors, where each sector is relatively homogeneous, allowing for an easier identification on the determinants of the rules governing revenues, expenditures, and portfolio management for each sector. On the other hand, this level of detail implies that the number of accounting identities and "behavioral" equations to be specified increases exponentially.

A possible alternative is to adapt the "New Cambridge" approach suggested by Godley and the Cambridge Economic Policy Group where the whole of the private sector is consolidated, so to focus on the determinants of the net stock of financial assets of a simplified economy composed by a private sector, a public sector, and the rest of the world.

To illustrate these points, Figure 3.8 reports an estimate of the private sector balance[6], obtained from annual data, along with government deficit, and the current account balance, with the solid vertical red line depicting the start of our database (1995). Further sectoral disaggregation is not available for the 1960-1979 period, which shows how the private sector was acaccumulating net financial assets which were mainly the liabilities of the public sector, while the current account balance was readjusted by exchange rate movements. As Italy started to fight inflation, and to try to avoid currency realignments in the 1980s, the current account started to deteriorate, up to the large devaluation of 1992, and the decline in government deficit relative to GDP implied a drop in the ability of the private sector to acaccumulate financial assets. When Italy was preparing for entering the Euro, the current account started to deteriorate again, from a peak in 1996 to a trough in 2010, when it started to recover, mainly because of the austerity measures which made imports collapse. From

[6]Government deficit is not available before 1995. For the 1960-1994 period we used the change in government debt to estimate government deficit, since the difference between the two - given by net capital gains - should be sufficiently small. The private sector balance, i.e. the excess of private saving over investment, is obtained by summing up government deficit to the current account surplus.

the beginning of the Great Recession in 2007, the private sector balance seems to have decoupled with the public sector balance.

Figure 3.8: Financial Balances

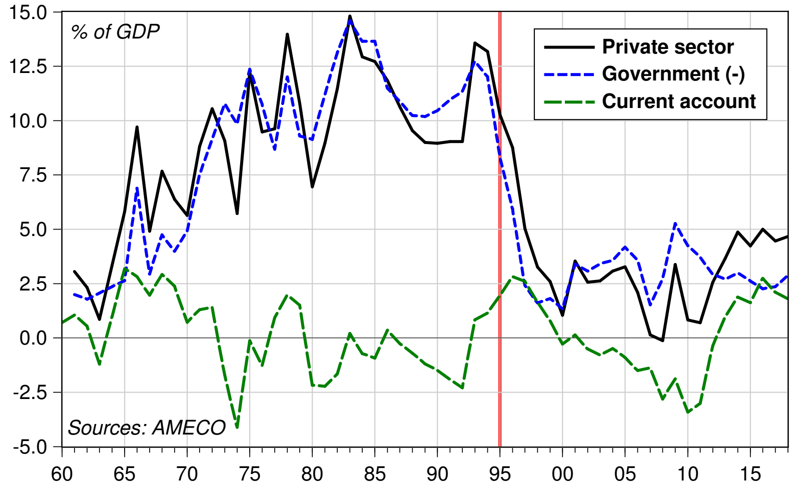


Figure 3.9 reports the available evidence from the AMECO database on the net lending of household and corporations[7], which shows that the entire decline in the private sector financial balance is due to the household sector. Again, modeling only the 1999-2016 period would take out the large decline in household saving relative to investment.

Figure 3.10, in turn, displays the Public Debt to GDP ratio from 1960 to present. It is clear that almost all of the rise in Public Debt the country experienced was during the EMS period in the 80s until 1992.

Without going into further details here, one notices that modeling the Italian economy using quarterly data for the 1999-2016 period alone would leave out some long-term feature of the Italian economy, namely: 1) the ability to manage the current account balance so to make the size of the public debt a domestic problem, which was easier to match as long as the private sector was willing to acaccumulate financial assets on top of investment in real assets; 2) the structural change in the private sector; 3) the huge rise of Public debt during the 80s. However, it will only be possible to eventually estimate the series backwards once we have the complete model at hand.

It is worth stressing, however, that our purpose here is to build (and show *how to build*) a multi-sector model, which will be among the most disaggregated

[7]Net lending for the household sector is not available, and it has been estimated as the difference between disposable income and current and capital expenditure, i.e. without taking into account net capital transfers.

Figure 3.9: Private Sector Balances

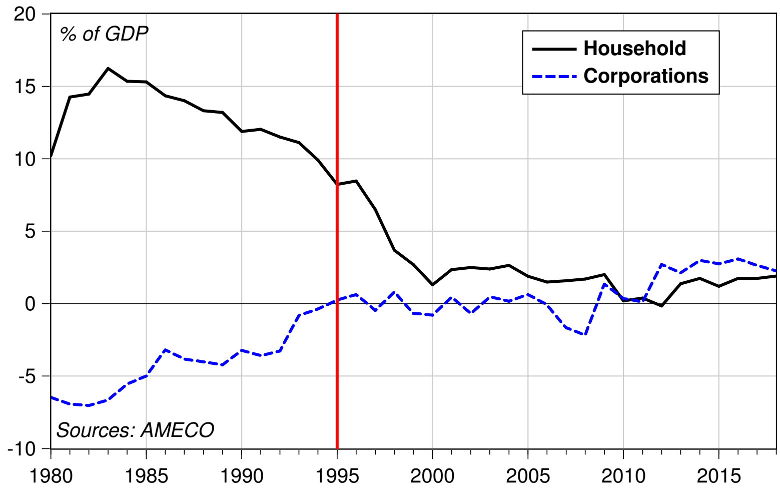
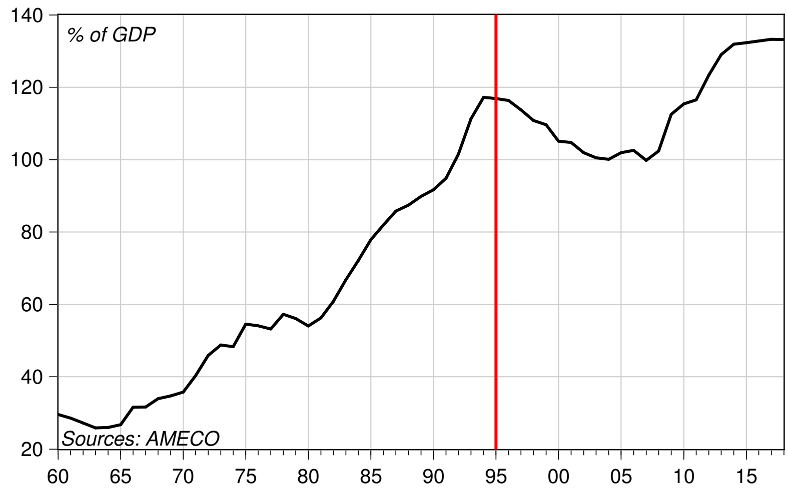


Figure 3.10: Debt to GDP



and advanced model in the existing literature. It is thus well beyond our effort here to estimate backwards the series for such a model, which will be the topic for future research.

3.3 The Accounting Structure

As pointed out in the previous sections, many complications arise when one tries to make the final step from a theoretical to an empirical model. In fact, when looking at the National Accounts, it is clear that in reality (almost) every sector holds (almost) every asset. Thus, if one doesn't want to incur in Robinson's (1962) criticism of building a useless 1:1 map of the economy, aggregations of sectors and a description and modelling of only the relevant assets and transactions is needed.

3.3.1 The (reduced-form) Transaction-Flow Matrix

To illustrate the point above, Table B.1 (in Appendix B) displays the "actual" Transaction Matrix for the Italian economy, i.e. the Non Financial Accounts of the Institutional sectors, as of 2015.

Starting from the top, the first block records the Rest of the World (RoW) Production account, which registers exports, imports, and the net indirect taxes paid domestically. We then pass to the "Generation of Primary incomes": adding the contributions to production to the GVA of the various sectors and subtracting the costs of production (equal to wages and taxes on goods&services) yields Gross Profits (consisting of net profits and mixed income).

The "Attribution of Primary incomes" records the wages and indirect taxes received (by households and RoW the former and Government and RoW the latter), the subsidies paid and the capital incomes paid and received by the various institutional sectors (which are divided into interests, dividends, reinvested earnings from FDI, other incomes from investments and rent from land) that, summed to gross profits, yields Primary income. Next, we have the"Distribution of Secondary incomes": to primary income, we add and subtract direct taxes, benefits (which consists of net social contributions, other social transfers and social transfers in kind) and other current transfers, to get to Disposable income. In the "Uses of Disposable incomes", from the post-tax income we add the variations in pensions entitlements and subtract consumption (collective and individual), and we get to Saving.

The "Variations in net wealth due to saving and transfers and capital account" records the transfers in capital account paid and received (consisting of taxes on capital account and other current transfers) that yields the variations in net wealth while, finally, in the "Net acquisition of non financial assets", we find investments (in fixed capital and in inventories) and other acquisitions of non-financial non-produced assets. What is left represents the Net Lending of the various sectors or, as Godley called it, the Net Acquisition of Financial Assets (NAFA).

As one may notice, however, we already encounter a series of problems. First and foremost, we will need to write an identity for each and every entry of both the Transactions and Balance sheet matrices. Thus, to keep the model simple enough is a priority. Secondly, as it is clear from the table, almost every sector is involved in almost all transactions. Reconstructing the who-to-whom payments is, thus, the second issue to solve.

Table B.2 (in Appendix B) shows the Simplified Transaction-Flow Matrix.

The matrix here[8] is a simplified version of Table B.1, which still records all transactions as they appear in the NFA.

First, however, a methodological remark is needed.

As we will see later, in the final model all the entries in the transaction matrix will have to be treated as stock-flow relations. The flows of Capital incomes, for example, will be calculated as $sector\_flow\_ = (r1_{t-1} * stock1_{t-1}) + (r2_{t-1} * stock2_{t-1})...$ (where $r1, r2$ etc. represents an adequate interest rate), while a number of quasi-identities will also have to be added (regarding tax payments/receipts, social transfers, etc.), which will in turn be calculated as $sector\_flow\_ = \theta * YP\_sector_{t-1}...$ (where θ represents an adequate tax rate) and so on.

In some cases, however, reconciling in the model a flow of interest payments to the appropriate stock may create discrepancies between the series calculated and the ones published in NFA. Thus, the discrepancy will then need to be added to the relative identity if we want our simulations to match historical stylized facts. To do this operation correctly, however, we will need that the structure upon which we build the model is *already* consistent from an accounting perspective, and this for multiple reasons. First, as we said, we will need to build exogenous variables for all the discrepancies created, and these will be calculated as the difference between the variable published in the NFA and the constructed one. Secondly, if there are any issues of consistency inside the data, these would be easier to detect.

Going back to Table B.2, the first difference between the two tables is that the upper part of the matrix, which records the incomes from production, has now been filled (Only Exports and Imports have still to be added). The second difference, as one may note, is the *Pool* column. Its purpose is to serve as payer/recipient every time it is not clear from the data, neither from its structure nor from additional sources, how to reconstruct the who-to-whom payments. The coefficients for the behavioral specifications would then be estimated econometrically.

From the NIPA tables, we get real GDP from the demand side, which is the sum of consumption, investments in fixed capital, changes in inventories, government expenditure and net exports of goods&services:

$$GDP = CONS + GFCF + DINV + G + XGS - MGS \tag{3.1}$$

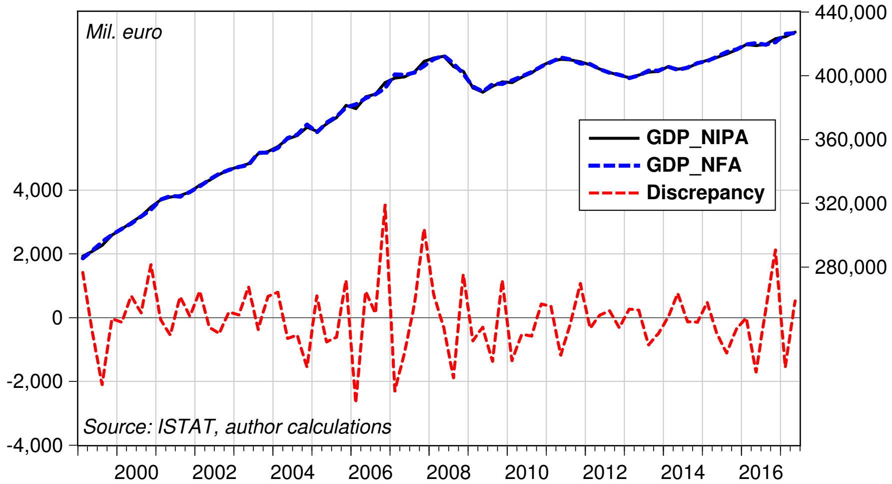
[8] It is worth mentioning that, in what follows, we will be working with series seasonally adjusted via the X-12 procedure in Eviews. As noted in a previous section, most series display a strong seasonality. However, when seasonally adjusting the data, the identities (usually) record a discrepancy. There are various ways to treat these discrepancies, and we will specify all operations made on the series.

We can then use GDP from NIPA to fill the upper-western corner of the Matrix[9]. Thus, starting from the first column and reading vertically, GDP from the production side is the sum of the wage bill, mixed income, operating surplus (net profits), indirect taxes paid and subsidies received:

$$GDP = WB + MIXY + OPS + INDTAX - SUBS \tag{3.2}$$

Figure 3.11 displays the two series for GDP (from NIPA tables and seasonally adjusted NFA). It is clear that the discrepancy is small enough, in the order of ± 3.5 Bn euro[10].

Figure 3.11: GDP and Discrepancies



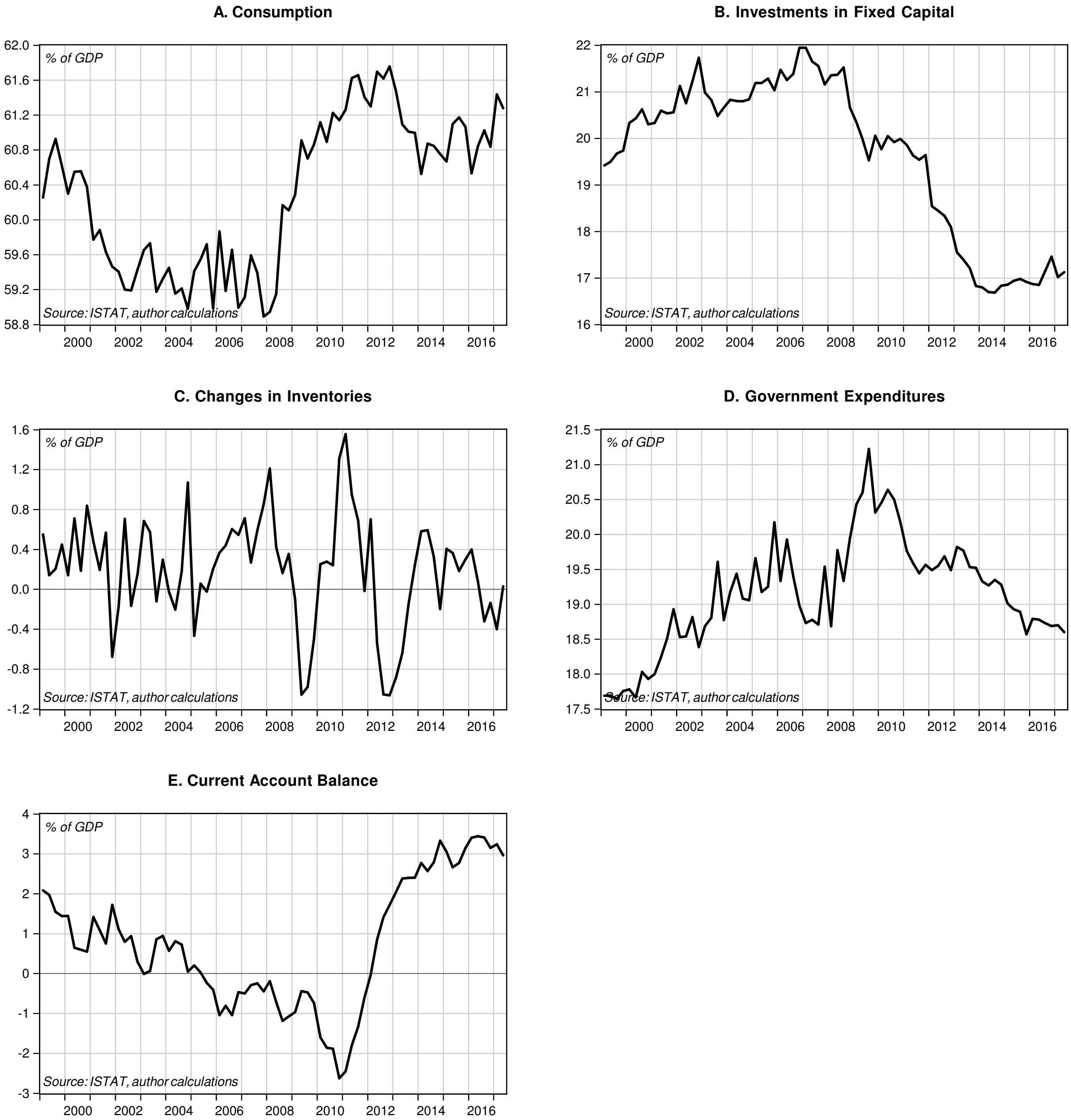
Since we have not examined GDP components so far, Figure 3.12 A-E show the various components of GDP (from the demand side). As it is usually the case in recessions, consumption has dropped less than output since 2007, so that its ratio to GDP has increased by 3 percent (although real consumption in 2017 is still 3 percent lower than it was in 2007). The drop in investment has instead been much more dramatic, with a fall in real terms of more than 5 percent of GDP from its peak in 2007, and a very small increase since 2014. Government expenditures displays the austerity measures put in place in the aftermath of both the Great Recession and the Sovereign Debt Crisis of 2012. Finally, as we said above, the CAB moved to positive territory, reaching an all time high in 2017, mainly due to the collapse of imports from 2011 onward. This was after more or less a decade which has seen imports accelerating over exports, determining a worsening of the external position of the country up to

[9]Note that in this way we can make the seasonally adjusted series from the NFA consistent with NIPA published data.

[10]As for all other figures displaying the discrepancies between published and constructed series, the variables are represented on the right hand scale, while discrepancies on the left hand side.

the financial crisis.

Figure 3.12: GDP Components



Turning back to the Matrix, households income from production (HH_INCP) is the sum of wages (i.e. the wage bill, wb, plus the wages received from abroad,

$wagesfrow$), mixed income and operating surplus[11]:

$$HH\_INCP = WAGES + MIXY + HH\_OPS \tag{3.3}$$

While for the Government it is the sum of the operating surplus and indirect taxes received minus the subsidies paid:

$$GVT\_INCP = GVT\_OPS + GVT\_INDT\_r - GVT\_SUBS\_p \tag{3.4}$$

Finally, for the RoW is the sum of net exports, wages and taxes received and wages and subsidies paid:

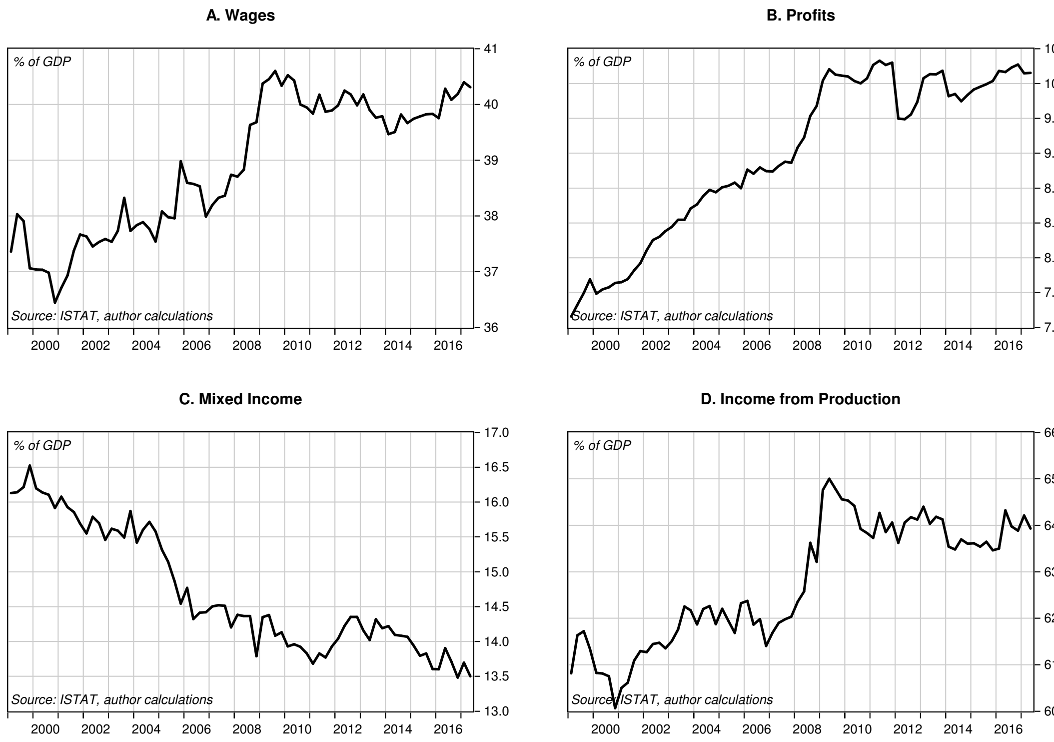
$$\begin{aligned} ROW\_INCP = {} & (ROW\_M - ROW\_X) + (WAGES2ROW + ROW\_INDT\_r) \\ & - (WAGESFROW + ROW\_SUBS\_p) \end{aligned} \tag{3.5}$$

Figures 3.13 to 3.15 display Incomes from Production for the various institutional sectors, split into their components, as a share of GDP.

Starting with the households sector, displayed in Figure 3.13 A-D, in the pre-crisis period, up to 2006, households incomes where on a more or less stable rising path, which accelerated in the following two years, pumped by the steady rise in wages and profits (reaching their peak in 2009), while the mixed income component was declining throughout. From 2008 onward, with the crush in financial markets and the austerity measures imposed on the private sector, which prevented wages to rise anymore, the trend inverted, and stabilized at a stagnant path.

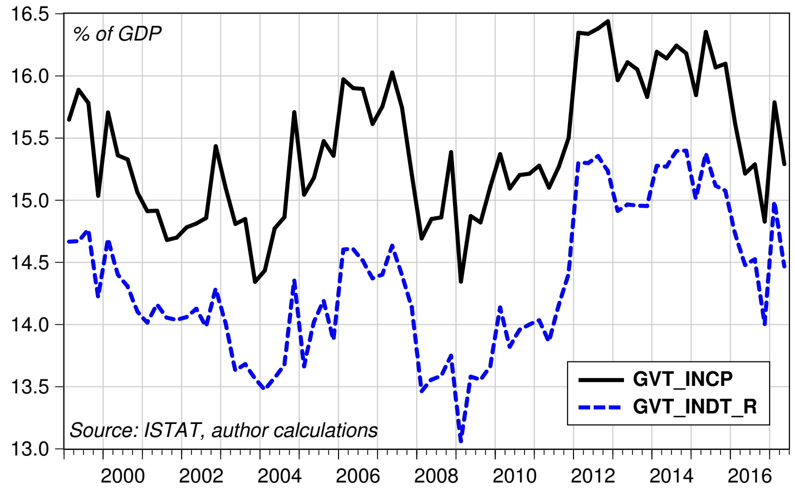
[11] "Mixed income is the surplus or deficit accruing from production by unincorporated enterprises owned by households; it implicitly contains an element of remuneration for work done by the owner, or the members of the household, that cannot be separately identified from the return to the owner as entrepreneur but it excludes the operating surplus coming from owner-occupied dwellings." (Lequiller and Blades, 2014:510)

Figure 3.13: Households Income from Production



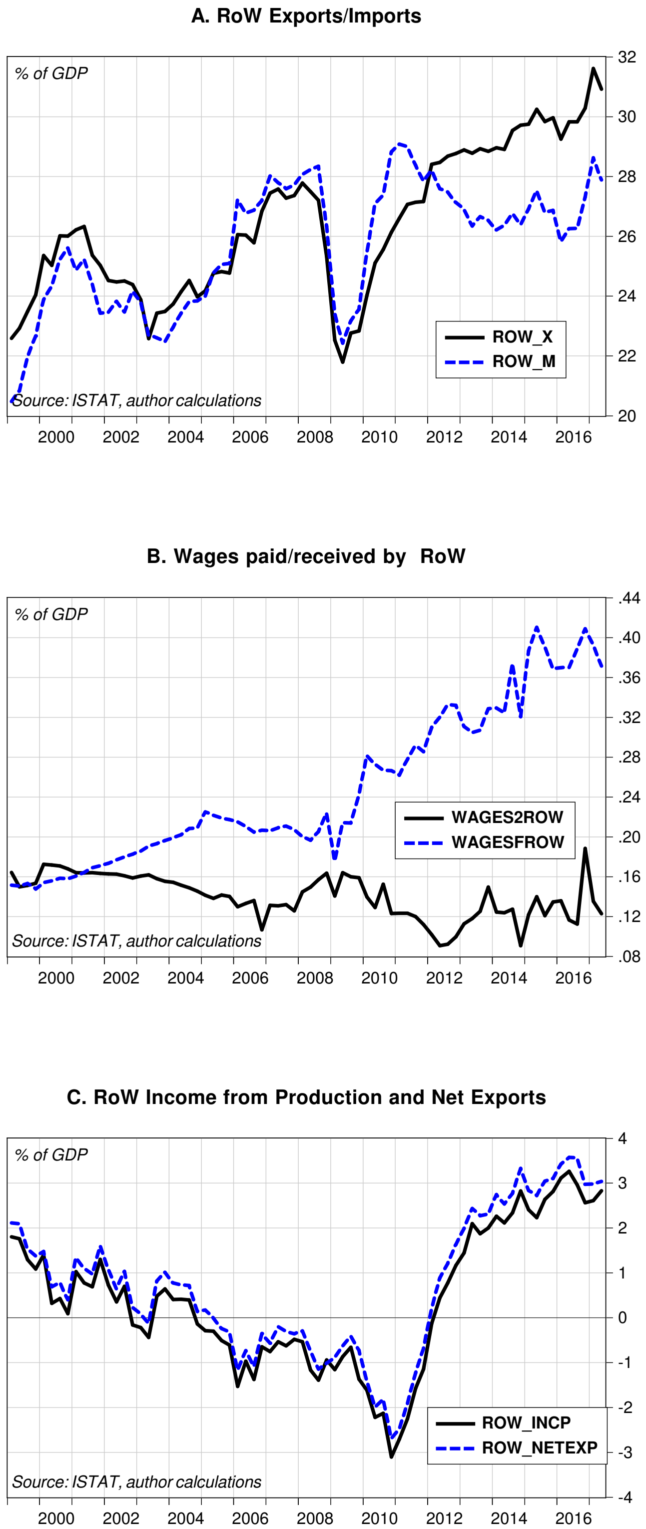
Regarding the Government, its Income from Production is completely dominated by the dynamics of indirect taxes received, displayed in Figure 3.14.

Figure 3.14: Government Income from Production and Indirect Taxes Received



Finally, the Foreign sector. Figures 3.15 A-C shows income from production and its main components. During the first years of the euro, Italy's net external position worsened, going negative from 2005 up to 2011 when, due to the collapse of imports, the CAB went back to positive territory. It is also interesting to note that, even if the numbers are small, while the share of domestic wages paid to foreigners has been stable all over the period under examination, wages received from abroad have doubled (which may be due to emigration). Finally, it is clear that it is net exports that dominates the dynamics of income from production for the external sector.

Figure 3.15: RoW Income from Production



The next block records the Income from capital paid and received. These are divided into Interests[12], which are paid and received by all sectors, Dividends[13], which are received by all but paid only by Corporations home and abroad, Reinvested earnings from FDI, paid and received only by domestic and foreign Corporations, Other capital incomes, paid only by domestic and foreign Financial Corporations and received by all but the Government and, finally, the Rent from Land, paid and received by households, firms and the government.

From an accounting perspective thus, using the pool account, the sum of all interests[14] received must equal the sum of all interests paid, and a possible modeling strategy would be to determine one of the payments as a residual. For instance, it must be the case that

$$
\begin{aligned}
&FC\_INT\_r = \\
&+ (HH\_INT\_p + NFC\_INT\_p + FC\_INT\_p + GVT\_INT\_p + ROW\_INT\_p) \\
&- (HH\_INT\_r + NFC\_INT\_r + GVT\_INT\_r + ROW\_INT\_r)
\end{aligned}
\tag{3.6}
$$

As already noted, however, we will adopt a strategy, described later, to match interest paid and received to the appropriate stock in the model.

A few things are worth noting regarding these capital incomes, on which some further considerations may be said and more in depth research is needed.

Starting from Interests, Figure 3.16 displays the amounts paid and received by NFC as percent of GDP. While the two series were moving together in the first part of the sample, from 2006 one may notice a divergence that lasts up to the financial crisis of 2008 and, from then on, the outlays are converging to receipts.

Figure 3.17, in turn, displays the drop in interests paid and received by Financial Corporations, that clearly show the effect of both the double dip recession of 2008 and 2012 and the drop in interest rates.

[12] When adjusting the series, we decided to add the discrepancies of the X-12 procedure to the interest received by Financial Corporations FC_INT_r. This is so because financial institutions get almost half of the total interests paid and one should always try to get these discrepancies away from series that will enter behavioral specifications estimates, in particular those regarding the households and external sector.

[13] Here the discrepancy is added to NFC's payments.

[14] Note that interest income, as recorded in NFA, is net of SIFIM: these are "services offered from the credit system for which there is not an explicit price, but are instead indirectly remunerated through the spread between active and passive rates and which are allocated to the end-user sectors, as provided for by EU Council Regulation no.1889/2002. The consumption of SIFIMs by the Public Administrations is therefore included in intermediate consumption, resulting in an increase of the same amount. On the other hand, interest income are increased by the component reclassified as SIFIM in intermediate consumption - obtained as the difference between the effective active interest earned on deposits and the reference interest - and interest expense is also reduced by the component reclassified as SIFIM - obtained as a difference between the reference interest and the interest actually paid on the debts." (ISTAT, p.3).

Figure 3.16: NFC. Interest paid/received

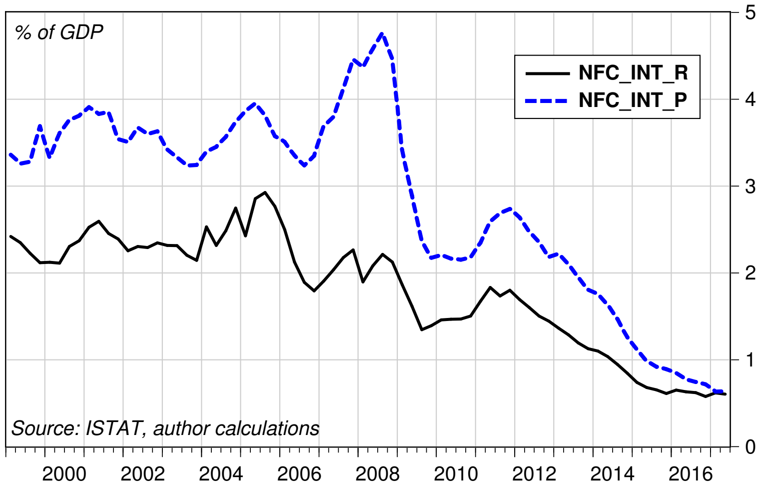
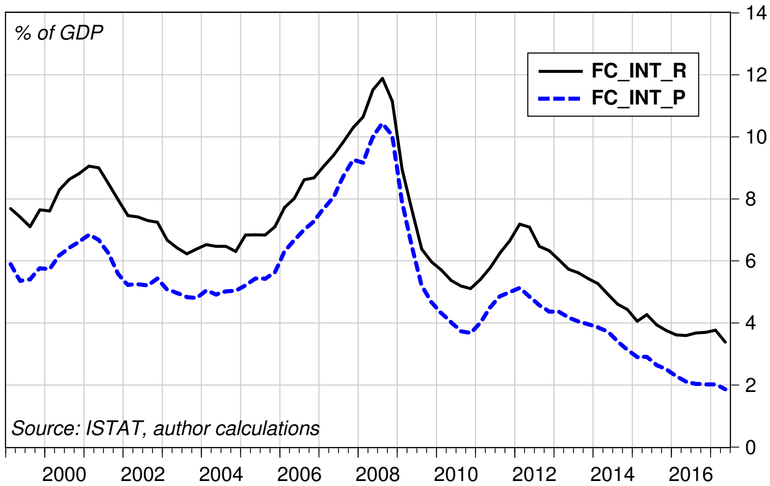


Figure 3.17: FC. Interest paid/received



Moving to Dividends, the vast majority are paid out by non-financial corporations and disbursed to households. As shown in Figure 3.18, however, these are both declining, as a share in GDP, throughout our sample. Figure 3.19, in turn, displays the Dividends paid and received by the RoW. Two thing are worth noting here: first, how the domestic private sector was part of the "dance" in the build up of the crisis, as reflected by their outlays abroad and, secondly, how the two series diverge after the initial drop, a situation that lasts until 2016, where they converge again (downwards, up to 0.5% of GDP).

Figure 3.18: Households and NFC. Dividends paid/received

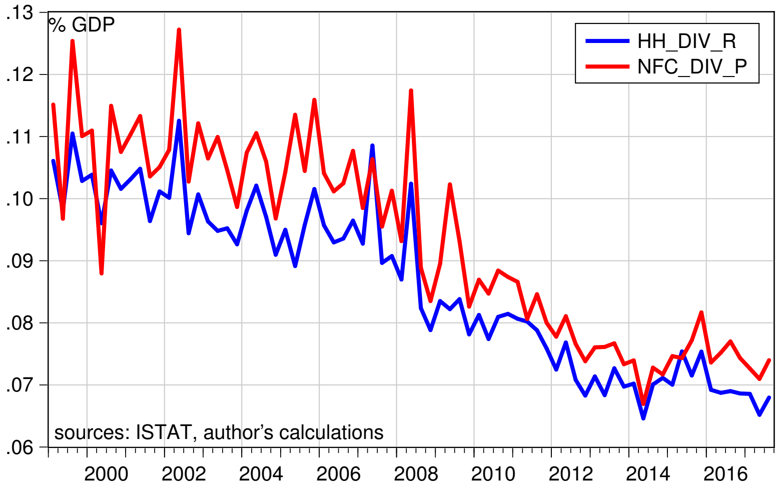
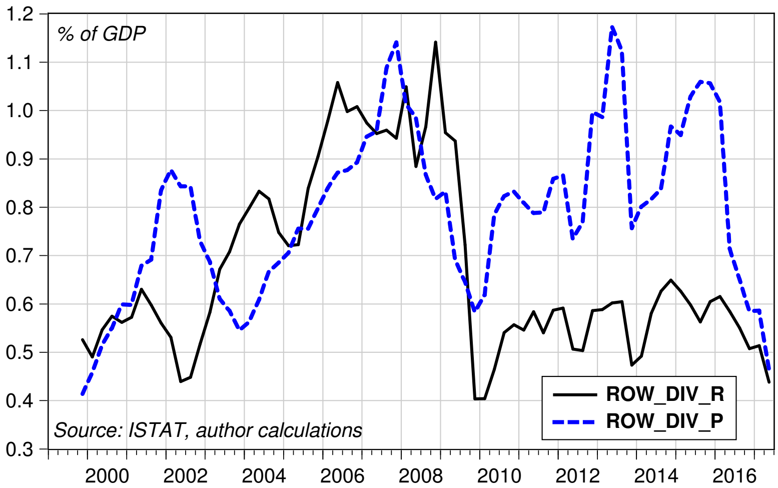


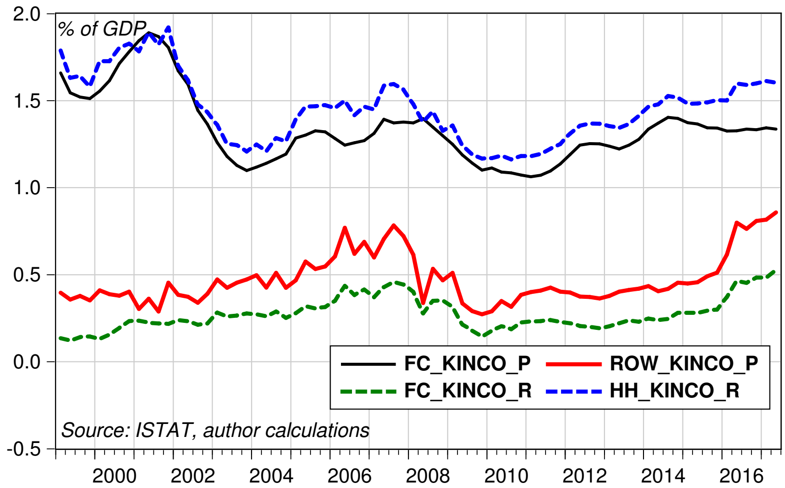
Figure 3.19: RoW. Dividends paid/received



Regarding Other incomes from capital, Figure 3.20 shows the relation between households and domestic NFC on one hand and the foreign sector and domestic banks on the other.

Figures 3.21 and 3.22 display, respectively, Reinvested earnings from FDI for domestic financial and non-financial corporations. Even if the numbers are

Figure 3.20: Other Current Transfers in Capital Account



small enough, it is striking, regarding FC, first, the drop in receipts, that fall down to 0.005 of GDP and, secondly, that banks are the targets of FDI from abroad starting from 2007. With respect to NFC, while the outlays have been on a downward path throughout, the receipts jump up to 0.7 % of GDP and then crashes down, arriving to negative territory. Finally, Figure 3.23 shows the dynamics of dividends received by the domestic sector against those paid by the RoW. It is peculiar how Banks only suffered from the crisis, in terms of dividends received from abroad, from 2009, well after the shock hit the corporate sector. Then starts to decline steadily, but it never goes negative as the other two.

It is clear here that, while adding a small discrepancy from a statistical procedure is, yes, arbitrary, but it makes little harm (hopefully), to impose how and why only certain sectors convey in some markets and not others may be trickier to justify. Thus, we will for now resort to the Pool.

Returning to the Matrix, Primary income, thus, is the sum of Incomes from production and capital incomes. For Households, it is the sum of Incomes from production, interests, dividends and other capital incomes received minus interests and rent from land paid:

$$\begin{aligned} HH\_YP = HH\_INCP + (HH\_INT\_r + HH\_DIV\_r + HH\_KINCO\_r) \\ - (HH\_INT\_p + HH\_RENTL\_p) \end{aligned} \tag{3.7}$$

For Non Financial Corporations, is the sum of profits, interest, dividends, reinvested earnings from FDI and other capital incomes received, minus interests, dividends, reinvested earnings from FDI and rent from land paid:

Figure 3.21: FC. Reinvested Earnings from FDI

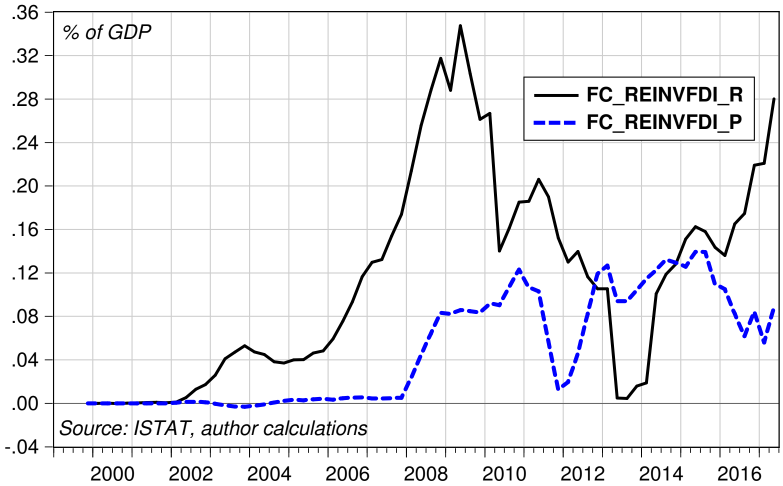
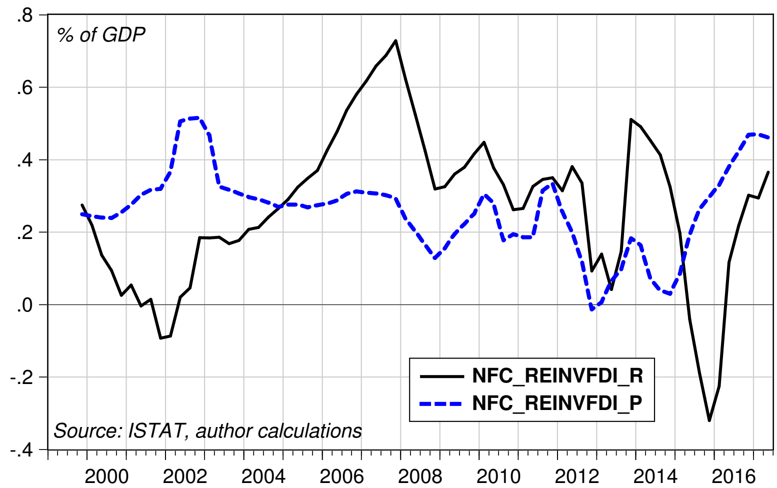


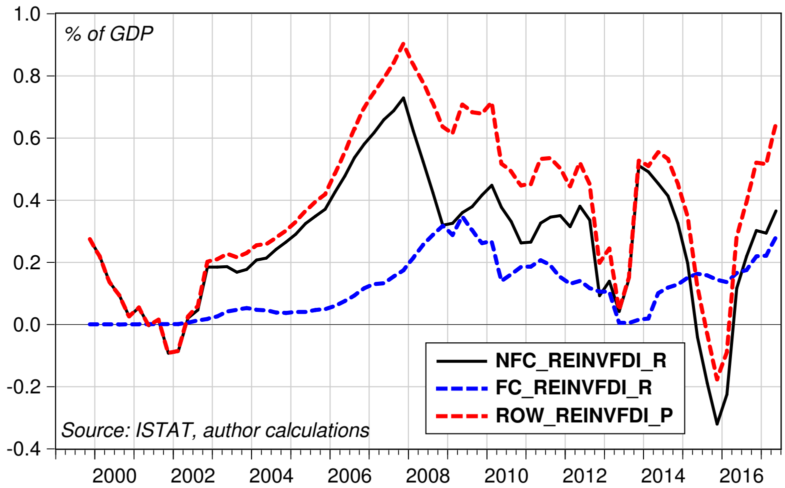
Figure 3.22: NFC. Reinvested Earnings from FDI



$$
\begin{aligned}
&NFC\_YP = NFC\_OPS \\
&+ (NFC\_INT\_r + NFC\_DIV\_r + NFC\_REINVFDI\_r + NFC\_KINCO\_r) \\
&- (NFC\_INT\_p + NFC\_DIV\_p + NFC\_REINVFDI\_p + NFC\_RENTL\_p)
\end{aligned} \tag{3.8}
$$

Financial Corporations, in turn, do not pay out rent from land:

Figure 3.23: Reinvested Earnings from FDI. Selected Sectors



$$\begin{aligned} &FC\_YP = FC\_OPS \\ &+ (FC\_INT\_r + FC\_DIV\_r + FC\_REINVFDI\_r + FC\_KINCO\_r) \\ &- (FC\_INT\_p + FC\_DIV\_p + FC\_REINVFDI\_p) \end{aligned} \tag{3.9}$$

Now comes the Government. To income from production, one adds interests, dividends and rent from land received by the domestic NFA and households, minus the interests paid:

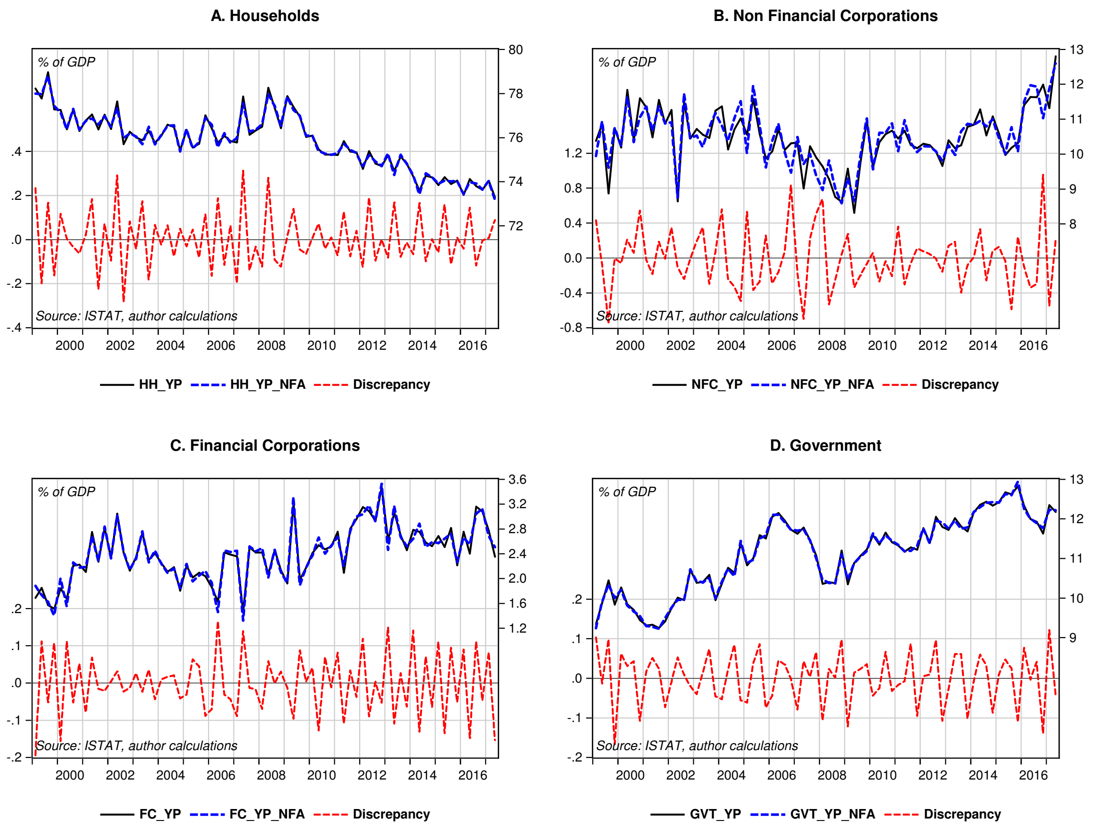
$$\begin{aligned} &GVT\_YP = GVT\_INCP \\ &+ (GVT\_INT\_r + GVT\_DIV\_r + GVT\_RENTL\_r) - (GVT\_INT\_p) \end{aligned} \tag{3.10}$$

Finally, the Rest of the World. To net Exports, we first add the transfers from the domestic sector to foreigners (in the form of wages and indirect taxes) and subtract the transfers from the foreign sector to the domestic economy (wages and subsidies), and then add and deduce capital incomes:

$$\begin{aligned} &ROW\_YP = (ROW\_M - ROW\_X) \\ &+ (WAGES2ROW + ROW\_INDT\_r) - (WAGESFROW + ROW\_SUBS\_p) \\ &+ (ROW\_INT\_r + ROW\_DIV\_r + ROW\_REINVFDI\_r + ROW\_KINCO\_r) \\ &- (ROW\_INT\_p + ROW\_DIV\_p + ROW\_REINVFDI\_p + ROW\_KINCO\_p) \end{aligned} \tag{3.11}$$

Figures 3.24 A-D display Primary incomes for the domestic economy, using both the constructed series and the "actual" (seasonally adjusted) ones, together with their discrepancy, as percent of GDP.

Figure 3.24: Primary Incomes. Domestic Economy



Even if these only represents pre-tax income, and thus the Government could still intervene to redistribute, it is quite striking how households never recovered from the recession, with their share going down by 4% of GDP.

Next, we need to get to disposable income (YD). To (YP) we need to add the direct taxes received (by the Government and RoW, i.e. some EU Institution) and paid by the sectors[15], social benefits and contributions[16] (recalling that we needed to add line 23, "Social Transfers in Kind", GINDC, for Households and Governments Disposable Income to add up) and the other current

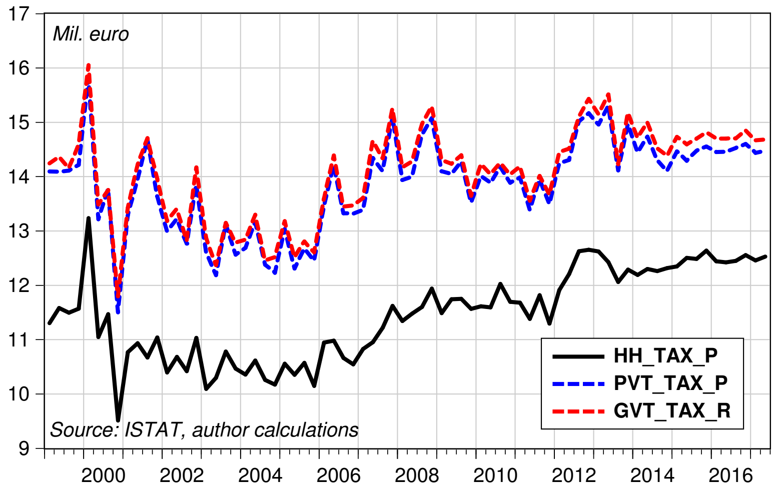
[15] Here we assumed that only NFC pay taxes to foreign institutions, thus, $ROW\_TAX\_r = NFC\_TAX\_pW$. The amount of taxes paid domestically, in turn, is computed as the difference between the total outlays and the amounts paid abroad, $NFC\_TAX\_pD = NFC\_TAX\_p - NFC\_TAX\_pW$. This is so for two order of reason: first, EU Institutions get almost nothing compared to the Government (100-500 Mil. against 40-60 Bln) and, secondly, this leaves us the opportunity not to use the Pool, since now the Government is (residually) the only recipient of taxes. For the same reason, the discrepancies stemming from the seasonal adjustments have been added to net Government receipts.

[16] As before, the discrepancies from seasonal adjustments have here been added to Government expenditures.

transfers paid and received[17]. As before, the next figures shows some interesting features coming out of a first data inspection.

3.25 displays Direct Taxes paid and received by the domestic Private sector[18]. The sector with the major outlays consists of course of Households, which account for over 80% of Government receipts. Moreover, while the taxes paid by Corporations are on a downward trend (for FC since 2003, while for NFC only after the crisis), the opposite is true for the households sector has only been slowed down by the Financial Crisis, but its still rising as % of GDP.

Figure 3.25: Taxes paid/received. Selected Sectors



Social Benefits and Contributions are displayed in 3.26 A-B. Figure A shows the expected major link between the household and government sectors. Non Financial Corporations, displayed in Figure B, started as a net contributor but, suddenly in 2006, their contributions dropped by one third, becoming a net recipient (a situation that lasted until 2014), with outlays and receipts stabilizing at the same level.

Finally, one finds Other Transfers in Current account, shown in 3.27. Here, two things are worth noting: first, how Financial Corporations receipts immediately follows the dynamic of their outlays; secondly, how the gap between households receipts and outlays widened from 2002 onward, and stabilized at a difference of 0.4% points of GDP.

Now we can turn, again, to the aggregates. Households Disposable Income,

[17] Again, Government outlays gets the discrepancies from seasonal adjustments.

[18] The discrepancy between total direct taxes received by the Government and the amount paid by the domestic private sector is given by the amounts paid by the Rest of the World.

Figure 3.26: Benefits & Contributions. Selected Sectors

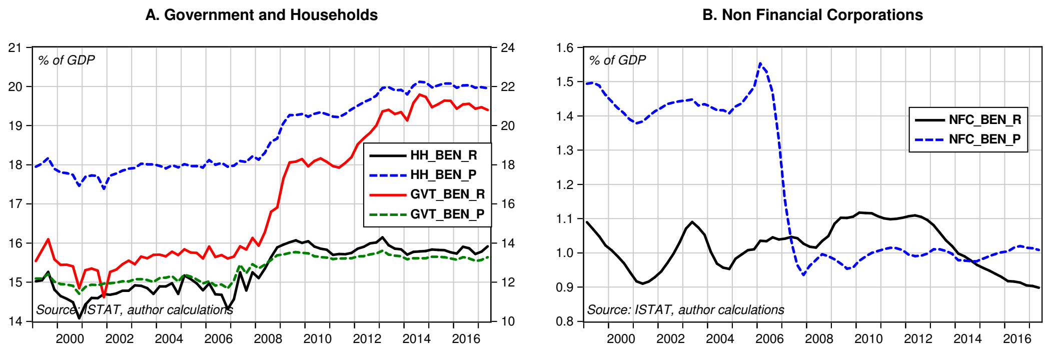
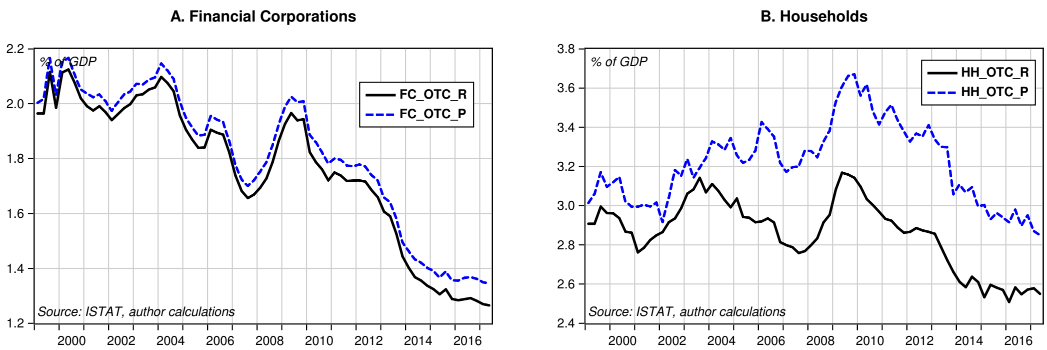


Figure 3.27: Other Current Transfers. Selected Sectors



thus, is given by:

$$HH\_YD = HH\_YP - HH\_TAX\_p + ((HH\_BEN\_r - GINDC) - HH\_BEN\_p) + (HH\_OTC\_r - HH\_OTC\_p) \tag{3.12}$$

where TAX are direct taxes, BEN are social benefits, $GINDC$ is Government (collective) consumption, and OTC are other current transfers.
Moving to NFC, recall that they pay taxes also to EU institutions, thus:

$$\begin{aligned} NFC\_YD &= NFC\_YP - (NFC\_TAX\_pW + NFC\_TAX\_pD) \\ &+ (NFC\_BEN\_r + NFC\_OTC\_r) - (NFC\_BEN\_p + NFC\_OTC\_p) \end{aligned} \tag{3.13}$$

Continuing with FC:

$$\begin{aligned} FC\_YD &= FC\_YP - FC\_TAX\_p \\ &+ (FC\_BEN\_r + FC\_OTC\_r) - (FC\_BEN\_p + FC\_OTC\_p) \end{aligned} \tag{3.14}$$

Turning to the Government, it receives and pays taxes, pays out social transfers in kind (to households) on top of the total benefits, and receives and pays other current transfers:

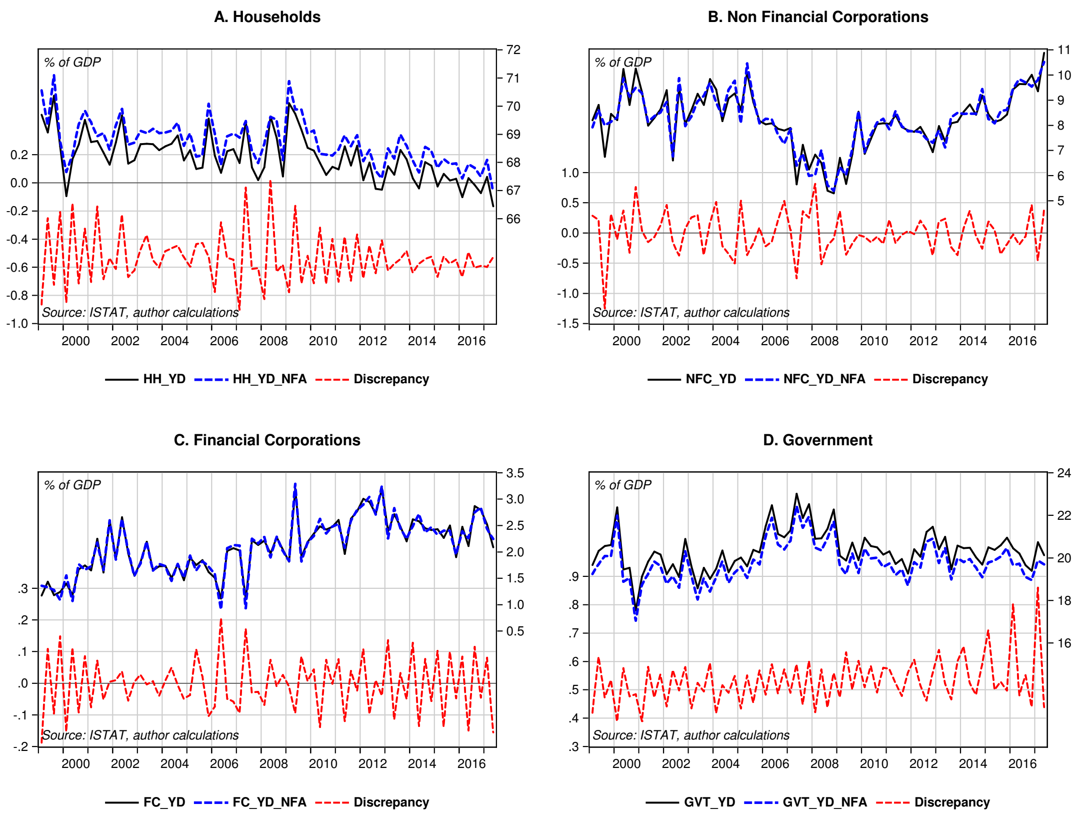
$$GVT\_YD = GVT\_YP + (GVT\_TAX\_r - GVT\_TAX\_p) \\ + (GVT\_BEN\_R - (GVT\_BEN\_p - GINDC)) + (GVT\_OTC\_r - GVT\_OTC\_p) \tag{3.15}$$

Finally, recall that the foreign sector pays taxes domestically but also receives them from NFC:

$$ROW\_YD = ROW\_YP + (NFC\_TAX\_p - ROW\_TAX\_p) \\ + (ROW\_BEN\_r - ROW\_BEN\_p) + (ROW\_OTC\_r - ROW\_OTC\_p) \tag{3.16}$$

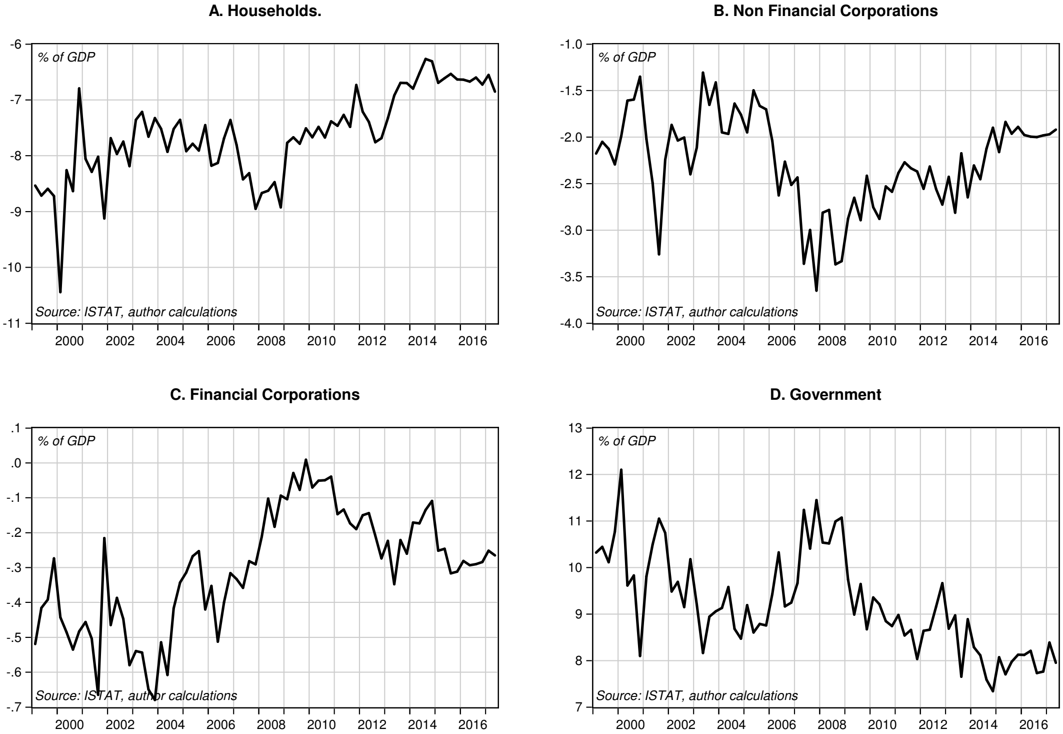
Figures 3.28 A-D shows Disposable Incomes for the domestic economy, using both the constructed series and the "actual" (seasonally adjusted) ones, together with their discrepancy, as percent of GDP.

Figure 3.28: Disposable Income. Domestic Eonomy



It is also useful to see how the Public sector intervened to correct incomes with transfers and taxes. Figures 3.29 A-D display the Net Transfers of the institutional sectors for the domestic economy. As one may expect, the Government collects net funds from domestic Corporations and distribute it to households[19]. The *burden*, however, shifted from Financial towards Non Financial Corporations.

Figure 3.29: Net Transfers. Domestic Economy



The lower part of the matrix in Table XX, then, records how Disposable income is spent between consumption, investments and additions to financial assets. Adding to Disposable Income the variations in pensions entitlements[20] (for households only) and subtracting them (only for the domestic private sector) and taking out consumption (of households and Government) leaves us with Savings (SAV). Thus:

$$HH\_SAV = HH\_YD + (HH\_PENSR\_r) - (HH\_PENSR\_p + HH\_CONSF) \tag{3.17}$$

$$NFC\_SAV = NFC\_YD - (NFC\_PENSR\_p) \tag{3.18}$$

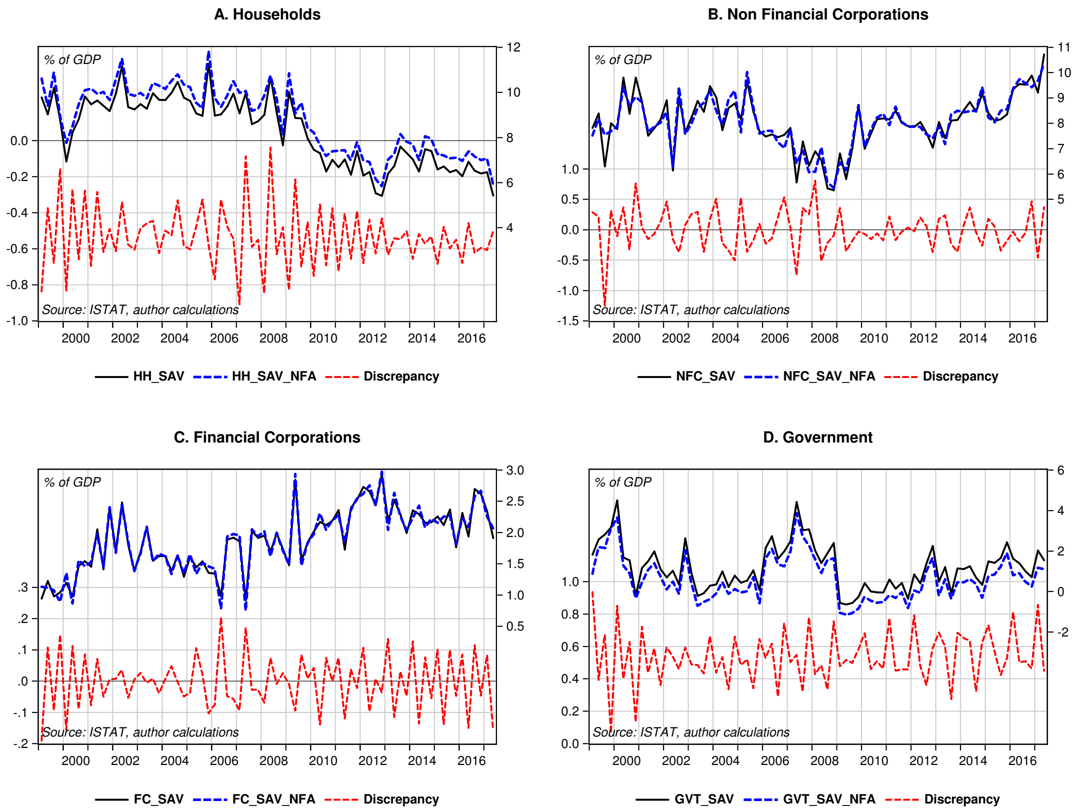
$$FC\_SAV = FC\_YD - (FC\_PENSR\_p) \tag{3.19}$$

$$GVT\_SAV = GVT\_YD - (GVT\_CONS\_COLL + GVT\_CONS\_IND) \tag{3.20}$$

[19] Remember that we assumed that only NFC pay taxes to EU institutions, i.e. the RoW.
[20] As before, we assigned the discrepancy from seasonal adjustment to NFC outlays.

Figures 3.30 displays Savings for the domestic economy, using both the constructed series and the "actual" (seasonally adjusted) ones, together with their discrepancy, as percent of GDP. Households experienced an erosion in their savings in the aftermath of the crisis, blowing away 3% of GDP and never recovering. Non Financial Corporations, in turn, have seen their savings on a downward path from 2004 to 2008. After the crisis, contrary to households, the figure returns back to its early 2000's peak.

Figure 3.30: Savings. Domestic Economy



The next block registers the variations in net wealth due to transfers in Capital account. Beginning from Taxes, also here we assumed that only NFC pays to EU institutions[21], then we find the other transfers in capital account[22] while lines 38 and 39 record the total transfers paid and received. Thus, subtracting the transfers from Savings yields the Variations in Net Wealth.

As for GDP, we decided here to make the series for $GFCF$ and $DINV$ con-

[21] Thus $NFC\_TRK\_TAX\_pW = ROW\_TRK\_TAX\_r$ while the amount paid domestically is calculated as a residual, $NFC\_TRK\_TAX\_pD = GVT\_TRK\_TAX\_r - (HH\_TRK\_TAX\_p + FC\_TRK\_TAX\_p)$, getting the discrepancy from seasonal adjustment.

[22] Here the discrepancy is added to Government payments.

sistent with the NIPA tables. Both components of Investment have thus been calculated as a residual for the non-financial sector:

$$NFC\_GFCF = GFCF\_NIPA - (HH\_GFCF + FC\_GFCF + GVT\_GFCF) \tag{3.21}$$

and

$$NFC\_DINV = DINV\_NIPA - (HH\_DINV + FC\_DINV + GVT\_DINV) \tag{3.22}$$

Finally, subtracting Investments and the other acquisitions of non-produced non-financial assets from Savings yields the Net Lending of the various sectors. As before, Figures 3.31 A-E display the Net Lending position of the institutional sectors, using both the constructed series and the "actual" (seasonally adjusted) ones, together with their discrepancy, as percent of GDP.

A few remarks are in order. First, to start with the technicalities, the series here do not show any *relevant* discrepancy[23]. Secondly, it is striking the deleveraging of the households sector after the crisis of 2008 up until 2013, where the accumulation of assets reached again 2% of GDP. The last release of data, however, shows another drop in the last two quarters. Again, it is strange to look at the Non Financial Corporation's position. From an expected deficit position in the start of our sample, from 2012 onward domestic NFC have been acaccumulating Financial assets, meaning they stopped investing in either Fixed Capital or Inventories. Finally, we already discussed how austerity policies, coupled with both crisis, helped improving the CA position, reducing the external deficit. However, this was at the expense of the Private domestic sector, in particular the households one.

To show this, Figures 3.32 A-B display the Net lending positions of the three macro-sectors and of the Private sector respectively, from 2000 to 2017, as percent of GDP, with the shaded areas corresponding to the two recessions. A few things are worth noting. First, from Figure A we see that up to 2003 the households' surplus mirrored the Government deficit but they then started to diverge, worsening the CAB. Only in 2010 the CAB recovered, but now the relation between the deficit and private sector surplus inverted. Secondly, from Figure B we can "appreciate" the huge drop in investments of Non-Financial Corp and collapse of the households sector in the aftermath of the Great Recession. Finally, here is even clearer how firms are even more on positive territory, which shall not be the case, while households are again experiencing a drop.

We can now turn to the Financial side of the model, introduced in the next Section. We will come back to the Transaction Matrix in the next Chapter.

[23]We register a small discrepancy for households and the government, but these are rather small, below 1% of GDP.

Figure 3.31: Net Lending positions of Institutional Sectors

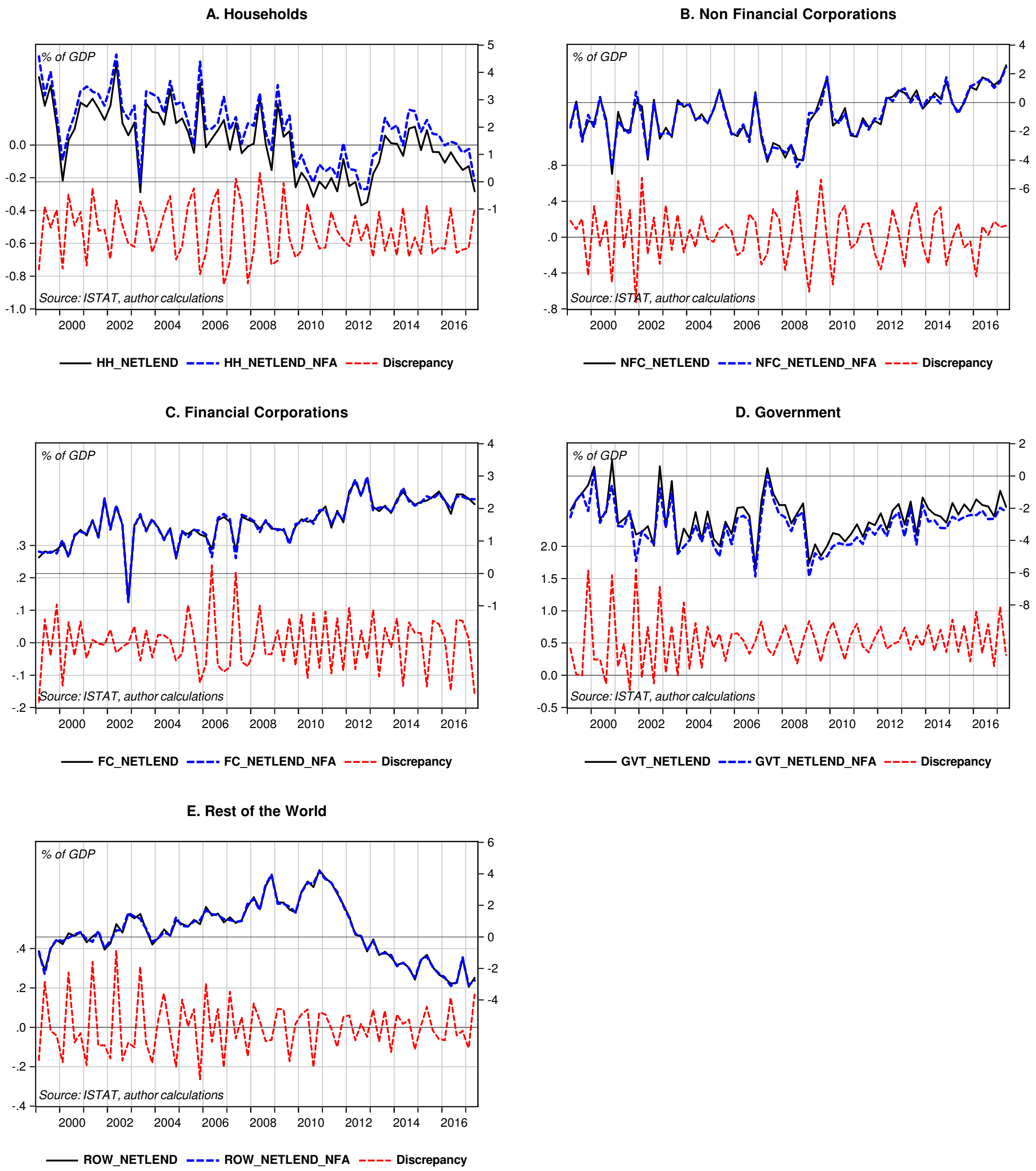
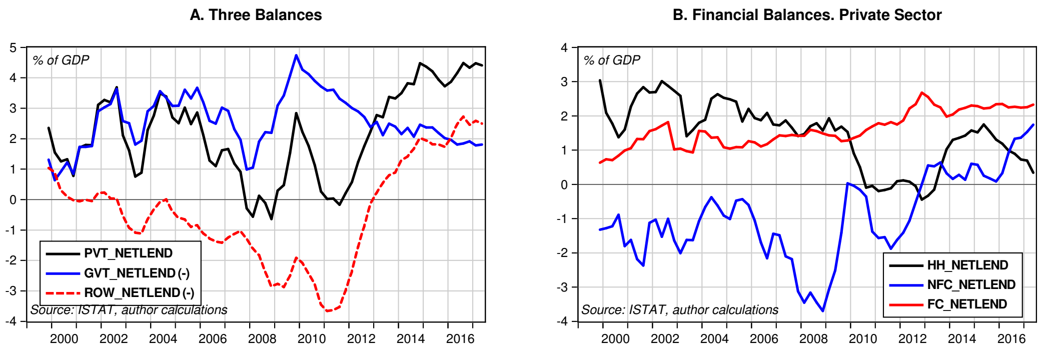


Figure 3.32: Three Balances and Private Sector NAFA



3.3.2 The Balance Sheet Matrix

Now we can turn to the Financial side of the system. As we detailed previously, Bank of Italy publishes quarterly Financial Accounts sectoral data, which are available from 1995q1 to present[24], displayed in Table B.4 in Appendix B, as for the end of 2016. As previously noted, the FAIS from BoI offer much more sectoral disaggregation than the NFA published by ISTAT. Financial corporations are here divided into 7 sub-sectors. Most important, the Central Bank is separated here from domestic banks, which will allow to model monetary policy in a more systematic way.

Starting from the top, we find “gold and monetary reserves”, “banknotes and monetary deposits” and “other deposits” (which are held by Monetary Financial Institutions, MFI, other residents and RoW), “short-term asset” (issued by Government, other residents and RoW), “long-term assets” (issued by MFI, the Government, other residents and RoW), “Derivatives”, “short” and “long-term loans” (issued by MFI, the Government, other residents and RoW), “shares” and “shares of mutual funds” (issued by domestic and foreign firms), “Insurance technical reserves” (split into life and pension fund insurances and others) and, finally, “other accounts” (made of commercial credit and others). What is left represents the Net Wealth of the various sectors.

As for the Transaction Matrix, also for the financial side we have to keep the model matrix as simple as possible, and combine the information on financial assets and liabilities with other data sources regarding investments in real assets. Moreover, it is not clear how to attribute the monetary base between the BoI and the ECB from FAIS, thus we will need to rely on other data sources.

In the current stage, the model balance sheet has been built by simplifying the available information from the financial accounts of the institutional sectors, published by Bank of Italy, through a careful analysis of stocks of assets

[24]Financial accounts are easily downloadable, along with statistical reports and data description at: `https://www.bancaditalia.it/statistiche/tematiche/conti-patrimoniali/conti-finanza/index.html`.

and liabilities which play the most relevant role for the Italian economy, and is displayed in table B.5 in Appendix B.

The upper block of the Balance-sheet records "real assets". The stocks of non-financial assets have been reconstructed using some measures available at annual frequency, namely the stocks of non-financial assets for each institutional sector, available from 2000 to 2015 with a sufficient breakdown (homes, other buildings, productive capital, consumer durables), and stocks and flows (gross capital formation and depreciation) measured at constant 2010 prices and substitution prices, available from 1995 to 2016, with the same breakdown. To obtain quarterly series we have to rely on the available flow measures for gross fixed capital formation, available from 1995 (1996 for fixed price measures) to present.

We use the available data at quarterly frequency to obtain the stock of non-financial assets at the end of each quarter, given by[25]:

$$k_t = k_{t-1} + GFCF_t - DEP_t$$

Where all variables are measured at constant 2010 prices and DEP is depreciation. We then obtain the estimate of stocks at market prices from

$$K_t = pk_t * k_t$$

Where pk is an appropriate market price.

Statistics on the market price of productive capital are not available, so we will simply use the investment deflator. For housing, we evaluated the implicit price measure which results from the stock reported in NFA, and the quarterly series published by ISTAT from 2010 onward. For the years before 2010 we interpolated the annual index constructed in Cannari et al. (2016). Finally, we need to allocate the stock of each non-financial asset to one of the institutional sectors. For 2015, the values and shares of non-financial assets are reported in Table 3.1.

Table 3.1: Stock of Non-financial assets of sectors. 2015, billions euro.

	Households		Non-Fin. Corp.		Fin. Corp.		Government		Tot
	Bn	%	Bn	%	Bn	%	Bn	%	Bn
Housing	5,345	91,7	383	6,6	10	0,2	90,7	1,6	5,829
Other buildings	705	29,9	1,312	55,5	91	3,8	255	10,8	2,363
Productive capital	77	11,1	539	77,6	4	0,6	74	10,7	696
Cultivated Land	219	88,6	18	7,4	0	0	10	4	247
Durables	561	100							561
Total	6,359	68,3	2,370	25,5	109	1,2	474	5,1	9,313

Source: ISTAT

[25] We interpolated the stock of capital by type of asset, using the share of gross fixed capital formation in each quarter to allocate the overall annual increase in the stock over quarters. This procedure assumes that, in each year, the ratio of capital consumption to gross fixed capital formation is constant (but changing from one year to the next).

Although it is apparent that the household sector owns a considerable share of other buildings, since we will not try to model the supply side by institutional sector in this version of the model, we have decided to simplify the model balance sheet allocating the whole of housing to the household sector (net of the government share), and the whole of the privately owned "other buildings" and "productive capital" to non-financial corporations. The model balance sheet for non-financial assets will therefore be given as in Table 3.2.

Table 3.2: Balance-Sheet. Real assets of sectors.

	Households	Non-Fin. Corp	Government
Housing	+K_hh		
Other Private capital		+K	
Public capital			+K_gvt

Next, lines 6 to 9 of the model Balance-Sheet deals with Central Bank operations.

The national Central Bank, Bank of Italy (BoI), is part of the European system of Central banks and, although it acts as the domestic agent of the ECB, which is a supra-national (foreign?) institution, it is part of domestic financial corporations[26].

For the purposes of the model, it was useful to obtain additional information with respect to that provided in the FAIS[27]. In FAIS, the main liability of the CB is in the category "Sight deposits with MFIs", at 719 bn euro in the first quarter of 2017. Information available from the BoI balance sheet[28] allow us to split this category into banknotes in circulation (179 bn euro), bank reserves (87 bn euro) and the Target2 balance with the ECB (420 bn euro), reaching a reasonable who-to-whom representation. In 3.33 we plot the three components of BoI liabilities: from the chart the effect of the QE stands out, with a growing debt position of BoI against the ECB, matched –as we shall see below –by an equivalent increase in government bonds held by BoI on the asset side.

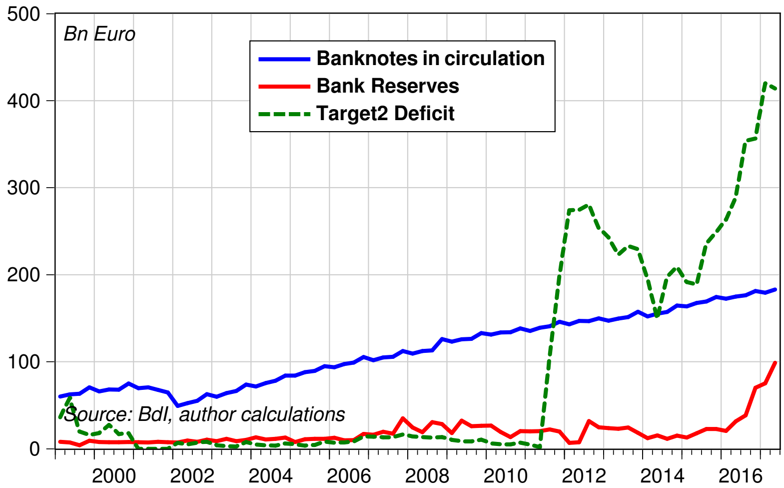
The recent large increase in bank reserves, well in excess of requirements, is puzzling and worth exploring, since the interest rate on such reserves is zero. This increasing demand for liquidity from banks may be aimed at insuring against a possible collapse in confidence on banks liabilities, but it is certainly worth of further exploration. Another possible explanation is that, since the ECB with QE exogenously created reserves and gave them to banks in exchange for illiquid assets, these reserves will remain in the system until the ECB does not get them back, *if* it does so. It seems indeed that the answer lies between

[26]For the statistical treatment of Central banks in monetary unions see SNA (2008), p.85, and BPM6 (2009), Appendix 3. "Typically, the Currency Union Central Bank (CUCB) maintains national offices in each member economy. This institutional unit, called "the national agency," acts as the central bank for that economy and must be treated for statistical purposes as an institutional unit that is separate from the headquarters of the CUCB." (p.260).

[27]A comprehensive analysis of the BoI and ECB monetary policies, as well as the details to link the information from FAIS to our transaction matrix will be given in Chapter 4.

[28]Moneta e banche, tables 3.3a & 3.3b.

Figure 3.33: Bank of Italy. Liabilities



the two.

It is worth stressing that, as detailed by the ECB (2017) and Bank of Italy (2018), the first round of divergences in Target2 balances (2010-2011) were related to tensions on financial markets due to the possibility of default of Greek sovereigns and on the stability of the Eurozone itself, that led to capital outflows from the so called peripheral countries to the "core" (via the LTRO refinancing operations, more on which will be said later in 4) and which ended with Draghi's famous "whatever it takes". "As banks lost access to market-based funding, they replaced private sources of funding with central bank liquidity obtained from their NCBs through repurchase operations. Those repurchase operations had no immediate impact on TARGET balances, as they were settled domestically, but the subsequent redistribution of liquidity, influenced by market stress and fragmentation, *did have an impact*. The link between the implementation of monetary policy decisions and TARGET balances was therefore *indirect*" (ECB, 2017:4, emphasis added). However, with the start of the Asset Purchase Programs (APP) and in particular with the launch of the Public Sector Purchase Programs (PSPP) launched in March 2015, which allowed the NCB to intervene on secondary markets to buy government bonds, the channels of transmission changed.

Indeed, the APP has led to a rise in cross-border payments by purchasing central banks, which has caused renewed increases in the total TARGET balances. This is so because when a NCB purchases securities, it makes a payment in central bank money to the selling counterpart at the time of settlement. "In the case of a cross-border transaction, that liquidity flow affects the TARGET balances of the sending and receiving NCBs and may potentially alter the total TARGET balance. Consequently, the location of the TARGET accounts used by APP counterparts to receive payment for securities determines the impact that asset purchases have on TARGET balances immediately following the purchase" (ibid:2) Thus, if the purchases are made with cross-border entities, this can *directly* affect the Target2 balance. Moreover, "counterparts whose NCBs are connected to TARGET use their accounts at those NCBs, while counterparts located elsewhere can use an account at a correspondent bank with access to TARGET. Banks based outside the euro area tend to make payments in TARGET via branches or correspondent banks in countries with claims in TARGET, such as Germany or the Netherlands. It follows that when an NCB purchases securities from a non-domestic counterpart, whether it is located in another euro area country or outside the euro area, the purchase is likely to give rise to cross-border flows of central bank money" (ibid:3). Finally, as explained by Bank of Italy (2018), a large majority of APP purchases involved counterparts located in a different country than the purchasing NCB and, moreover, around 50% of these purchases have involved sellers resident outside the euro area. This led to substantial cross-border flows of central bank money, affecting national TARGET balances and leading to structural inflows of central bank money in countries hosting large numbers of non-resident counterparts (notably Germany and Netherlands).

On the asset side, depicted in Figure 3.34, apart from the Refinancing operations for Banks, we chose to focus on three major set of assets: (1) gold and foreign reserves[29], which are a liability of the (extra-euro) rest of the world, which have been slowly increasing; (2) Foreign liabilities held and (3) government bonds held, which have been relatively stable up to 2011, and have risen spectacularly with the QE programs (in particular with the PSPP launched in March 2015), reaching more than 300 billion euro in 2017. As it is well known, BoI is purchasing such bonds on the secondary market, and indeed the increase in the stock of public bonds held in the first quarter of 2017 is more than three times the increase in the total stock of bonds outstanding. As we shall see later, the increasing share of government bonds held by BoI is matched by a similar decrease in the share of such bonds held by domestic financial corporations and foreign actors, while bonds held by households have remained relatively stable (Figure 3.45). The shaded areas in the Figure corresponds to the two different phases of Quantitative Easing operations of the ECB and the SECB, more on which will be said in Chapter 4.

In the current stage of the model we have netted out the BoI position with the ECB, subtracting the assets from the liabilities, and finally we have obtained a residual category for "other net financial assets", which was relatively large compared to total BoI assets up to 2005, but it is now almost negligible, at 3 percent of total assets in the first quarter of 2017.

The resulting model balance sheet, for those assets/liabilities relevant for the Italian Central Bank, is reported in Table 3.3.

In Table 3.3 we have dropped the column for non-financial corporations

[29]These are made up of assets and liabilities against extra-euro RoW and liabilities against the SDR system.

Figure 3.34: Bank of Italy. Assets

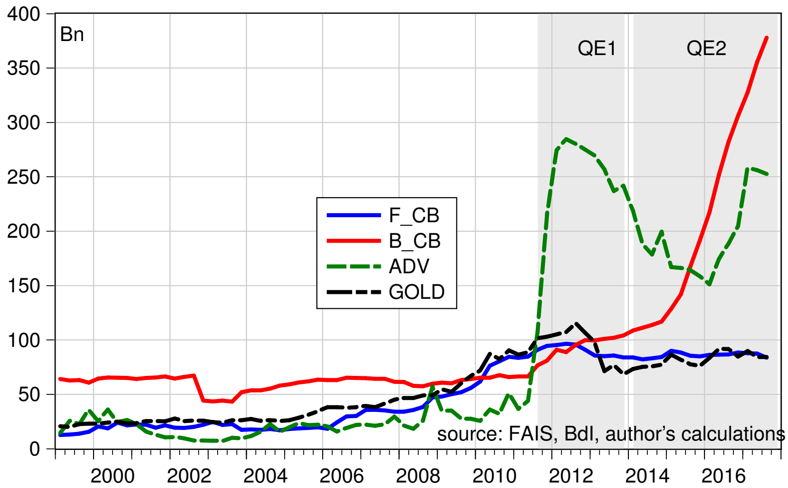


Table 3.3: Bank of Italy balance sheet.

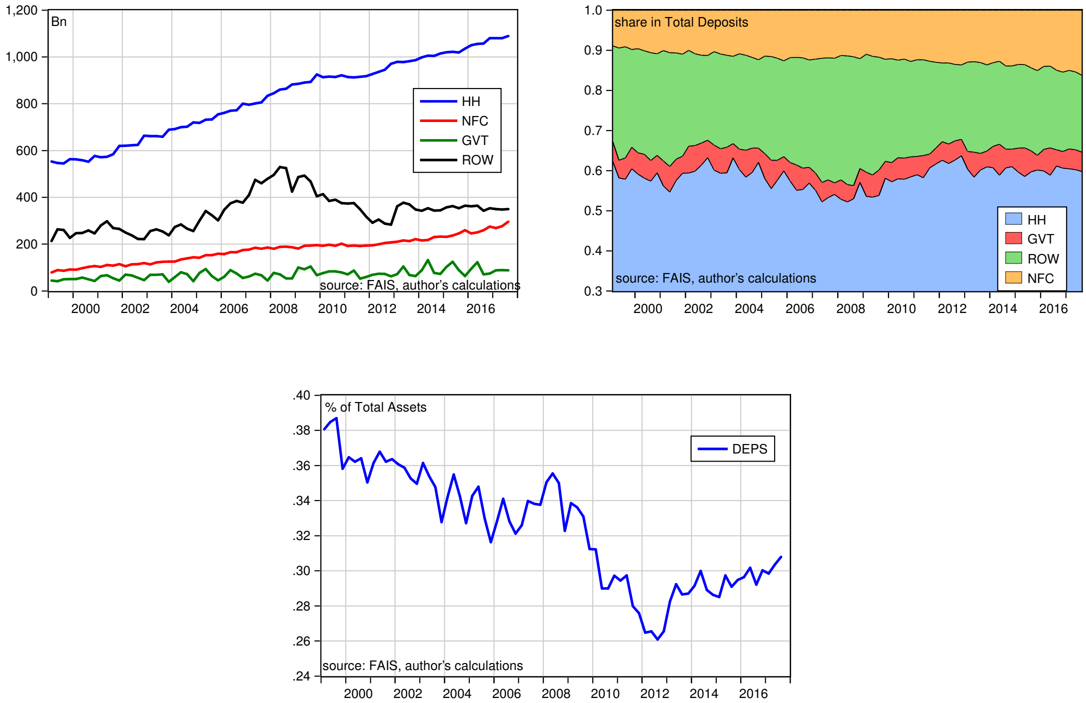
	HH	FC	BoI	GVT	RoW	Tot
Gold			+GOLD		-GOLD	0
Monetary base	$+MB_{HH}$	$+MB_{FC}$	$-MB$		$+MB_{T2}$	0
CB refinancing		-ADV	+ADV			0
Government Bonds			$+B_{CB}$	$-B_{CB}$		0
Foreign Liabilities			$+F_{CB}$		$-F_{CB}$	0
Other net fin.assets			$+ONFA_{CB}$			
Total			$+NFA_{CB}$			

(NFC) since we assume that all banknotes are held by the household sector. Net financial assets of the BoI (NFA_cb) measure the market value of BoI own capital, which has been steadily increasing, and it is now (2017) around 113 billion euro.

We can now turn to Financial Corporations. These play the crucial role of "fuel" of the system, providing credit for consumption and investment. Line 9 of the model Balance-sheet records "banks deposits". Banks hold deposits of households, firms, the public sector and of the RoW[30] (these are the sums of "banknotes and monetary deposits" and "other deposits"). Figure 3.35 reports the Deposits of the institutional sectors, both as their composition and as a share in total Financial Corporations assets.

[30]The rest of the deposits are held by the CB, for the "other deposits" part (200 Billion) and the banking sector (380 Billion in "banknotes and monetary deposits" and 340 Billion in "other deposits", which have been consolidated into FC). These are omitted from the model, 1) for the sake of simplicity, 2) because only a small part of the "banknotes and monetary deposits" of banks is held abroad, and most of these deposits are inside the banking sector itself.

Figure 3.35: Deposits



Next, lines 10 to 12 records Banks Loans. In the model, banks provide loans to households as consumer credit (BLCC) and as mortgage credit (BLMO), and to firms as investment finance (BLFIRMS).

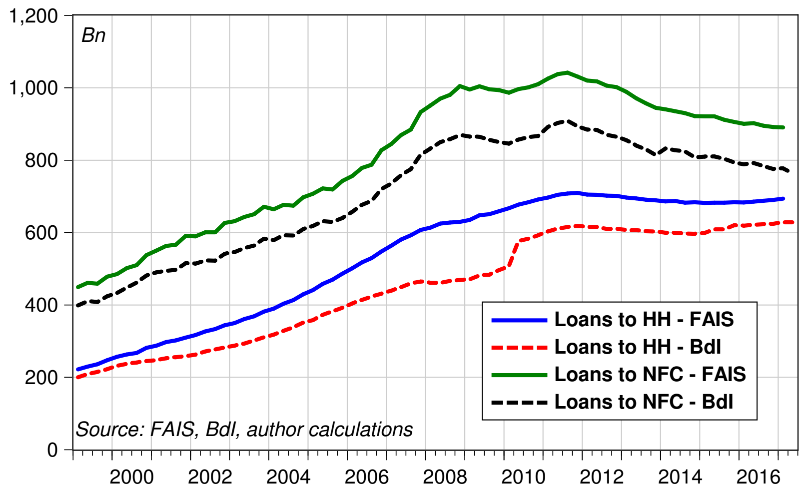
Information on Bank Loans may be found in multiple sources. As we said earlier, from the FAIS we have information on assets and liabilities issued by MFI and held by the various institutional sectors relative to short and medium-to-long term Loans. Thus, BLCC will be equal to the stock of short-term loans issued by MFI held by HH, BLMO the stock of long term loans issued by MFI held by HH and BLFIRMS to the sum of the stocks of short and long term loans issued by MFI and held by NFC. In addition, BoI also publishes more accurate information on the banking sector, splitting the loans to the private sector into loans to:

- Insurances&Pens.Funds,
- Central&Local government,
- households (producers),
- households (consumers),
- Non-profit inst.,
- Intra-group (domestic),

- MFI,
- Non financial Corp.,
- Other financial Corp.

However, since for now we are only interested in Loans to households and firms, Figure 3.36 displays bank loans from both databases. For both households and NFC, the dynamics of the series are more or less equal (but for households between 2007 and 2010, where BoI registers a crash which is not present in FAIS). However, the FAIS overestimate loans throughout the sample. This is partly given by the fact that FAIS are not consolidated[31].

Figure 3.36: Bank Loans: BoI and FAIS



Now lets take a closer look at our variables. Figures 3.37 and 3.38 display banks short and long term loans to households, respectively.

Figure 3.39, in turn, display Loans to NFC.

Finally, Figure 3.40 records, on the left hand side scale, the total amount of loans (i.e. BLCC+BLMO+BLFIRMS) as a share of total assets and, on the right hand side, the flows. Regarding the former, it is quite striking how banks have downplayed their role as lenders by the end of the 1990s: loans, indeed, accounted for just 28% of total assets in 1999 from a peak of 39% in 1995. However, driven by the rising flows of credit from mortgages first, and for firms finance later, the share in total assets went back to 34% up to the Great Recession. From 2011 to present, the share stepped from 32 to just 26%, reaching an historical low. However, the flows records some positive movements, driven again by mortgage credit, so next data releases shall register an improvement.

[31] Future versions of the model would have to improve this, as well as other, aspects.

Figure 3.37: Bank Loans: Consumer Credit

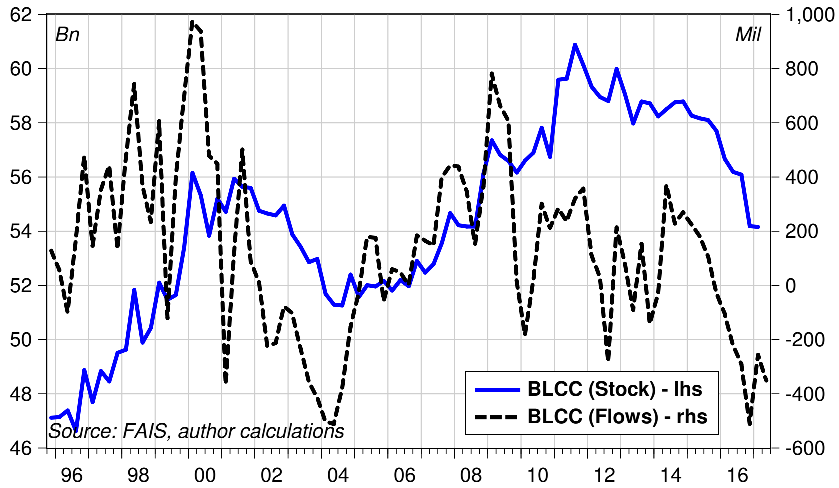
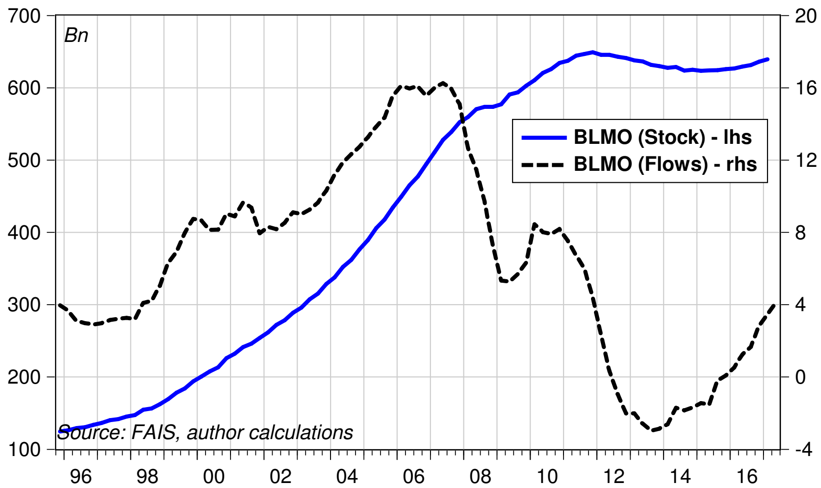


Figure 3.38: Bank Loans: Mortgages



Next, in line 12 we find Banks Debts. These are the stock of banks liabilities of "Long term asset", which in the model are an asset held by households and the RoW only. Figures 3.41 A-B and Figure 3.42 display the total amount of Banks Debt the former (in nominal terms and as a share in total assets) and the shares of households and RoW holdings of banks equities (as a share in total assets and as a share of total debt issued).

To close with the Banking sector, line 13 records Banks issued shares, held

Figure 3.39: Bank Loans: Loans to NFCs

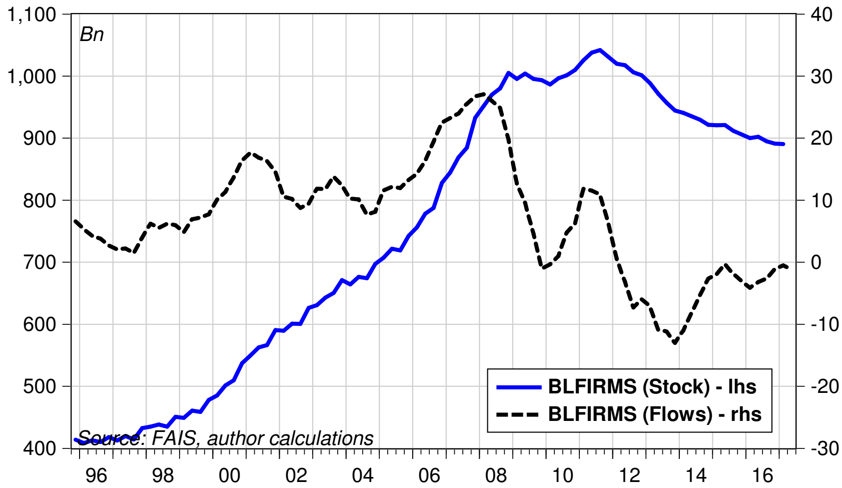
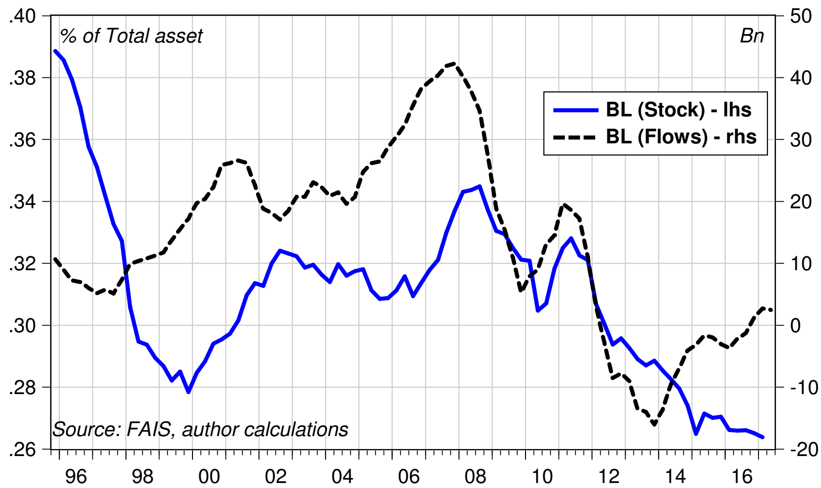


Figure 3.40: Bank Loans



by households only. We used this assumption for the sake of simplicity, but foreign capital in Italian banks' equities is relevant, and should be treated more properly. These are reported in Figure 3.43.

Having closed the discussion of the Financial Corporate Sector, we can now turn to the Government. In the model, the public sector only holds deposits, domestic firm's shares and a residual category of other net assets ($ONFA$), while issues Debt, which is in turn held by all other sectors.

Figure 3.41: Bank Securities

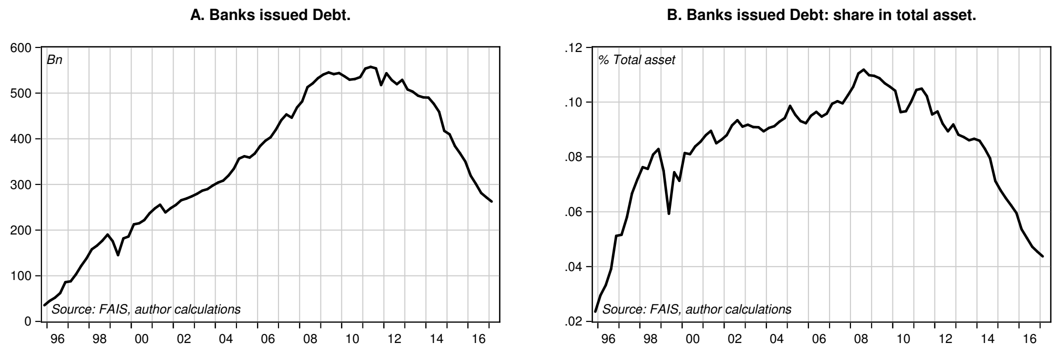


Figure 3.42: Bank Securities: Composition and shares in total assets

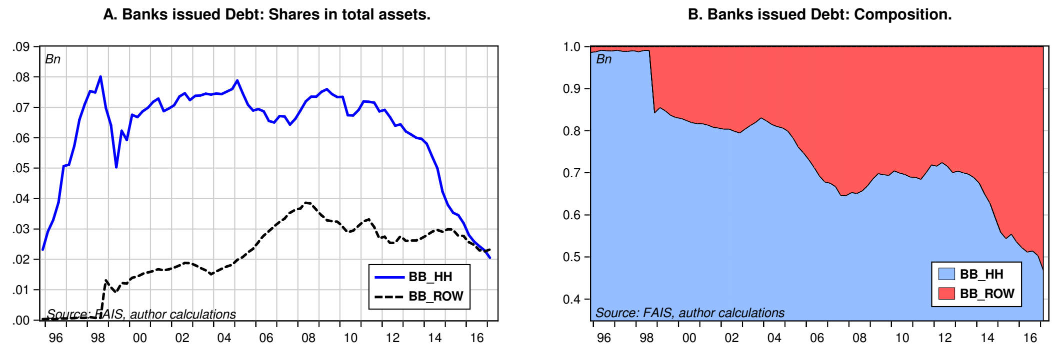
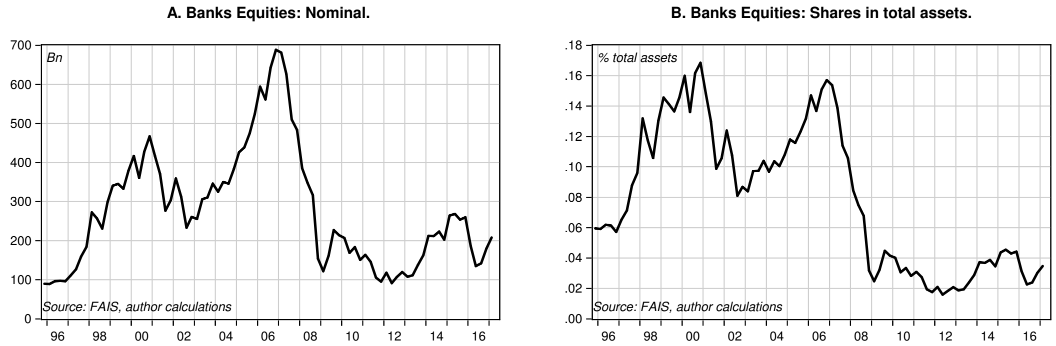


Figure 3.43: Bank Shares

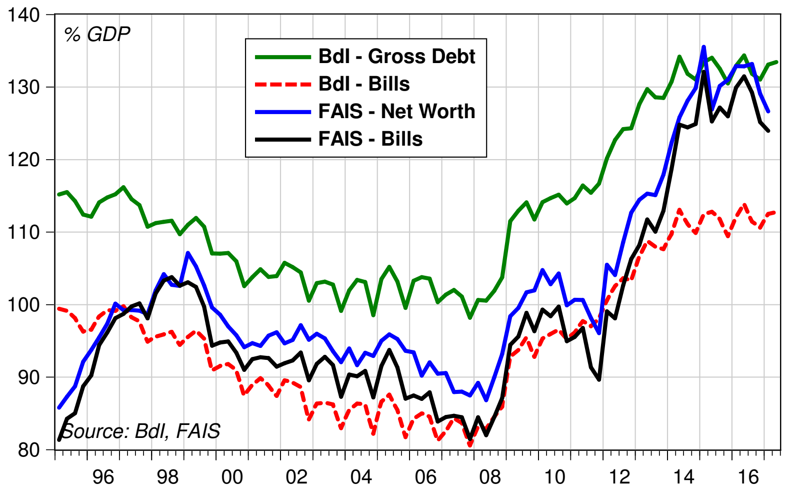


Information on Government Debt may be found in multiple sources. The BoI publishes measures for both the Bills held by the institutional sectors (divided into CB, BNK, OFI, OR and RoW), and Gross Debt held (monthly data, from 2000 to 2017 the former, and from 1990 to 2017 the latter). On the other hand, from the FAIS we have more disaggregated data (as previously noted, for 13 sectors[32]) relatively to assets emitted from the Government. In particular, we have information regarding:

- CCT from Central Government
- Non-CCT from Central Government
- Long-term asset from Local Government
- Short-term asset from Central Government

First, Figure 3.44 displays the relative series for Public Debt[33]. The Debt/GDP ratio was on a stable, slightly downward path in the first years of the EMU but, from the Great Recession onward, it went up to over 130% of GDP.

Figure 3.44: Public Debt. BoI and FAIS



It seems that the FAIS underestimate Public Debt up to 2014, and this may be worth researching. On the Asset side, the Government only holds "other deposits" (30 Billion), "L-T loans" (120 Billion, which are infra-government) and "shares" (100 Billion, of domestic firms). Regarding Liabilities, and apart from the aforementioned Short and Long-Term assets issued (115 and 2000 Billion, respectively), we find "Deposits" (both "money" and "other", for 170 and 80 Billion respectively, held by other residents, i.e. Non-Monetary Financial

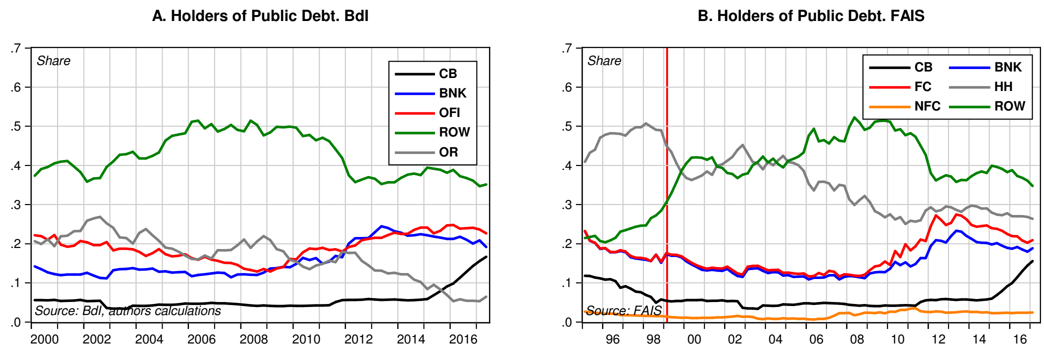
[32]Recall that, for model purposes, all financial institutions, with the exception of the Central Bank, are added up to form the Financial sector (FC). Moreover, the Public Sector is made up of Central and Local governments and INPS.

[33]Net Worth is calculated as Total Asset-Total Liabilities for the sum of Central and Local governments and INPS.

Corporations), Derivatives (30 Billion) and "L-T loans" (95 Billion, half from Banks half from RoW). However, Bills account for 90% of total Public Debt.

Figure 3.45, in turn, displays the holders of public debt, as a share of the total, for both databases.

Figure 3.45: Public Debt. Sector Shares



Couple of things stands out.

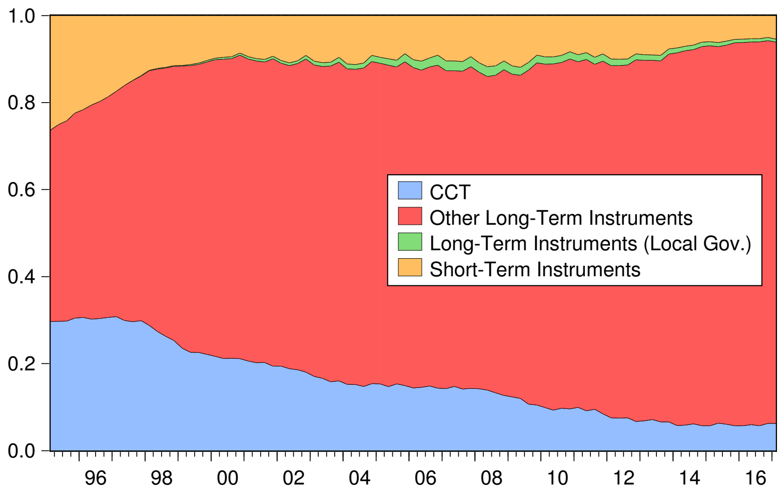
First, the BoI data, which only covers the period from 2000 on, takes out of the picture the big shift in the holdings of Public Debt which took place when Italy started its journey to join the Eurozone. Households saw their share declining from 37 to 15% (from 1996q1 to 2000q1), mirrored by an increase in Banks holdings from 10 to 20% and the huge increase in debt held abroad, from 20 to 40%.

Secondly, the differences in the two sets of data stem out from the different aggregations. While a first data inspection shows that the series related to the CB and Banks have similar patterns, this is not so for the Private domestic sector. Indeed, the series for Financial Corporations and the Other Residents from BoI look very different with respect to the ones constructed from the FAIS. While for FC the BoI systematically underestimates their shares, but at least the trends are equal, for the Private Non-Financial sector the story changes more drastically.

Thinking about the Private Non-Financial sector, Figure 3.45 also shows the holdings of Public Debt for Households and Non-Financial Corporations. It is clear that the overall (downward) dynamic is driven by the continuous drop in the households sector, which sees their holdings collapse between '97 and '99 (in the road to join the EZ), rise again in the run-up to the financial crisis and, finally, a new collapse (from 320 to 140 Bn). At the same time, Non-Financial Corporations, albeit on a much smaller scale, saw their holdings expand (from 10 to 50 Bn) between 2006 and 2011, followed by a small drop during the Sovereign Debt crisis and stabilizing afterwards at this new, higher, level.

From the FAIS, we can thus recover information on the composition of Public Debt, shown in Figure 3.46[34]. It is evident the steadily decline in CCT emitted from the Government, which is now ever more relying on other long-term debt instruments, that are indeed accountable for the general trajectory of Public Debt.

Figure 3.46: Composition of Public Debt

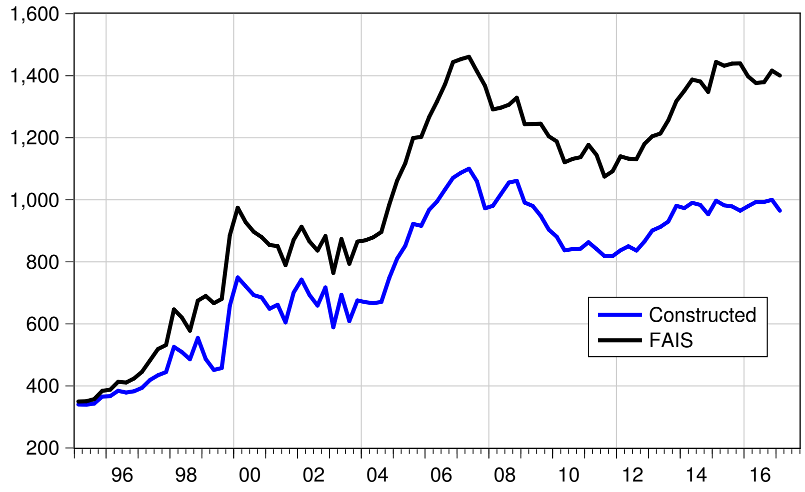


Next, line 17 in Table B.5 records Firms Issued Shares. These, together with bank loans and retained earnings, constitute their other major source for investment finance. To make the best out of this data sources, some consolidations and simplifications are in order. As we said, FAIS have information on both shares of firms (domestic, "listed" domestic and foreign) and of mutual funds (domestic and foreign). To keep thing simple, ease the analysis and better appreciate the channels at work, we only focus on shares of domestic firms, which are assumed to issues shares that are held by households, Financial Corporations and the Government. Moreover, all Financial corporations but Banks and Financial Auxiliaries have been consolidated into the households sector. This is so because households usually use these as intermediaries to acquire financial instruments, resulting in the appearance of these assets into the financial corporations balance-sheets.

It shall be noted, however, that several complications arise in the case of shares. First, it may well be possible that there is cross holding of shares between firms. Secondly, since we want to identify the FDI portion of shares, we only track the assets found in balance sheets of the holding sectors and assign it as a liability for Non Financial Corporations. Of course, using this proce-

[34]While we said that our measure also contains the long-term liabilities of the Local Government, these turn out to be small and have been consolidated with the Central Government in the Figure.

Figure 3.47: Firm's Issued Shares

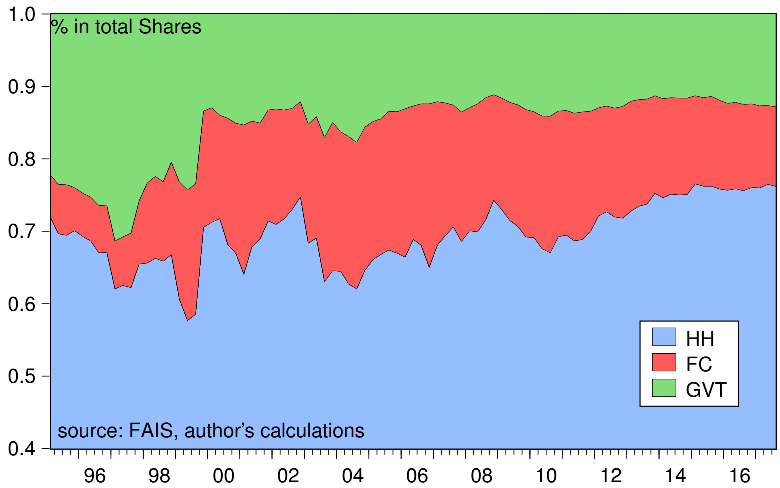


dure we will somewhat underestimate the shares issued domestically. Figure 3.47 displays the two series for shares, i.e. the constructed and actual (EN_{nfc}) ones. Figure 3.48, in turn, shows the holdings of shares of the various sectors. While households kept their 70-75% of the totality of shares throughout the sample, it really was the Government to step back, with its share reducing in favor of Financial Corporations. Between 1995 and 2001, from a peak of 31% in 1997 the Government moved to around 10-15%, where it still is nowadays. This was counterbalanced by the growing portion of shares going to Financial Corporations, which went from 0.07 in 1995 to 21% in 2001 and then kept their holdings above those of the Public Sector until present. However, from 2010 onward both the Public Sector and Financial Corporations have been reducing their holdings in favor of households[35].

Lines 18-20 of Table B.5 display the foreign sector block of our model Balance-sheet. As we said, we wanted to clearly identify FDI's, both incoming and outgoing. In order to do this, we set FDI "outgoing" (FDIO) as the stock of foreign shares held by domestic firms while "incoming" FDI (FDII) are the stock of shares of domestic firms held by foreigners. These are shown in Figure 3.49, both as a share of GDP. While domestic firms slowly but continuously increased their holdings of foreign shares (FDIO) despite of the various crises occurred, "incoming" FDI's (FDII) clearly shows the dynamics related to the cycle. They step from 2% of GDP in 1995 to 1% in 2001, followed by a decline related to the US dot.com crisis of 2001 that only inverted the trend by the end of 2002, when they started to gain momentum again. The pre-2008 crisis rise is evident, as it is its collapse in the two following years (2008-2011). With the

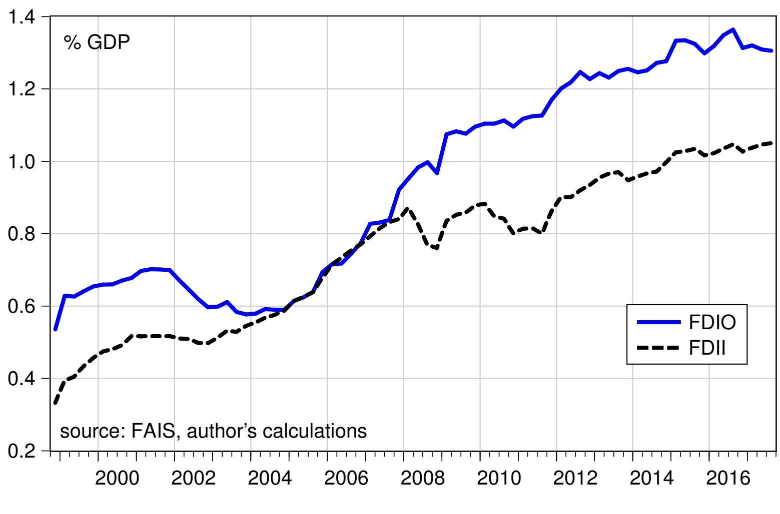
[35]Moreover, remember that we consolidate the balance sheet of households to that of non-banking financial intermediaries: purchases of equities by the latter appear in the model in the household balance sheet.

Figure 3.48: Holders of NFC Shares



value of Italian firms on international financial markets collapsing, after eight consecutive years of recession, the recent upswing in FDII may well be due to predatory M&A by foreign actors.

Figure 3.49: Foreign Direct Investments, Incoming and Outgoing



Next we find Foreign issued Liabilities (F), which are held by households, Financial corporations and the Central Bank. These consists of Short and Long term instruments plus the shares of mutual funds issued by the RoW (i.e. lines $14 + 21 + 41$ of Table 4.3). Also in this case, since most financial firms only act as intermediaries for households, we consolidated Pension and Insurances and OFI into the households sectors. Figure 3.50 displays, as usual, the constructed series and the FAIS one. Both have the exact same dynamic, of course, and display a continuous increase, only slowed down by the various cycles, reaching in 2017 1.600 Bn euros from a mere 210 in 1995 (from 1 to 3.8% of GDP).

Figure 3.50: Foreign issued Liabilities

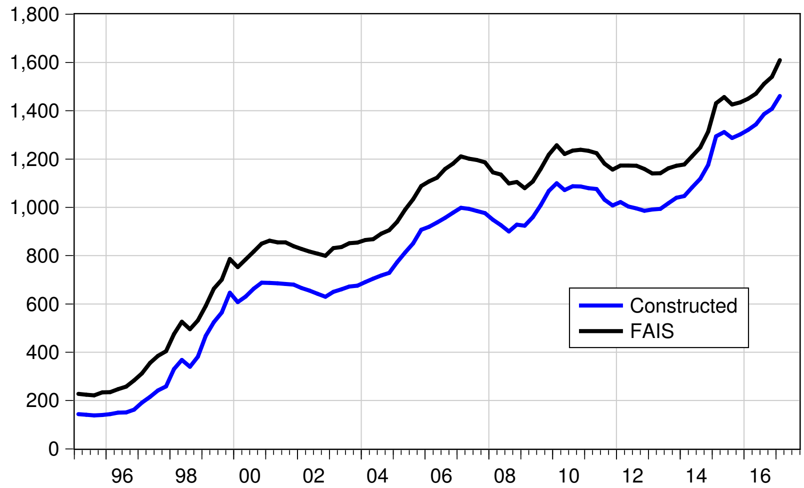
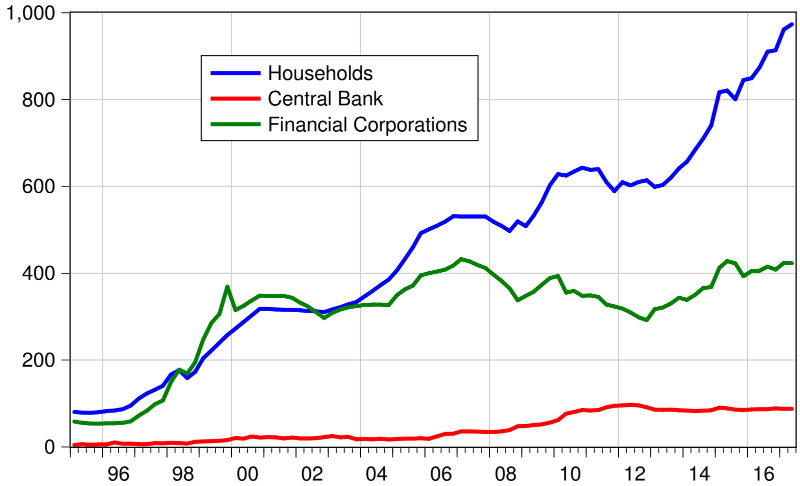


Figure 3.51, in turn, displays the holders of foreign liabilities. While the Central Bank only after the crisis started to acaccumulate foreign assets, Financial Corporations very much enjoyed the dot.com boom, stepping from 0.3 in 1995 to 1.2% of GDP in 2000. From then on, however, they never recovered those numbers, showing a continuous decline, briefly interrupted in the run-up to the Financial Crisis between 2004 and 2006, which only seems to have stabilized by the end of the sample at 0.9% of GDP. Households, on the opposite, clearly show a steep increase in their holdings, reaching 2.4% of GDP in 2017.

Figure 3.51: Holders of Foreign issued Liabilities



Up to now, we have built the starting database and set up the accounting skeleton for our empirical model. From NFA, we have recovered quarterly data, from 1999 to present, for all relevant "real" transactions, while we made use of FAIS with respect to Stocks&Flows for all Assets and Liabilities, with both sets of data recording current monetary values. As we discussed in more detail in Section 3.2, however, achieving consistency between these two sets of data is not as simple as it sounds.

The next Chapter is indeed devoted to show how one can deal with the issues that will arise.

Chapter 4

Merging Stocks & Flows

Now that we have set up the basic accounting skeleton of our model with the Transaction and Balance Sheet matrices, the next task consists of merging the two databases together, defining all the entries of the Transaction Matrix.

We changed slightly the notations for our model variables, to ease the distinction between the accounting equations set up in Chapter 3 and the ones entering the model.

The method to proceed will go as follows. We will start from the Real-Financial interactions of the model. First, in Section 4.1 we will compute Net Capital Gains for all our assets, and use it to connect our variables regarding Net Financial Assets from FAIS to the Net Lending from NFA. We then turn back to the "real" side of our model, in Section 4.2, where we will link the assets in sectors' balance sheets to the respective income flows in the Transaction Matrix, replacing all the respective entries relative to capital income flows. Next, we will explain how to introduce the Central Bank sector into the model, and make a short digression to explain the different phases of the Quantitative Easing programs carried out by the ECB and SECB. We will then introduce, in Section 4.4, all other variables relevant to our model, in particular those regarding the Labor Market. Finally, we will conclude this Part of the Thesis by assessing what are the final steps that need to be taken to "close" the model, which will be carried out in Part 3, Chapter 5.

In this way, we will build a *complete* accounting structure for an applied SFC macro-model in the spirit of Godley and Lavoie ((2007)) that, by itself, already sheds some light on many relevant interactions of an economic system that *necessarily* need to hold. Thus, even if the model is still mainly "a-theoretical", it already has much less degrees of freedom, i.e. some links among variables and sectors are indeed given by logic and accounting *per se*, while others step out from assumptions we made on the basis of data exploration.

4.1 Capital Gains and Asset pricing

For the $i-th$ sector, we model the stock of net financial assets at market prices NFA from the corresponding net flow:

$$NFA_{i,t} = NFA_{i,t-1} + NETLENDF_{i,t} + NKG_{i,t} \tag{4.1}$$

Where $NETLENDF$ is the net lending, as published in FAIS, and NKG is net capital gains, measured as the residual from (4.1). For the household sector, we also estimate the stock of net financial assets at historical prices, NFA_HP, by accumulating the relative net flow, i.e. ignoring capital gains, and therefore fluctuations due to changes in the market price of assets.

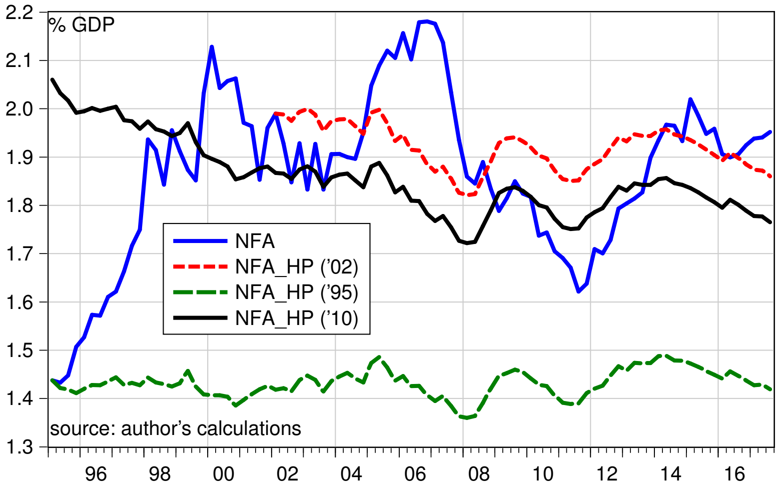
$$NFA\_HP_{hh,t} = NFA\_HP_{hh,t-1} + NETLENDF_{hh,t} \tag{4.2}$$

The rationale for determining NFA_HP is that, while consumers are likely to adjust expenditure with changes in their total net financial wealth, it is implausible that they adjust their expenditure, quarter by quarter, with changes, say, in the stock market price index. Secondly, there is a technical consideration. We need to recall that the ultimate goal is to build a fully empirical model, where all structural (behavioral) equations will have to be estimated with the appropriate techniques. The series upon which these estimations would have to be performed, thus, need to be as "smooth" as possible, if we want to achieve robust parameters and meaningful results. However, as we said many times, if we also want to model assets at historical prices, we will need to add additional identities and equations to the model, increasing its complexity.

However, it is only possible to establish whether to model or not some variables when one has the *complete* structure at hand. Moreover, when dealing with medium-large size models, the choices one makes need to be partly driven by theoretical considerations but, mostly, by pragmatic ones. If the estimations do not show any sign of correlation among some theoretical links or there is strong evidence against it, it may be better either not to model it at all or to better fit the data than the theoretical aspects. For the same reasons, it may be useful to go back to the theory if, for the sake of trying to fit the data better with the structural equations, we came out with a model that behaves strangely when performing simulations. More on this will be said later on when we will describe the Dynamic Accounting of Balance sheets and Flow of Funds in Section 5.3 and when we will describe the estimated structural equations in Chapter 5. For now, in any case, we think it is useful for the reader that wants to work with such models to know the technicalities behind these kinds of operations.

The different measures are displayed in Figure 4.1. When plotting the constructed variables, however, we noticed that the gap between the series at historical prices and the current market prices are definitely too large. This is so because the price bubble during the dot.com crisis affected heavily the data in the first part of the sample. To correct for this, we thus decided, first, to try to accumulate the flows starting from the end of 2001 (red solid line) and, secondly,

Figure 4.1: Households Net Financial Assets. Current and Historical Prices



to compute prices indexed at 2010 (black solid line).

Net capital gains should be due to changes in the market price of assets, but also to write-offs due to bankruptcy. In principle, and abstracting from write-offs of debt, if e is one equity with a market value pe, the market value of the stock of equities evolves following:

$$e_t \cdot p_t = e_{t-1} \cdot pe_t + f_t \cdot pe_t \tag{4.3}$$

where f is the number of new equities issued during the period. Notice that the number of equities at the beginning of the period, i.e. e_{t-1}, must be valued at the current market price. Adding and subtracting $e_{t-1} \cdot pe_{t-1}$ we get:

$$e_t \cdot p_t = e_{t-1} \cdot pe_{t-1} + f_t \cdot pe_t + (e_{t-1} \cdot pe_t - e_{t-1} \cdot pe_{t-1}) \tag{4.4}$$

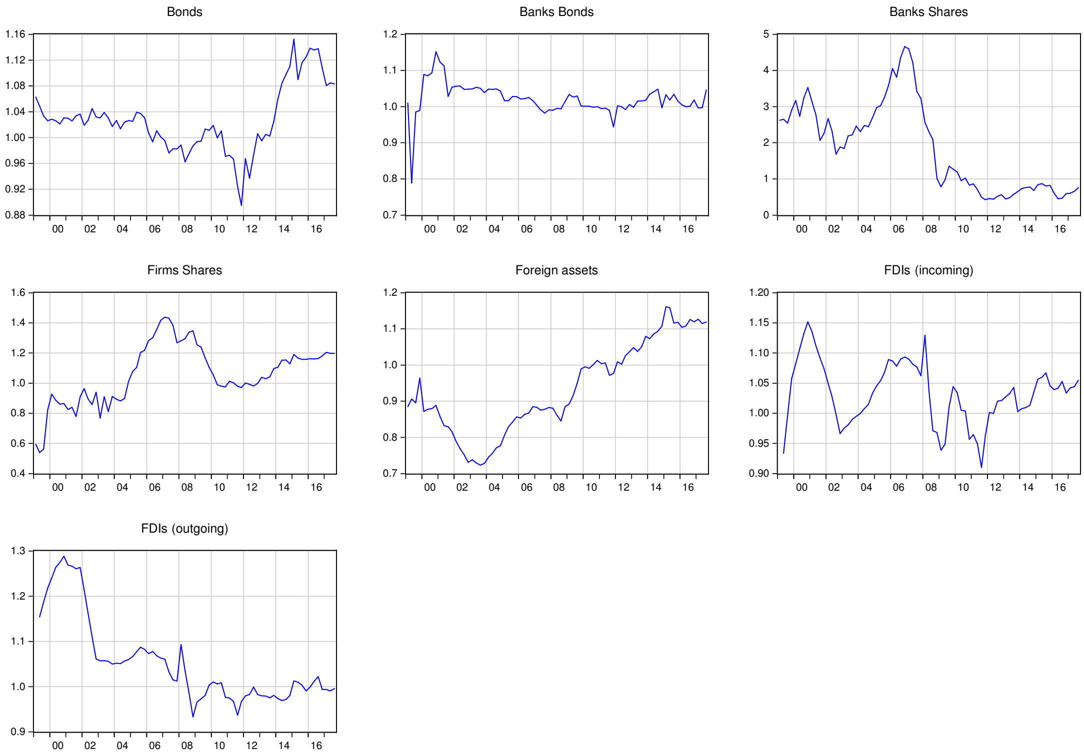
Multiplying and dividing by pe_{t-1} the last bracket, and using $E_t = e_t \cdot pe_t$, we get

$$E_t = E_{t-1} + F_t + \dot{pe}_t \cdot E_t \tag{4.5}$$

where $\dot{pe}_t$ is the rate of change in pe. Net capital gains, abstracting from write-offs, are equal to the rate of change in the market price of the asset, multiplied by the opening stock of assets. We have used (4.5) to compute the rate of change in each asset, given the values of the stocks available from the balance sheets, and the value of flows. These are shown in Figure 4.2.

A problem emerges, in practice, when more than one sector is holding the stock E as an asset. In principle, we could use equation (4.5) for each sector,

Figure 4.2: Evolution of market prices of Financial Assets



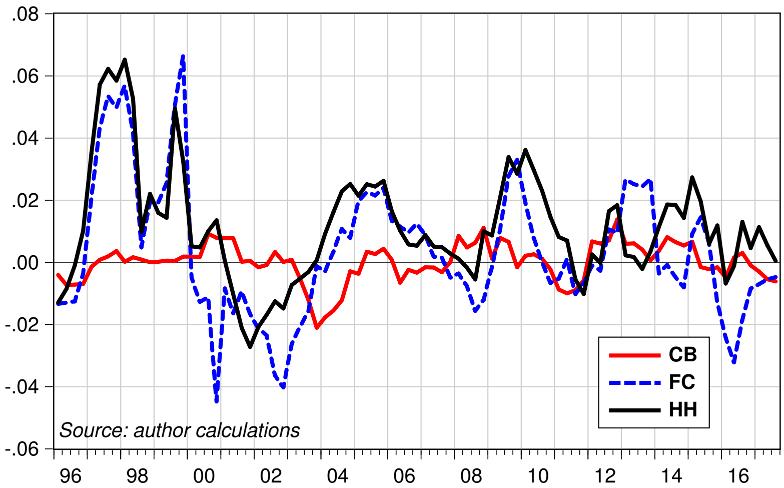
and assuming that each sector holds the same basket composing E, the rate of change in the market price should be the same, or at least similar, when computed from different sectors data. If, however, each sector holds a different component of the total basket defining E, the market price of each respective basket will vary. The problem is even more severe when we allow for write-offs. To show this, Figure 4.3 displays the implicit prices for Foreign Assets held by households, Bank of Italy and Financial Corporations.

One way to address the issue, and obtain consistent identities, would be to split (4.5) for the different baskets for each sector, and using different prices for each basket, with pe the weighted average for all equities. However, since this procedure implies the proliferation of price variables for financial assets, which sometime have unpredictable dynamics, we preferred to use a short-cut, which is to (a) compute the market price of the aggregate stock, (b) compute net capital gains for each sector on the basis of the overall market price, and (c) compute a residual component. For each sector, thus, we have:

$$E_{i,t} = E_{i,t-1} + F_{i,t} + \dot{p}e_t \cdot E_{i,t} + NKGD_{i,t} \tag{4.6}$$

where $NKGD$ is the discrepancy for the $i{-}th$ sector arising from the different composition of the basket of the $i - th$ sector against total basket.

Figure 4.3: Implicit Price of Foreign Assets: sector breakdown



4.1.1 Net Capital Gains by Asset

Next, we compute Net Capital Gains for each and every asset of the model. Following the classification of financial assets in Table B.5, we have:

Gold held at the Central Bank. The "real" stock of gold $GOLDQ$ is estimated at $t = 1$ dividing the stock at market prices $GOLD$ by the market price of gold $PGOLD$. The real stock is then accumulated overtime using:

$$GOLDQ_t = GOLDQ_{t-1} + {}^{VGOLD_t}/_{PGOLD_t} \qquad \text{(NKG\_GOLD.01)}$$

where $VGOLD$ is the Euro value of net flows in gold at the Central Bank. the accounting identity for the value of gold implies a discrepancy, $NKGD\_GOLD$,

$$GOLD_t = GOLD_{t-1} + VGOLD_t + pgold_t \cdot GOLD_{t-1} + NKGD\_GOLD_t \qquad \text{(NKG\_GOLD.02)}$$

Monetary Base and Bank Deposits. The stocks of monetary base and bank deposits obviously should not imply capital gains. However, comparing the change in the end-of-period stocks of deposits to the corresponding flow, there are discrepancies, which we compute as write-offs and treat as exogenous, according to

$$DEPS_{i,t} = DEPS_{i,t-1} + VDEPS_{i,t} - DEPSWO_{i,t} \qquad \text{(NKG\_DEPS.01)}$$

Consumer Credit. The comparison of the changes in the stock of consumer credit to the corresponding flow suggests that the difference is due to to write-offs of non-performing loans, so that

$$BLCC_t = BLCC_{t-1} + VBLCC_t - BLCCWO_t \quad \text{(NKG\_BLCC.01)}$$

Write-offs $BLCCWO$ are rapidly increasing since 2010. Again, we treat $BLCCWO$ as exogenous, so that the write-offs will not play a role on model accounting[1].

Mortgages Long-term loans to households follow a similar pattern as consumer credit, i.e. computing the stock of such loans by accumulating the flows, and comparing the result to the current value of loans, shows that the latter is always below the former, by an amount presumably due to write-offs. We therefore adopt a similar identity rather than trying to infer an implicit "market price" of mortgages:

$$BLMO_t = BLMO_{t-1} + VBLMO_t - BLMOWO_t \quad \text{(NKG\_BLMO.01)}$$

The determination of the change in the stock of mortgages $VBLMO$ will be discussed in Chapter 5.

Loans to NFC Inspection of stocks and flows reveal similarities to consumer credit: revaluation seems to be due to write-offs, rather than changes in the market price of loans, so we use:

$$BLFIRMS_t = BLFIRMS_{t-1} + VBLFIRMS_t - BLFIRMSWO_t \quad \text{(NKG\_BLFIRMS.01)}$$

The net increase in loans to firms, VBLFIRMS, will be determined from the residual need for liquidity of the firms' sector, as discussed below.

Banks Securities We have assumed that banks' debt other than equities is held by household and the foreign sectors. Comparing the published measure at market prices to the stock of debt obtained by accumulating the flows, we notice that the former is always slightly higher than the latter, so the difference cannot be interpreted as debt write-off, even for recent periods when some Italian banks saw the market value of their securities collapse.

We therefore chose to model the stock revaluation as a change in the market price of the stock. One solution would be to compute the revaluation separately for assets held by households, and for those held by the foreign sector, with the aggregate percent change in price given by a weighted average of the two components. Namely

$$BB_{HH,t} = BB_{HH,t-1} + VBB_{HH,t} + \dot{pbb}_{HH,t} \cdot BB_{HH,t-1}$$

$$BB_{RoW,t} = BB_{RoW,t-1} + VBB_{RoW,t} + \dot{pbb}_{RoW,t} \cdot BB_{RoW,t-1}$$

[1] The write-offs so calculated are not large, anyway. The stock of consumer credit, as used in the model, is rather modest in Italy, at 3 percent of GDP. The highest write-off we estimate was 0.3 percent of GDP, in the second quarter of 2017.

$$\dot{pbb}_t = \dot{pbb}_{HH,t} \cdot \frac{BB_{HH,t-1}}{BB_{t-1}} + \dot{pbb}_{RoW,t} \cdot \frac{BB_{RoW,t-1}}{BB_{t-1}}$$

However, the dynamics of the market prices for the two sub-components is quite erratic, and difficult to model, so we therefore preferred to estimate the market price from the aggregate stock, assuming that the two sectors hold the same basket of banks' debt, and compute the residual as a discrepancy, so that the identity becomes:

$$BB_{HH,t} = BB_{HH,t-1} + VBB_{HH,t} + \dot{pbb}_{HH,t} \cdot BB_{HH,t-1} + DISC\_VBB_{HH,t} \tag{NKG\_BB.01}$$

$$BB_{RoW,t} = BB_{RoW,t-1} + VBB_{RoW,t} + \dot{pbb}_{RoW,t} \cdot BB_{RoW,t-1} + DISC\_VBB_{RoW,t} \tag{NKG\_BB.02}$$

implying that $DISC\_VBB_{HH,t} + DISC\_VBB_{RoW,t} = 0$.

Banks' Equities We have assumed that banks' equities are held only by domestic households, although this assumption should be relaxed in future releases, given the relevance of Foreign Direct Investments in the financial sector. Our assumption simplifies the accounting, and we abstract from write-offs for this asset, using simply

$$EB_t = EB_{t-1} + VEB_t + \dot{peb}_t \cdot EB_{t-1} \tag{NKG\_EB.01}$$

As we will discuss in more detail in the next Chapter, we assume that the decision on the value of net new equities VEB is taken exogenously by banks, and that the households are always willing to purchase whatever new equities are issued.

Government Bonds The treatment of Government Bonds will be similar to that of banks' debt, since the implicit market price that can be obtained from computing the revaluation account of sectors holding these bonds is not easy to establish. We therefore compute a single market price from the aggregate stock of Bonds, and discrepancies for each sector, with discrepancies summing up to zero. For each sector i we have:

$$B_{i,t} = B_{i,t-1} + VB_{i,t} + \dot{pb}_t \cdot B_{i,t-1} + DISC\_VB_{i,t} \tag{NKG\_B.01}$$

where $\dot{pb}_t$ is computed from

$$B_t = B_{t-1} + VB_t + \dot{pb}_t \cdot B_{t-1} \tag{NKG\_B.02}$$

The supply of new government bonds is determined by the government financing needs, while the demand side will be modeled differently according to the sectors, and will be discussed in Chapter 5.

Firms' Equities The implicit market price of firms' equities that can be obtained by the revaluation account of sectors holding these assets (i.e. households, financial firms and the government) shows that the dynamics for the financial sector is markedly different from the other two sectors. This is possibly the result of our simplifying assumption for computing the portfolio of the financial sector, and again suggests to model the market price with the same method adopted for banks' debt and government bonds:

$$EN_{i,t} = EN_{i,t-1} + VEN_{i,t} + \dot{pen}_t \cdot EN_{i,t-1} + DISC\_VEN_{i,t} \quad \text{(NKG\_EN.01)}$$

where $\dot{pen}_t$ is computed from

$$EN_t = EN_{t-1} + VEN_t + \dot{pen}_t \cdot EN_{t-1} \quad \text{(NKG\_EN.02)}$$

the supply of new equities VEN is modeled as an autonomous decision of firms (the flow of equities has been negative, on average, since 2014), while the demand will be modeled differently according to the sectors.

Foreign Direct Investments "Incoming" and "Outgoing" foreign direct investments are seen as a relation between domestic non-financial firms and foreign firms, and we chose to ignore potential write-offs, and use the stock-flow identity to compute an implicit market price for each of the two assets[2]:

$$FDII_t = FDII_{t-1} + VFDII_t + \dot{pfdii}_t \cdot FDII_{t-1} \quad \text{(NKG\_FDII.01)}$$

$$FDIO_t = FDIO_{t-1} + VFDIO_t + \dot{pfdio}_t \cdot FDIO_{t-1} \quad \text{(NKG\_FDIO.01)}$$

Foreign Liabilities We assume that foreign liabilities are held by households, financial firms and the Central Bank. When computing the implicit market price index from the stock-flow identity, the implicit market price for Central Bank holdings has very different dynamics from the other two, so we again resort to using a discrepancy, and computing the market price of these assets from the aggregate stock.

$$F_{i,t} = F_{i,t-1} + VF_{i,t} + \dot{pf}_t \cdot F_{i,t-1} + DISC\_VF_{i,t} \quad \text{(NKG\_F.01)}$$

where $\dot{pf}_t$ is computed from

$$F_t = F_{t-1} + VF_t + \dot{pf}_t \cdot F_{t-1} \quad \text{(NKG\_F.02)}$$

Other net financial Assets Other net financial Assets are treated exogenously. Net capital gains on these assets (NKG_ONFA) for each sector are obtained residually so that

$$ONFA_{i,t} = ONFA_{i,t-1} + VONFA_{i,t} + NKG\_ONFA_{i,t} \quad \text{(NKG\_ONFA.01)}$$

[2] We abstracted from exchange rate movements, which would have been incorporated in these FDI's. The role of the exchange rate should be taken into account in further developments. However, if a large part of FDI's are with other Eurozone countries, the exchange rate should not be so relevant.

4.1.2 The Revaluation Account: Vertical Consistency

We are now able to specify the component of net capital gains (including write-offs) for each sector:

$$NKG_{HH,t} = \dot{pbb}_{HH,t} \cdot BB_{HH,t-1} + \dot{peb}_{HH,t} \cdot EB_{HH,t-1} + \dot{pb}_{HH,t} \cdot B_{HH,t-1} + \dot{pen}_{HH,t} \cdot EN_{HH,t-1} + \dot{pf}_{HH,t} \cdot F_{HH,t-1} + BLCCWO_t + BLMOWO_t + DISC\_VB_{HH,t} + DISC\_VEN_{HH,t} + DISC\_VF_{HH,t} + NKG\_ONFA_{HH,t} \quad \text{(NKG\_HH)}$$

$$NKG_{NFC,t} = \dot{pb}_{NFC,t} \cdot B_{NFC,t-1} + \dot{pen}_{NFC,t} \cdot EN_{NFC,t-1} + \dot{pfdio}_t \cdot FDIO_{t-1} - \dot{pfdii}_t \cdot FDII_{t-1} + BLFIRMS_t + DISC\_VB_{NFC,t} + NKG\_ONFA_{NFC,t} \quad \text{(NKG\_NFC)}$$

$$NKG_{CB,t} = \dot{pgold}_t \cdot GOLD_{t-1} + \dot{pb}_{CB,t} \cdot B_{CB,t-1} + \dot{pf}_{CB,t} \cdot F_{CB,t-1} + DISC\_VB_{CB,t} + NKG\_ONFA_{CB,t} + NKG\_GOLD_t \quad \text{(NKG\_CB)}$$

$$NKG_{GVT,t} = \dot{pen}_{GVT,t} \cdot EN_{GVT,t-1} - \dot{pb}_t \cdot B_{t-1} + NKG\_ONFA_{GVT,t} \quad \text{(NKG\_GVT)}$$

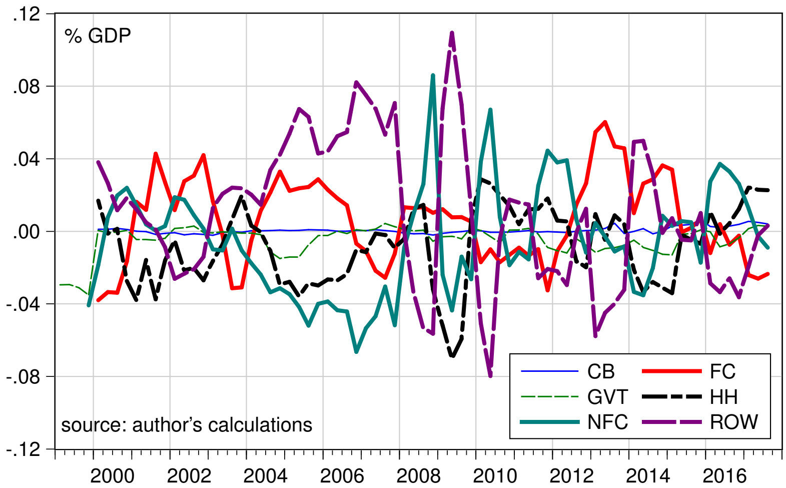
$$NKG_{RoW,t} = -\dot{pgold}_t \cdot GOLD_{t-1} + \dot{pbb}_{RoW,t} \cdot BB_{RoW,t-1} - \dot{pfdio}_t \cdot FDIO_{t-1} + \dot{pfdii}_t \cdot FDII_{t-1} - \dot{pf}_t \cdot F_{t-1} + DISC\_VB_{RoW,t} + NKG\_ONFA_{RoW,t} \quad \text{(NKG\_ROW)}$$

And it must be the case that

$$\sum NKG_i = 0$$

So that one variable can be obtained as a residual (*redundancy*) from the accounting identity. Figure 4.4 displays Net capital gains for all our sectors. At a first inspection, the figure suggests that the losses (gains) of households are the mirror image of the gains (losses) of financial corporations, and the same is true with respect to firms and the foreign sector.

Figure 4.4: Italy. Net Capital Gains



4.2 Building the Behavioral Transaction Matrix

We may close, for now, with the Financial side, since we will deal with Portfolio Choice and Dynamic Accounting in the next Chapter, and focus on how to build the Behavioral Transaction Matrix for our model.

As we said previously in Section 4.2, to do this we need to replace, whenever possible, the accounting identities which enter Table 4.2 by their stock-flow counterparts, and explicitly address all flow-flow relations (i.e. regarding wages, taxes, contributions etc.). We will start with the Production block, and then move to transactions in incomes from capital. Finally, we will deal with taxes, benefits & social contributions.

4.2.1 Production

Table B.3 displays first block of the Matrix. As usual, all entries with a (+) sign represents *sources of funds* while (-) stands for *uses of funds*.

As for Table B.2, the first block of the model Transaction Matrix deals with total GDP and how this splits into Incomes from Production (for households and the government), operating surplus (for banks and non-financial firms) and Incomes from trade (for the RoW). Two things stand out. First, we eliminated the Pool column since, as we will describe here and in subsequent sections, *it is possible* to establish *complete* accounts for all payments and and asset transactions, given one applies the right procedures on the series and the relative accounting identities. Second, and following the discussion made in the previous Chapter, we added a column for the Central Bank. This will indeed prove very useful to better analyze the relationships between the financial and real side of the economy, with particular focus on the transmission mechanisms of

Monetary Policy, and especially of the current QE programs on banks balance sheets and the credit market.

Before starting, a methodological remark is needed. As clear from the Matrix, we consolidated the domestic Production block into a single sector that pays wages and produce all Gross Domestic Product. For example, by looking at Table B.2 we notice that, out of 99 Billion euros of wages received, almost all goes to the households sector (so that our choice to attribute all *wages* to households fits perfectly with reality). On the other hand, these wages are paid out, for 59 Billion by non-financial firms, for another 27 Billion by the government while the rest 13 Billion are split more or less equally between the household and the financial sector. However, if we want to model how the sectoral GDP is produced, the number of equations in the model would increase exponentially. Moreover, we believe in the fact that the economy is demand-led also in the long-run, due to an under-utilization of existing productive capacity.

Table 4.1: Behavioral Transaction Matrix. Italy. GDP & Income from Production

		Sectors							
		Production	HH	NFC	FC		GVT	RoW	Tot
	Transactions				Banks	Central Bank			
1	GDP	$GDP = CONS + GFCF + DINV + G + XGS - MGS$							
2	Wage income: domestic	(-) $WB = wageu \cdot emp$	(+) $wages$					(-) $wagesfrow$	0
3	Wage income paid abroad	(-) $WAGES2ROW$						(+) $wages2row$	0
4	Mixed income	(-) $MIXY = ratio^{mixy} \cdot GDP$		(+) $mixy$					0
5	Operating surplus	(-) $OPS = GDP - (WB + MIXY + INDTAX - SUBS)$	(+) $ops_{hh} = \pi_{hh} \cdot OPS$	(+) $ops_{nfc} = OPS - (ops_{hh} + ops_{fc} + ops_{gvt})$	(+) $ops_{fc} = \pi_{fc} \cdot OPS$		(+) $ops_{gvt} = \pi_{gvt} \cdot OPS$		0
6	Indirect taxes	(-) $INDTAX = \theta^{i} \cdot GDP$					(+) $indt_{gvt} = indtax - indt_{row}$	(+) $indt_{row} = \theta^{iw} \cdot INDTAX$	0
7	Subsidies	(+) $SUBS = \theta^{s} \cdot GDP$					(-) $subs_{gvt} = SUBS - subs_{row}$	(-) $subs_{row} = \theta^{sw} \cdot SUBS$	0
8	Imports	(-) MGS						(+) mgs	0
9	Exports	(+) XGS						(-) xgs	
10	*Sum 2-9 Income From Production*		(+) $INCP_{hh}$	(+) ops_{nfc}	(+) ops_{fc}		(+) $INCP_{gvt}$	(+) NET_TRADE	0

Gross Domestic Product (GDP) from the supply side is equal to the sum of consumption ($CONS$), investments and changes in inventories ($GFCF$ and $DINV$, respectively), government expenditures (G) and exports (XGS), minus imports (MGS) (4.7). The supply components will be estimated in Section 5.4. From the production side, it is equal to the sum of domestic and foreign wage income paid (WB and $WAGES2ROW$), mixed income ($MIXY$), operating surplus (OPS), indirect taxes & subsidies to production ($INDTAX$ and $SUBS$, respectively), imports & exports (MGS and XGS).

$$GDP = CONS + GFCF + DINV + G + XGS - MGS \tag{4.7}$$

We start from the wage bill WB (4.8), which is given by the product of (estimated) average wages ($wageu$) and employment (emp)[3]. The wages paid domestically are split between those paid to the households sector ($wages$, which are determined as a residual in (4.9)) and those paid abroad to foreigners ($wages2row$). The mixed income, in turn, is computed as a share in GDP. Then we have the profits generated in the economy (OPS)[4], which need to be split among the different sectors. We assumed that these are divided on the basis of fixed shares (4.11) to (4.13), with non-financial corporations profits (OPS_{nfc}) determined as a residual (4.14).

$$WB = wageu \cdot emp \tag{4.8}$$

$$wages = WB + WAGESFROW - WAGES2ROW \tag{4.9}$$

$$MIXY = ratio^{mixy} \cdot GDP \tag{4.10}$$

$$ops_{hh} = \pi_{hh} \cdot OPS \tag{4.11}$$

$$ops_{fc} = \pi_{fc} \cdot OPS \tag{4.12}$$

$$ops_{gvt} = \pi_{gvt} \cdot OPS \tag{4.13}$$

$$ops_{nfc} = OPS - (ops_{hh} + ops_{fc} + opsgvt) \tag{4.14}$$

[3]where $emp = gdpk/prod$, and $prod$ represents average labor productivity, and will be estimated in Chapter 5.

[4]Which, recall, are determined residually from GDP.

With respect to indirect taxes and subsidies, we followed the same approach. Total indirect taxes and subsidies are given by the implicit tax rates (computed later in the Section) times GDP (in equations 4.15 and 4.16), and we split them between the government and EU institutions by calculating the amounts accruing to foreigners as the product of the corresponding implicit tax rates times the total payments (in equations 4.17 and 4.19) and computing the government receipts residually (in equations 4.18 and 4.20).

$$INDTAX = \theta^{i} \cdot GDP \tag{4.15}$$

$$SUBS = \theta^{s} \cdot GDP \tag{4.16}$$

$$indt_{row} = \theta^{iw} \cdot INDTAX \tag{4.17}$$

$$indt_{gvt} = INDTAX - indt_{row} \tag{4.18}$$

$$subs_{row} = \theta^{sw} \cdot SUBS \tag{4.19}$$

$$subs_{gvt} = SUBS - subs_{row} \tag{4.20}$$

Imports and exports, in turn, will be estimated and discussed in the next Chapter.

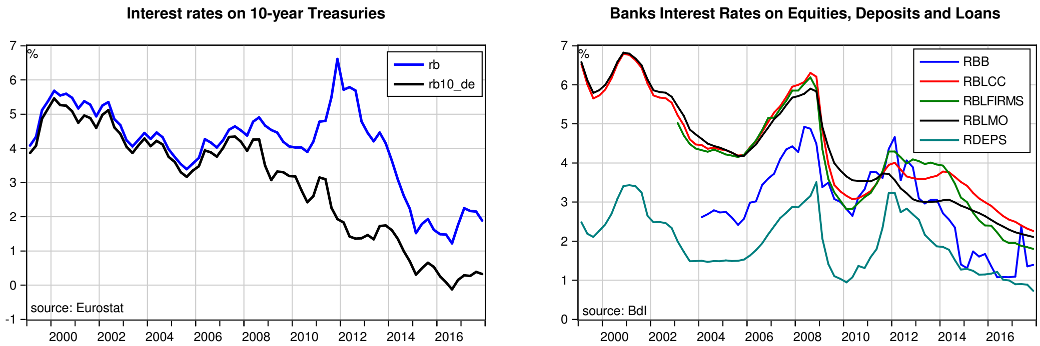
4.2.2 Transactions in Capital Incomes

One of the most powerful tool of SFC models lies in their ability to deal with real-financial connections. This means, in particular, linking the assets in the Balance Sheets to the flows of capital income that, added to incomes from production (or profits, for corporations), forms the Primary Income (YP) of the institutional sectors.

In our model, we will have four kind of incomes from capital. These are divided into incomes from interest, earned on Banks Deposits, Loans and Debt instruments, Government Bills and foreign liabilities, income from dividends, for both Shares of domestic firms and banks and the ones related to FDI's. The last two, which only involve model accounting, are Other net capital incomes (KYNET) and Net Rent from land ownership (RENTLN).

To do this, we first need to resort to additional data sources regarding interest rates (on deposits, on Bank Loans and Equities and on government Bills) and price indexes for Shares (for both domestic and foreign ones) and Gold. Starting from government Bonds, we use the rate on Italian 10-year Treasuries, while the black solid line is the corresponding rate on Germany Bund, which we will use to compute a *spread* measure that, as we will see later, will play a role in the estimations. Then we have the Banks' interest rates on deposits, loans and issued equities. These are displayed in Figure 4.5.

Figure 4.5: Selected Interest Rates



However, we cannot use a single published rate for the baskets representing foreign liabilities and equities of banks and firms, so we compute the ex-post returns, displayed in Figure 4.6, as follows[5]:

$$r_t^f = {}^{RoW\_INT\_P_t} / {}_{F_{t-1}}$$

$$r_t^{en} = {}^{NFC\_DIV\_P_t} / {}_{EN_{t-1}}$$

$$r_t^{eb} = {}^{FC\_DIV\_P_t} / {}_{EB_{t-1}}$$

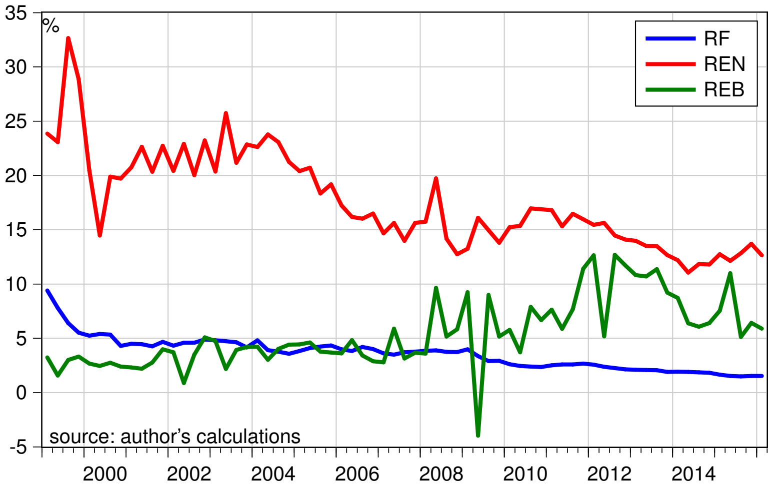
Next, we need to compute income and payment flows related to the Central Bank and deduct them from the total receipts and payments of the financial sector. As we previously said, we will deal with the Central Bank in more detail later in the chapter but, for the time being, we start by computing interest income received by Bank of Italy as the sum of receipts on government bonds, foreign liabilities and ECB advances:

$$\begin{aligned} INTR_{cb} = (&r_t^{adv} \cdot ADV_{t-1} \\ &+ r_t^b \cdot B_{cb,t-1} + r_t^f \cdot F_{cb,t-1}) \end{aligned} \tag{4.21}$$

Figure 4.7 displays the different income streams accruing to Bank of Italy, as percent of GDP.

[5]Recall that flow variables are not annualized, so they must be multiplied by four when building stock-flow ratios.

Figure 4.6: Ex-post Returns. Selected Assets



We further assume that the Central Bank does not retain any of this interest income, which is in fact completely disbursed as CB_OTC_P to the Government sector and subtracted from the total outlays of financial firms by setting $CB\_NETLEND$ equal to zero.

We now have all the ingredients we need to compute the capital income flows for all our sectors. However, when accumulating the relevant income streams for the different sectors one notices the emergence of new discrepancies between the constructed variables and the published ones, which we will model as exogenous and add them to the relative accounting identity.

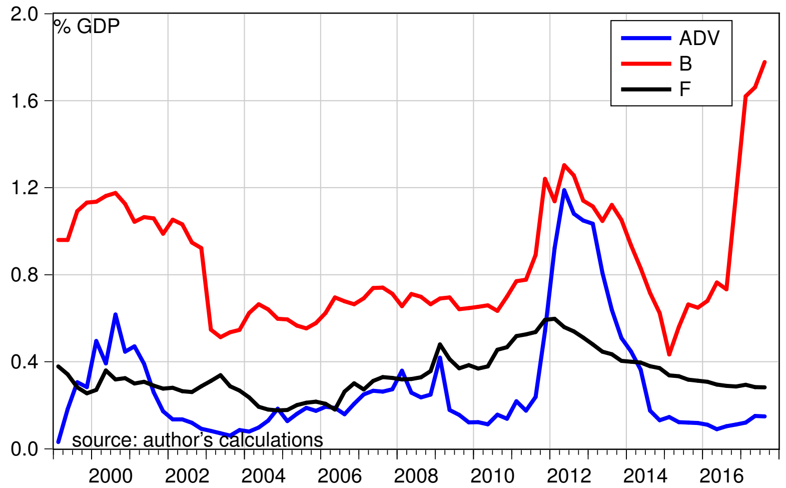
Households receive interest incomes (4.22) on their stock of deposits $DEPS_{HH,t}$, government bonds $B_{HH,t}$, banks debt instruments $BB_{HH,t}$ and foreign liabilites $F_{HH,t}$ and pay interest income (4.23) on their stock of consumer and mortgage credit $BLCC$ and $BLMO$:

$$INTR_{hh} = (r_t^{deps} \cdot DEPS_{hh,t-1} + r_t^b \cdot B_{hh,t-1} + r_t^{bb} \cdot BB_{hh,t-1} + r_t^f \cdot F_{hh,t-1}) - DISC\_INTR_{hh} \tag{4.22}$$

$$INTP_{hh} = (r_t^{blcc} \cdot BLCC_{t-1} + r_t^{blmo} \cdot BLMO_{t-1}) - DISC\_INTP_{hh} \tag{4.23}$$

Non-Financial Firms, in turn, only receive interests on the stocks of deposits and government bonds (4.24), while paying out interest on the loans received by banks (4.25). Thus:

Figure 4.7: Central Bank. Interest streams



$$INTR_{nfc} = (r_t^{deps} \cdot DEPS_{nfc,t-1} + r_t^b \cdot B_{nfc,t-1}) - DISC\_INTR_{nfc} \quad (4.24)$$

$$INTP_{nfc} = (r_t^{blfirms} \cdot BLFIRMS_{t-1}) - DISC\_INTP_{nfc} \quad (4.25)$$

As we noted previously in Chapter 3, the financial sector, of course, deals mainly with income from financial capital and collects interest streams on the different stock of loans it issues, i.e. $BLCC$, $BLMO$ and $BLFIRMS$, and from the stocks it holds of foreign liabilities and government bonds it holds (4.26). On the payment side, they pay out interest on the ECB advances received via Bank of Italy and on the stock of issued equities and securities (FC.06):

$$INTR_{fc} = (r_t^{blcc} \cdot BLCC_{t-1} + r_t^{blmo} \cdot BLMO_{t-1} + r_t^{blfirms} \cdot BLFIRMS_{t-1} + r_t^b \cdot B_{fc,t-1} + r_t^f \cdot F_{fc,t-1}) - DISC\_INTR_{fc} \quad (4.26)$$

$$INTP_{fc} = (r_t^{adv} \cdot ADV_{t-1} + r_t^{deps} \cdot DEPS_{t-1} + r_t^{bb} \cdot BB_{t-1}) - DISC\_INTP_{fc} \quad (4.27)$$

We can now turn to the Public sector. The Government collect interest income from deposits (4.28) and pays out the interest on the existing stock of government Bonds (4.29):

$$INTR_{gvt} = (r_t^{deps} \cdot DEPS_{gvt,t-1}) - DISC\_INTR_{gvt} \tag{4.28}$$

$$INTP_{gvt} = (r_t^{b} \cdot B_{t-1}) - DISC\_INTP_{gvt} \tag{4.29}$$

Finally, the foreign sector, which receives interests on deposits and government bonds (4.30) and pays those related to foreign issued liabilities (4.31):

$$\begin{aligned} INTR_{row} = (r_t^{deps} &\cdot DEPS_{row,t-1} \\ &+ r_t^{b} \cdot B_{row,t-1}) - DISC\_INTR_{row} \end{aligned} \tag{4.30}$$

$$INTP_{row} = (r_t^{f} \cdot F_{t-1}) - DISC\_INTP_{row} \tag{4.31}$$

We will apply the same procedure for dividends, which are paid by Banks and Firms on their respective equities EB and EN, and collected by households, financial corporations and the Government. Since we decided to model FDI's, however, we need to disentangle the portion of dividends paid abroad by non-financial firms from their total dividend outlays. We do this by subtracting from the total $TOTDIVP_{nfc}$ the receipts of the rest of the world (4.33). Thus:

$$DIVP_{nfc} = TOTDIVP_{nfc} - DIVR_{row} \tag{4.32}$$

and are given by

$$DIVP_{nfc} = (r^{en} \cdot EN_{t-1}) \tag{4.33}$$

While for dividends related to banks' equities we got:

$$DIVP_{fc} = (r^{eb} \cdot EB_{t-1}) \tag{4.34}$$

The receipts in turn are computed, as before, making use of additional exogenous variables for the discrepancies:

$$DIVR_{hh} = (r^{en} \cdot EN_{hh,t-1} + r^{eb}_{\cdot} EB_{hh,t-1}) + DISC\_DIVR_{hh} \tag{4.35}$$

$$DIVR_{fc} = (r^{en} \cdot EN_{fc,t-1}) + DISC\_DIVR_{fc} \tag{4.36}$$

$$DIVR_{gvt} = (r^{en} \cdot EN_{gvt,t-1}) + DISC\_DIVR_{gvt} \tag{4.37}$$

We can now move to FDI's. For the sake of simplicity, and because it is not straightforward to understand how to disentangle the part of dividends paid and received by domestic firms coming from FDI relations and domestic ones, we assigned it all to to the former. We thus start by computing FDI's income of domestic non-financial firms as the sum of reinvested earnings from FDI paid by foreigners and total dividends received by domestic firms (4.38), while the income of foreign firms from FDI's is the sum of dividends and reinvested earnings from FDI's received by the Rest of the World (4.39). We thus have:

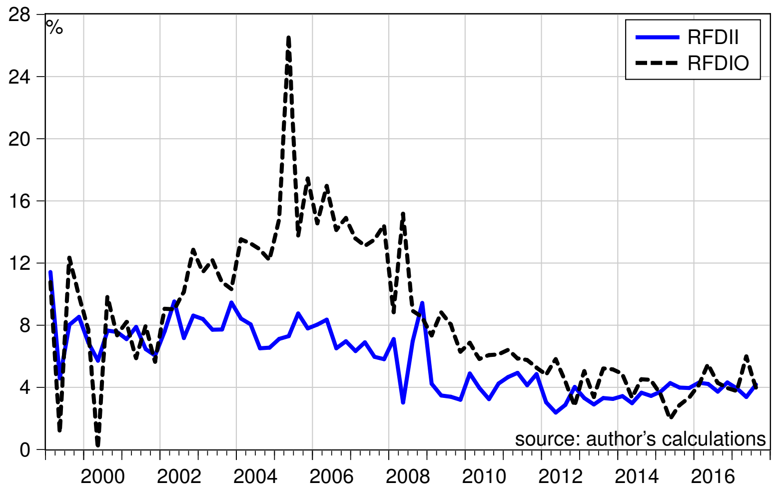
$$FDIY_{nfc} = DIVR_{nfc} + REINVFDIP_{row} \tag{4.38}$$

$$FDIY_{row} = DIVR_{row} + REINVFDIR_{row} \tag{4.39}$$

We use these to compute an implicit rate of return for $FDII$ and $FDIO$ as the ratio between the current flows and the opening stocks, displayed in Figure 4.8:

$$r^{fdio} = ^{FDIY_{nfc}} / _{FDIO_{t-1}}$$
$$r^{fdii} = ^{FDIY_{row}} / _{FDII_{t-1}}$$

Figure 4.8: Implicit Rates of return for FDI's



Finally, we need to include the reinvested earning from FDI's of domestic financial firms into our variable related to "other capital income", i.e. $KINCO\_R$, so that we may compute net capital incomes for all sectors, and add the net Rent from land paid by domestic households and non-financial firms to the government so as to arrive again at our measures for Primary incomes. We have the following:

$$KYNET_{hh} = KINCOR_{hh} \tag{4.40}$$

$$\begin{aligned} KYNET_{nfc} = KINCOR_{nfc} + (REINVFDIR_{nfc} - \\ REINVFDIP_{row}) - (REINVFDIP_{nfc} - REINVFDIR_{row}) \end{aligned} \tag{4.41}$$

$$\begin{aligned} KYNET_{fc} &= KINCOR_{fc} - KINCOP_{fc} \\ &+ REINVFDIR_{fc} - REINVFDIP_{fc} \end{aligned} \tag{4.42}$$

$$\begin{aligned} KYNET_{row} &= KINCOR_{row} - KINCOP_{row} \\ &+ DIVR_{nfc} - DIVP_{row} \end{aligned} \tag{4.43}$$

$$RENTLNR_{gvt} = RENTLNP_{nfc} + RENTLNP_{hh} \tag{4.44}$$

Table 4.2 highlights the part of our Transaction Matrix related to these incomes from capital.

Table 4.2: Transaction Matrix. Italy. Incomes from Capital

		Sectors						
		HH	NFC	FC		GVT	RoW	Tot
	Transactions			Banks	Central Bank			0
10	SUM 2-9 Income from production	(+) HH_INCP = wages + mixy + hh_ops	(+) nfc_ops	(+) fc_ops		(+) GVT_INCP = gvt_ops + gvt_indt_r - gvt_subs_p	(+) ROW_YTRADE = (mgs -xgs + disc_trade) + (wages2row + row_indt_r) - (wagesfrow + row_subs_p)	0
11	Interest received	(+) hh_int_r = ($r^{deps} \cdot DEPS_{HH,t-1}$ + $r^{b} \cdot B_{HH,t-1}$ + $r^{bb} \cdot BB_{t-1}$ + $r^{f} \cdot F_{HH,t-1}$) + disc_hh_int_r	(+) nfc_int_r = ($r^{deps} \cdot DEPS_{NFC,t-1}$ + $r^{b} \cdot B_{NFC,t-1}$) + disc_nfc_int_r	(+) fc_int_r =($r^{blcc} \cdot BLCC_{t-1}$ + $r^{blmo} \cdot BLMO_{t-1}$ + $r^{blfirms} \cdot BLFIRMS_{t-1}$ + $r^{b} \cdot B_{FC,t-1}$ + $r^{f} \cdot F_{FC,t-1}$) + disc_fc_int_r	(+) cb_int_r = ($r^{adv} \cdot ADV_{t-1}$ + $r^{b} \cdot B_{CB,t-1}$ + $r^{f} \cdot F_{CB,t-1}$)	(+) gvt_int_r = ($r^{deps} \cdot DEPS_{GVT,t-1}$) + disc_gvt_int_r	(+) row_int_r = ($r^{deps} \cdot DEPS_{RoW,t-1}$ + $r^{b} \cdot B_{RoW,t-1}$) + disc_row_int_r	0
12	Interest paid	(-) hh_int_p = ($r^{blcc} \cdot BLCC_{t-1}$ + $r^{blmo} \cdot BLMO_{t-1}$) + disc_hh_int_p	(-) nfc_int_p = ($r^{blfirms} \cdot BLFIRMS_{t-1}$) + disc_nfc_int_p	(-) fc_int_p = ($r^{adv} \cdot ADV_{t-1}$ + $r^{deps} \cdot DEPS_{t-1}$ + $r^{bb} \cdot BB_{t-1}$) + disc_fc_int_p		(-) gvt_int_p = ($r^{b} \cdot B_{t-1}$) + disc_gvt_int_p	(-) row_int_p = ($r^{f} \cdot F_{t-1}$) + disc_row_int_p	0
13	Dividends + Reinvested earnings from FDI received	(+) hh_div_r = ($r^{e} \cdot EN_{HH,t-1}$ + $r^{eb} \cdot EB_{t-1}$) + disc_hh_div_r	(+) nfc_fdiy = ($r^{fdio} \cdot FDIO_{t-1}$) = nfc_div_r + row_reinvfdi_p	(+) fc_div_r = ($r^{e} \cdot EN_{FC,t-1}$) + disc_fc_div_r		(+) gvt_div_r = ($r^{e} \cdot EN_{GVT,t-1}$) + disc_gvt_div_r	(+) row_fdiy = ($r^{fdii} \cdot FDII_{t-1}$) = row_div_r + row_reinvfdi_r	0
14	Dividends + Reinvested earnings from FDI paid		(-) (nfc_div_p + row_fdiy) = $r^{e} \cdot EN_{t-1} + r^{fdii} \cdot FDII_{t-1}$	(-) fc_div_p = $r^{eb} \cdot EB_{t1}$ + disc_fc_div_p			(-) nfc_fdiy = ($r^{fdio} \cdot FDIO_{t-1}$)	0
15	Other net Capital Income	(+) hh_kynet = hh_kinco_r	(+) nfc_kynet = nfc_kinco_r + (nfc_reinvfdi_r - row_reinvfdi_p) - (nfc_reinvfdi_p - row_reinvfdi_r)	(+) fc_kynet = fc_kinco_r - fc_kinco_p + fc_reinvfdi_r - fc_reinvfdi_p			(+) row_kynet = row_kinco_r - row_kinco_p + nfc_div_r - row_div_p	0
16	Net Rent from Land Ownership	(-) hh_rentln_p	(-) nfc_rentln_p			(+) gvt_rentln_r		0
17	Sum 10-16 Primary Income	HH_YP = HH_INCP + (hh_int_r + hh_div_r + hh_kynet) - (hh_int_p + hh_rentln_p)	NFC_YP = nfc_ops + (nfc_int_r + nfc_fdiy + nfc_kynet) - (nfc_int_p + nfc_div_p + row_fdiy + nfc_rentln_p)	FC_YP = fc_ops + (fc_int_r + fc_div_r + fc_kynet) - (fc_int_p + fc_div_p)	CB_INT_R	GVT_YP = GVT_INCP +(gvt_int_r + gvt_div_r + gvt_rentln_r) - (gvt_int_p)	ROW_YP = ROW_YTRADE + (row_int_r + row_fdiy + row_kynet) - (row_int_p + nfc_fdiy)	0

4.2.3 Taxes, Benefits & Contributions

Having completed the determination of income from capital, we may now turn back to the "real" side. The next block we need to introduce deals with current transactions between the government and the other sectors, i.e. with direct taxes, subsidies and social contributions. What is left forms the sectors Disposable incomes.

We start from direct taxes. First recall, from Chapter 3, that we assumed that only non-financial firms pay taxes to the RoW (i.e. EU institutions) (4.45) and pays domestically the difference between the total amount of taxes they pay and the amount paid abroad (4.55), which implies the foreign sector and the government are the only recipients. As usual, constructing these variables creates a discrepancy between the published series and the computed ones, which we will treat as exogenous variables and, in this specific case, add it to the identity for government tax receipts (4.47). We thus have:

$$TAXR_{row} = TAXPW_{nfc} \tag{4.45}$$

$$TAXPD_{nfc} = TAXP_{nfc} - TAXPW_{nfc} \tag{4.46}$$

$$\begin{aligned} TAXNR_{gvt} = (&TAXP_{hh} + TAXPD_{nfc} \\ &+ TAXP_{fc} + TAXP_{row}) + DISC\_TAX \end{aligned} \tag{4.47}$$

To compute tax payments, however, we still need to make some adjustments on the series and some further assumptions. In particular, and to simplify the model structure, we assumed that only households receive/pay for benefits/contributions. We thus define the government payments equal to benefits received by households ($PENSPAYM$) (4.48) and government receipts of social contributions equal to households benefits paid ($SOCCON$) (4.49):

$$PENSPAYM = BENR_{hh} \tag{4.48}$$

$$SOCCON = BENP_{hh} \tag{4.49}$$

Secondly, we need to compute implicit tax rates for all taxes, benefits, and contributions of our model. To do so, we compute the various tax rates as the ratio between the tax streams and the corresponding income flows. Table 4.3 illustrates the different tax rates.

We are now able to compute the different income streams related to taxes, benefits and contributions and fill the block of the behavioral Transaction Matrix accordingly. Thus, households pay direct taxes depending on the sum of their primary incomes and benefits received, non-financial business, in turn,

Table 4.3: Implicit Tax Rates

	Tax Rates	Flows
Indirect taxes	θ^{i}	indtax/gdp
EU indirect taxes	θ^{iw}	row_indtax_r/indtax
Subsidies to production	θ^{s}	subs/gdp
EU subsidies to production	θ^{sw}	row_subs_p/subs
Direct taxes		
- hh	θ^{dt}_{hh}	hh_tax_p/(hh_yp+panspaym)
- nfc	θ^{dt}_{nfc}	nfc_tax_p/nfc_ops
- fc	θ^{dt}_{fc}	fc_tax_p/fc_ops
- row	θ^{dt}_{row}	row_tax_p/wagesfrow
EU direct taxes	θ^{dtw}	row_tax_r/wages2row
Social contributions	θ^{sc}	soccon/(wages+mixy+hh_ops)
Social benefits	θ^{pens}	(penspaym/retired)/wageu

only pay direct taxes on their profits, while the foreign sector pays on the basis of the wage income received domestically. Finally, non-financial businesses pay, to EU institutions, direct taxes on the wages paid abroad, and domestically the difference between their total outlays in direct taxes (computed as for the Financial sector) and the amounts paid abroad.

$$TAXP_{hh} = \theta^{dt}_{hh} \cdot (YP_{hh} + PENSPAYM) \tag{4.50}$$

$$TAXP_{fc} = \theta^{dt}_{fc} \cdot ops_{fc} \tag{4.51}$$

$$TAXP_{row} = \theta^{d}_{row} \cdot WAGESFROW \tag{4.52}$$

$$TAXPW_{nfc} = \theta^{dtw}_{n} fc \cdot WAGES2ROW \tag{4.53}$$

$$TAXP_{nfc} = \theta^{dt}_{nfc} \cdot ops_{nfc} \tag{4.54}$$

$$TAXPD_{nfc} = TAXP_{nfc} - TAXPW_{nfc} \tag{4.55}$$

Next, we have Social Benefits & Contributions (which are mainly composed by Pensions). As previously said, these transactions only involve the households and the government sectors. Households pay contributions depending on their income from production (4.56), and receive benefits according to the number of retired people times an average ex-post benefit, linked to average wages (4.57).

More on this will be said later when introducing the Labor Market.

$$soccon = \theta^{sc} \cdot (wages + mixy + ops_{hh}) \tag{4.56}$$

$$penspaym = \theta^{pens} \cdot wageu \cdot retired \tag{4.57}$$

To close this block, we need to add the "other current transfers". However, recall first that we need to add seignorage, i.e. all interest payments to the Central Bank need to be transferred to the government accounts (4.58)and, second, that we need to net out from these transfers those related to benefits and contributions of all sectors but households. We thus have:

$$OTCP_{cb} = INTR_{cb} \tag{4.58}$$

$$OTCN_{row} = -(OTCN_{hh} + OTCN_{nfc} + OTCN_{fc} + OTCN_{gvt}) \tag{4.59}$$

Where

$$OTCN_{hh} = OTCN\_TOT_{hh} \tag{4.60}$$

$$OTCN_{nfc} = NOTCN\_TOT_{nfc} + BENR_{nfc} - BENP_{nfc} \tag{4.61}$$

$$OTCN_{fc} = OTCN\_TOT_{fc} + BENR_{fc} - BENP_{fc} \tag{4.62}$$

$$\begin{aligned} OTCN_{gvt} = {} & OTCN\_TOT_{gvt} + (BENR_{gvt} - SOCCON) \\ & - (BENP_{gvt} - PENSPAYM) \end{aligned} \tag{4.63}$$

We are now able to completely specify all transfers in current account related to taxes, benefits and social contributions. These are displayed in Table 4.4, which highlights the relative block in the Behavioral Transaction Matrix.

Table 4.4: Transaction Matrix. Italy. Taxes and Transfers

		Sectors						
		HH	NFC	FC		GVT	RoW	Tot
	Transactions			Banks	Central Bank			0
17	Sum 8-14 Primary income	(+) HH_YP	*(+) NFC_YP*	*(+) FC_YP*	*(+) CB_INT_R*	*(+) GVT_YP*	*(+) ROW_YP*	0
18	Direct Tax - received					(+) gvt_tax_r = (hh_tax_p + nfc_tax_pd + fc_tax_p + row_tax_p) + disc_tax	(+) row_tax_r = nfc_tax_pw	
19	Direct Tax - paid	(-) $hh\_tax\_p = \theta^{d}_{hh} \cdot (HH\_YP + penspaym)$	$nfc\_tax\_pd = nfc\_tax\_p - nfc\_tax\_pw = (\theta^{d}_{nfc} \cdot NFC\_OPS) - (\theta^{dw} \cdot wages2row)$	$fc\_tax\_p = \theta^{d}_{fc} \cdot FC\_OPS$			$row\_tax\_p = \theta^{d}_{row} \cdot wagesfrow$	
20	Social Benefits	(+) penspaym = hh_ben_r				(-) penspaym		0
21	Social Contributions	(-) soccon = hh_ben_p				(+) soccon		0
22	Other (net) current transfers	(+) hh_otcn	(+) nfc_otcn	(+) fc_otcn	(-) cb_otc_p	(+) gvt_otcn	(-) row_otcn	0
23	*Sum 18-22 Disposable income*	*(+) HH_YD*	*(+) NFC_YD*	*(+) FC_YD*	0	*(+) GVT_YD*	*(+) ROW_YD*	0

4.2.4 The transactions in Capital Account

The next block of the Matrix deals with the uses of disposable income, which is mainly consumption (and the variations in pension entitlements), that ends up with sectors Saving but, since we are here interested in the real-financial connections and on how to merge our sets of data with the appropriate techniques, we will jump directly to the uses of Saving. First, we have the transactions related to transfers and taxation on capital accounts and, finally, we will link investments to sector accounts. We will treat consumption in more detail in Chapter 5, when we describe the structural equations and their estimation. Thus, we begin by defining the taxes paid on capital account (line 36 in Table 3, Appendix 1). As before, we assumed that only non-financial corporations pay taxes to foreign institutions, and pay domestically the difference between their total outlays and the amounts paid abroad[6]. The government is by far the net recipient of taxes (with the RoW collecting some 30 billions out of more or less 700), which it only raises domestically. We have:

$$TRKTAX\_R_{row} = TRKTAX\_PW_{nfc} \tag{4.64}$$

$$\begin{aligned} TRKTAX\_R_{gvt} = (&TRKTAX\_P_{hh} \\ &+ TRKTAX\_PD_{nfc} + TRKTAX\_P_{fc}) \end{aligned} \tag{4.65}$$

Next we have the transfers in capital account (line 37 in Table B.2). However, it is useful to disentangle the amounts paid: a) from the RoW to the government as the total amount paid by foreigners and b) from the government to the domestic productive sectors (firms and banks)[7]. We thus have:

$$TRKO\_WG = TRKO\_P_{row} \tag{4.66}$$

$$TRKO\_GN = TRKO\_R_{nfc} \tag{4.67}$$

$$TRKO\_GF = TRKO\_R_{fc} \tag{4.68}$$

We can now compute the net transfers for all sectors as the difference between outlays and receipts:

$$NTRK_{hh} = TRKO\_R_{hh} - TRKO\_P_{hh} \tag{4.69}$$

$$NTRK_{nfc} = -TRKO\_P_{nfc} \tag{4.70}$$

[6] Thus, $NFC\_TRK\_TAX\_PD = NFC\_TRK\_TAX\_P - NFC\_TRK\_TAX\_PW$.

[7] These may prove useful as policy variables in simulations exercises.

$$NTRK_{fc} = -TRKO\_P_{fc} \tag{4.71}$$

$$\begin{aligned} NTRK_{gvt} &= (TRKO\_R_{gvt} - TRKO\_GW) \\ &- (TRKO\_P_{gvt} - TRKO\_GN - TRKO\_GF) \end{aligned} \tag{4.72}$$

$$NTRK_{row} = TRKO\_R_{row} \tag{4.73}$$

4.2.5 Investments

We have now arrived to the last block of the Matrix, which deals with investment. As usual, and as we have seen in detail in Chapter 3, in National Accounts these are split into Gross Fixed Capital Formation, variations in inventories and other acquisition of non-produced non-financial assets. We create exogenous variables for the sectoral shares of the first two components ($GFCF$ and $DINV$) accordingly to what we said in Chapter 3, Section 3.2, regarding our measures for the capital stock. We thus have:

$$GFCF_{hh} = ratio_{hh}^{gfcf} \cdot GFCF\_H \tag{4.74}$$

$$GFCF_{nfc} = ratio_{nfc}^{gfcf} \cdot (GFCF\_M + GFCF\_NR) \tag{4.75}$$

$$GFCF_{fc} = ratio_{fc}^{gfcf} \cdot (GFCF\_M + GFCF\_NR) \tag{4.76}$$

$$GFCF_{gvt} = ratio_{gvt}^{gfcf} \cdot GFCF\_G \tag{4.77}$$

$$DINV_{hh} = ratio_{hh}^{dinv} \cdot DINV \tag{4.78}$$

$$DINV_{fc} = ratio_{fc}^{dinv} \cdot DINV \tag{4.79}$$

$$DINV_{gvt} = ratio_{gvt}^{dinv} \cdot DINV \tag{4.80}$$

$$DINV_{nfc} = DINV - (DINV_{hh} + DINV_{fc} + DINV_{gvt}) \tag{4.81}$$

The resulting Net lending for all sectors, or Net Acquisition of Financial Assets (NAFA), will then be split among the different assets on the relative balance sheets, which of course imply other specular changes in some other sectors accounts. However, we will deal with portfolio choice in Chapter 5.

We can now turn finally, to one of the most promising aspects of the model we are developing, i.e. how to include the Central Bank into our analysis and how to deal with Monetary Policy, in particular with respect to the Quantitative Easing programs and how these impact the banking sector balance sheets and the functioning of credit markets. These issues will be carried out, mostly, in the next Section, leaving the discussion of the structural equations for the next Chapter.

4.3 The Central Bank

Following the description of the Central Bank Balance sheet we made in Chapter (3), Bank of Italy provides the system with the liquidity demanded, in the form of monetary base (MB), and holds, as corresponding assets, Gold ($GOLD$), the advances it makes to the banking sector through the refinancing operations (ADV), Government Bonds (B_{CB}), Foreign Liabilities (F_{CB}) and and other net financial assets ($ONFA_{CB}$).

In normal times, it is reasonable to assume that the demand for monetary base, coming from household, banks and foreign institutions, is accommodated by the Central Bank (4.83). The change in the monetary base is in turn related to changes on the asset side. In such cases, the first component would be determined by the demand for liquidity coming from households, the reserve requirement needed by banks, and that part of external imbalances which is not covered by changes in other net assets vis-à-vis the rest of the world. Indeed, this is in line with the theoretical discussions of the Central Bank monetary policy made in Godley and Lavoie (2007, Ch.10) and Lavoie (2014, Ch. 4). Moreover, this is explicitly stated by the ECB itself when claiming that, during the pre-crisis period, "base money developments in the euro area were therefore largely a reflection of changes in currency in circulation and required central bank reserves" (ECB, 2017:62).

$$MB = MB_{HH} + MB_{FC} + MB_{T2} \tag{4.82}$$

However, we are not living in normal times.

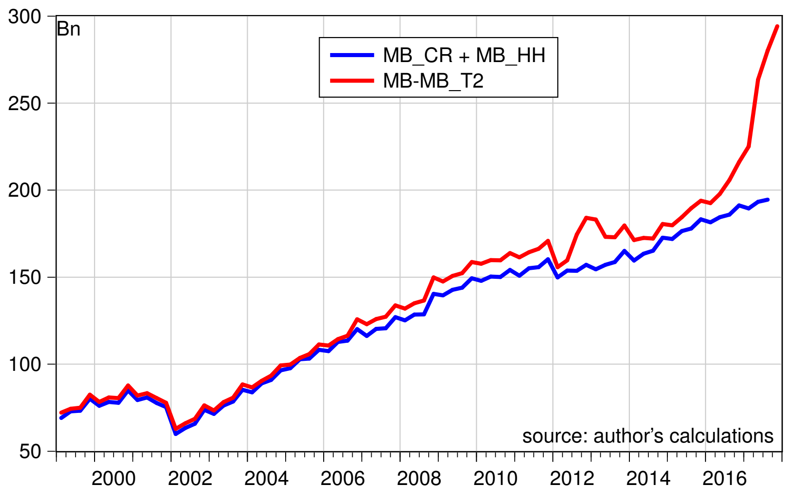
In response to the financial crisis, the Eurosystem supplied central bank reserves well above the demand for liquidity stemming from the banking sector, inducing a sizable increase in base money (and excess reserves). This mechanism was further enhanced when the PSPP was launched. In fact, when purchasing assets, the ECB supplies reserves. "Since banks are typically the only entities, apart from central government, that hold deposit accounts with the central bank, purchases are always settled through them, regardless of who the ultimate seller is. Thus, purchases conducted under the APP resulted in a mechanic, direct increase in base money" (ECB, 2017:64). This is shown in Figure 4.9, which displays, on one hand, the (demand for) Monetary Base computed as the sum of the Reserve requirements of banks and circulating money held by households and, on the other, the Monetary Base net of Target2.

Therefore, in the presence of non-conventional monetary policy, the amount of reserves in the system is determined by the decisions of the central bank instead of being demand-driven (through the net demand for credit), as endogenous money theory would imply.

There is nothing that the banks can do to reduce the amount of reserves. The only thing they can change is excess reserves, which diminish when their demand for compulsory reserves increase because of increases in deposits. The total monetary base is then fully determined by Central Banks decisions to purchase assets (open market operations, TLTRO's etc., as in exogenous money).

The rate of interest on reserves in then exogenous and set by the Central Bank, even when the demand for high-powered money (i.e. compulsory reserves plus banknotes) is not equal to the supply. This is so because, with QE, the Central Bank must operate under the floor system, so as to keep control over interest rates: i.e. the target rate and that on reserves must be equal (see Lavoie, 2010). Accordingly, if the Central bank wants to keep control over the bill rate, then the Central Bank has to buy the residual amount of bills in the system at its chosen interest rate, i.e. the rate on reserves or a mark-up on the base rate. The rate of interest on bonds, or its price, should therefore be endogenous, and affected by Central Bank decisions on QE operations.

Figure 4.9: Monetary Base and Banks Excess Reserves



Thus, the monetary base on the asset side of banks' balance sheet (MB_{FC}) is split into two components (4.83): the reserve requirement (MB_CR_{FC}), which vary with the reserve ratio to deposits ($coef^{res}$), and the share of sight deposits on total deposits ($coef^{sdeps}$, in equation 4.84), and the residual liquidity (MB_O_{FC}). Residual liquidity may be driven, on the one hand, by the demand for excess liquidity connected to financial instability, but on the other it has been the outcome of unconventional monetary policy (QE). As the ECB buys government bonds and other financial assets from banks, in exchange for liquidity, the banking sector as a whole cannot but accumulate such liquidity. We will therefore model the excess stock of monetary base as the residual in banks' portfolio adjustment[8].

$$MB_{FC} = MB\_CR_{FC} + MB\_O_{FC} \qquad (4.83)$$

[8]More on this will be said in Chapter 5

where

$$MB\_CR_{FC} = coef^{res} \cdot coef^{sdeps} \cdot DEPS \tag{4.84}$$

We have already begin to visualize in Section 3.3.2 how QE operations impacted the BoI balance sheet. In the next paragraph we will reconstruct the QE policies in detail, while we will explain how to model it accordingly using our accounting structure in Section 5.3.

4.3.1 The QE Programs

From the Great Recession onward, world Central Banks started adopting non-standard measures to counteract the ongoing effects of the financial crisis. The ECB, which is the EU institution in charge of Monetary Policy operations, together with the SECB, has implemented several programs to provide liquidity, refinance the banking system and purchase public and private assets.

On the European side, the ECB adopted three main Non-standard monetary policy measures, utilizing a wide array of financial instruments and operations:

- Long Term Refinancing Operations (LTRO) - In recent years, the regular operations have been complemented by two liquidity-providing long-term refinancing operations in euro with a three-year maturity (maturing on 29 January 2015 and on 26 February 2015), as well as by US dollar liquidity-providing operations;
- Targeted Long Term Refinancing Operations (TLTRO) - These are Eurosystem operations that provide financing to credit institutions for periods of up to four years. They offer long-term funding at attractive conditions to banks in order to further ease private sector credit conditions and stimulate bank lending to the real economy;
- Asset Purchase Program (APP) - In addition and since 2009, several programs of outright asset purchases have been implemented with the objective of sustaining growth across the euro area and in consistency with the aim of achieving inflation rates below, but close to, 2% over the medium term.

These are summarized in Table 4.3.1.

Additional information on the ECB and SECB monetary policy can be found in the Annual Relation of the National Central Bank Governor[9]. To track the evolution of the QE program, thus, we reconstructed the ECB policies directly, using the information found in the BoI Annual Relations (from 2008 to present) and combining them with the data sources of our model.

[9]For the Bank of Italy, the complete documentation can be downloaded from `https://www.bancaditalia.it/pubblicazioni/relazione-annuale/`.

Table 4.5: The ECB Monetary Policy

Program			Started	Ended	EUR billions
LTRO			Dec. 22, 2011	Jan. 29, 2015	480
			Mar. 1, 2012	Feb. 26, 2015	530
TLTRO	TLTRO1		Sept. 2014	Sept. 2018	
	TLTRO2		June 2016	Mar. 2017	
APP	CSPP		June 2016	ongoing	140
	PSPP		Mar. 2015	ongoing	1900
	ABSPP		Nov. 2014	ongoing	25
	CBPP	1	July 2009	June 2010	60
		2	Nov. 2011	Oct. 2012	16
		3	Oct. 2014	ongoing	240

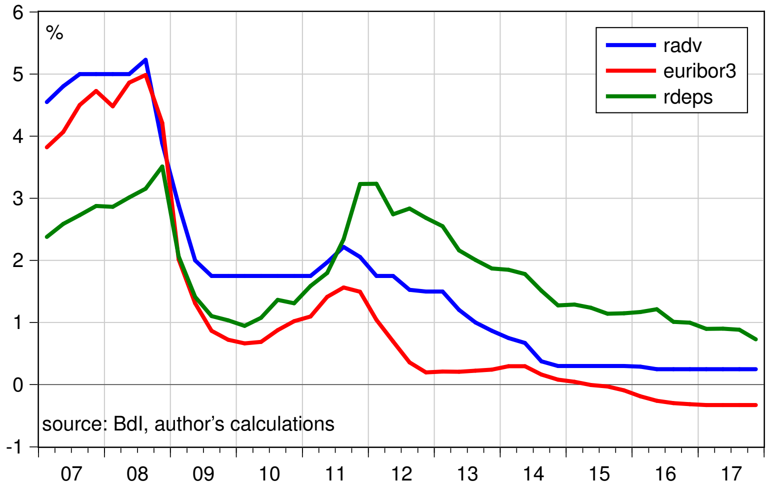
QE Phase 1: 2008-2014q4

Contrary to the FED, BoJ and BoE, the ECB kept the base interest rate at 4% up to mid-2008. At the onset of the Crisis, the ECB rose the MRO rate by 25 basis points up to 4.25% "to contrast the risks of *rising inflation expectations* from a level coherent with price stability" (BoI, 2009:63). Then the Crisis hit. The augmented volatility on multiple financial markets determined a rapid deterioration of liquidity on the inter-bank market, destabilized even more the Global financial system. Between October 2008 and may 2009, in a concerted maneuver with other world major Central Banks, the ECB decreased the base interest rate down to 1%, "*the lowest level ever attained*" (BoI, *ibid.*:64) and started extraordinary bank refinancing operations to pump the flow of credit in the economy. In June 2009 the ECB launched the first (but not last!) Covered Bond Purchase Program, aimed at sustaining banks liquidity. However, the program ended in June 2010, when it reached a nominal amount of 60bn(!!) euros for the whole Eurosystem. In any case, the consolidated balance-sheets of the national Central Banks expanded by 60% during 2008, due to the increased refinancing operations carried out. Between the end of 2009 and the start of 2010, along with the growing rumors about the state of Greece public finances, the tensions on financial markets exacerbated and, by the end of April, the contagion towards other EZ sovereigns started. "Some market segments ceased to operate correctly: liquidity dried up, transactions fell and the bid-ask spreads reached unprecedented levels" (BoI, 2010:74). On May 3 2010, after the Troika (ECB-IMF-UE Commission) and the Greek Government signed the first Agreement, the ECB suspended the minimum rating requirement for Greek Sovereigns.

On May 10 the ECB started the first of a series of liquidity-providing operations through the purchase of Securities, both private and public. The central banks of the Eurosystem started purchasing securities in the context of the Securities Markets Program (SMP), aimed at containing the severe tensions in certain market segments which were thought of being plunging the monetary policy transmission mechanisms. The numbers of the programs, however, were more or less null compared with the deleveraging processes happening in the European financial sector. Most important, the program was meant to have no effect on the Monetary Base, through liquidity-absorbing operations.

Through all 2010, the ECB continued to keep very accommodating monetary conditions in the context of a depressed economic activity well below its potential, low actual and expected inflation and severe tensions in sovereign debt markets. The main refinancing rate has been kept at 1% throughout, while real short-term rates reached negative territory. Despite its efforts, the tensions on Sovereigns erupted by the start of 2011. The European Council decided to increase the lending capacity of the newly issued European Financial Stability Facility (EFSF) and created the European Stability Mechanism, which will act as the *vade mecum* of the Austerity programs put forward in the so-called peripheral countries of the Eurozone in subsequent years. [It is worth stressing that if only the EU Council had decided to "save" Greece in 2010, the costs for the Eurosystem would have been much lower, not to mention the social and welfare costs.] Finally, in contrast to all other Central Banks, by the end of 2010 the ECB *raised* the base interest rate by 50 basis points, to overcome possible inflation pressures coming from rising commodity prices.

Figure 4.10: ECB refinancing rate, Euribor and Banks rate on deposits



New tensions emerged in March, reflecting fears of a negative spiral fueled by lower growth rates, worsened fiscal conditions in some member countries and restrictions in their banking systems. The situation exploded during the summer, due to the uncertainty related to the Greek elections and the stability of the Eurozone itself, when concerns about the stability of the Greek Debt extended to Italian and Spanish Securities. In August, the (newly formed) Italian and Spanish Governments announced new Austerity measures aimed at consolidating their fiscal stances.

In November 2011 the ECB launched the second Covered Bond Purchase

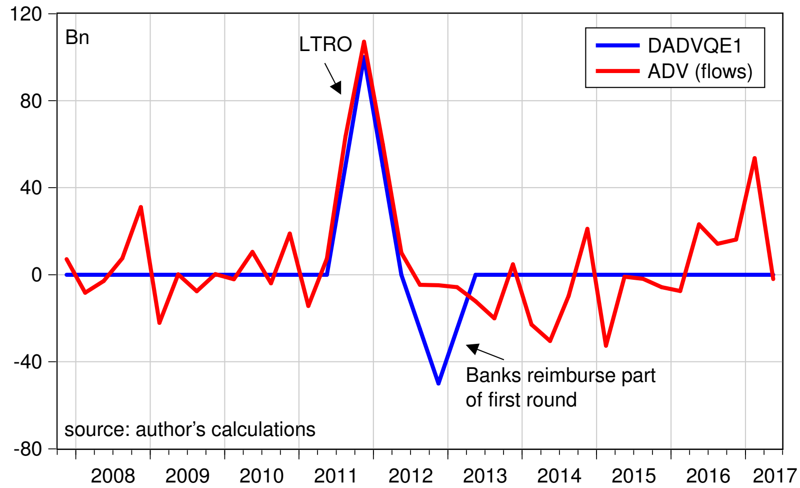
Program (CBPP2, for a nominal amount of 40 Billion), reactivated the SMP (albeit, again, on a very small scale) and continued to extend the refinancing operations and to lower the collateral requirements to enter its programs. By the end of the month, however, the climate in financial markets worsened significantly. The heterogeneous monetary conditions in the euro area countries increased: the intensification of capital outflows from the countries most affected by the crisis and a clearer market segmentation along national borders increased the risks of a systemic banking crisis, which would have led to a strong restriction of credit, with serious consequences for the macroeconomic framework.

Given the worsened financial conditions, in December 2011 the ECB Board decided to cut the base rate by 50 basis points, reducing it back to 1% and lowered the minimum reserve requirements from 2 to 1%. This created an increase in free reserves of some 100 Billion, of which 12 Billion pertaining to the BoI. It also launched the first two rounds of a three Long Term Refinancing Operation (LTRO) program. In the first three-year operation (December 2011) the Eurosystem provided 490 Billion of liquidity (of which 116 pertained the BoI) while the second one (February 2012) allotted over 530 Billion (of which 139 Billion related to BoI transactions), injecting over 1.000 Billion euros that directly reached an high number of banks. From December 2011 to June 2012 the Italian Government decided to grant the State guarantee on newly issued bank liabilities, which contributed to increase the volume of Italian counterparts in monetary policy operations, in line (albeit on a much lower scale) with other member countries Government interventions. By April, the Banks issued liabilities amounted to 87 Billion euros[10].

We thus created an exogenous variable that keeps track of the first two rounds of the TLTRO programs, i.e. the first injection and the reimbursement by banks, displayed in Figure 4.11 against the flows of advances.

[10]It is worth mentioning that the Italian Government intervention was small compared to the ones put in place in Germany and France, which amounted to over 500 Billion euro.

Figure 4.11: QE 1: Refinancing Operations



These measures contributed to avert the risks of a systemic crisis. "Together with the measures taken in several member countries to stabilize their fiscal stances and enhance pro-growth policies - *among which the ones adopted by the Italian government are worth noting* - the progresses in European governance and the agreement on the restructuring of Greek debt, monetary interventions helped raise the confidence of intermediaries and revive exchanges" (BoI, 2012:68, emphasis added).

In aggregate, the liquidity introduced into the system necessarily translated into an equal increase of the banking funds held at the ECB. It is worth mentioning that, as reported by BoI (BoI, 2014), most of these funds have not been deposited by the intermediaries that received them, meaning that this liquidity has not been idle in Banks balance-sheets but has in contrast been circulating[11] The increase in liquidity provided to peripheral countries banks mirrored the decrease in financial flows going to the core, which was reflected in the widening of the Target2 balances. The Eurosystem refinancing operations for peripheral banks counterbalanced the net private capital outflows in those countries. In the CAB, the debit position towards the RoW of the domestic Private and Public sectors became that of the BoI, whose net debt position rose up to almost 300 Billion by mid-2012. By May 2012, however, more than half of the first three year LTRO refinancing operations were already reimbursed, 80 Billion of which pertaining to the BoI (over some 250 of total payouts).

Nevertheless, during the summer the tension on sovereign erupted again, with spreads reaching their historical maximum (over the institution of the EMU). The situation only recovered after Draghi's famous "*whatever it takes*"

[11]Most of these funds have indeed been used, for example, to reduce the debit position of peripheral banks *vis-a-vis* German and French banks who were highly exposed in some peripheral markets (especially in Spain, Portugal and Greece).

Figure 4.12: Spread between 10-yr Italian Bonds and German Bunds

on 26 July 2012. However, it was not until the end of 2013 that the ECB decided to put in in place some other extra-ordinary measures, in the face of a growing deflation fears and stagnant, if not depressed, economic activity across all the Eurozone.

QE Phase 2: 2014q1 - present

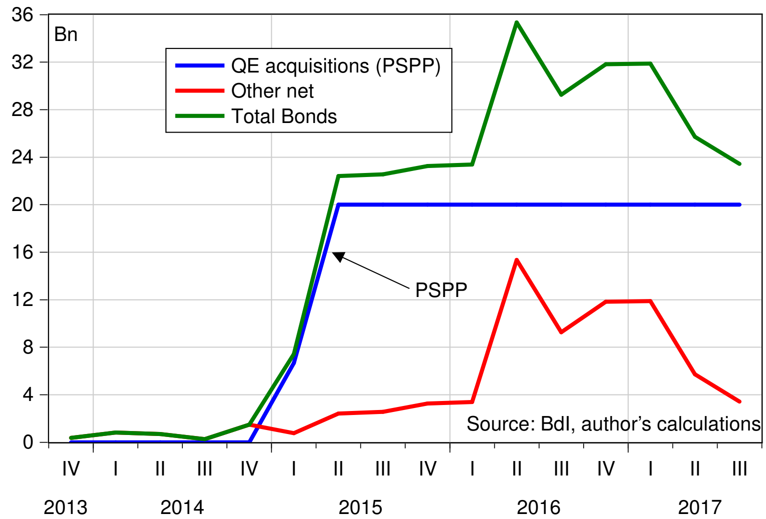
Facing the real possibility of the contagion of a debt-deflation spiral throughout the Area, and the exceptionally low levels achieved by inflation, both effective and expected, in January 2014 ECB announced to lower official rates down to 0.3% at an unprecedented level, moreover, it started to implement new longer-term refinancing operations to stimulate the offer of credit and extended the APP to private securities.

Moreover, the Board considered the monetary stimulus to be still insufficient and decided to extend the APP programs to Government Securities (PSPP). The PSPP program, which started in March 2015, "expects interventions of 60bn per month at least until the end of September 2016, and in any case until any lasting inflation adjustment consistent with the objective of price stability" (BoI, 2014:34). At its launch, the PSPP program, which together with the LTRO operations has been by far the major instrument in terms of volumes, was intended to buy Italian Securities for a total amount of 150 Billion, of which 130 directly purchased by the BoI. By April 2016, the total purchases in the APP program amounted to 918 Billion (19 Billion of ABS, 172 Billion of Corporate Covered Bonds and 727 Billion of Government Securities, of which 118 Billion of Italian Bonds[12]). To disentangle the acquisition related to QE interventions

[12] 108 Billion were directly purchased by the BoI.

from normal purchases, we created a variable (DADVQE2), which tracks the net purchases of the PSPP program. These are displayed in Figure 4.13.

Figure 4.13: QE 2: the Asset Purchase Program. Flows

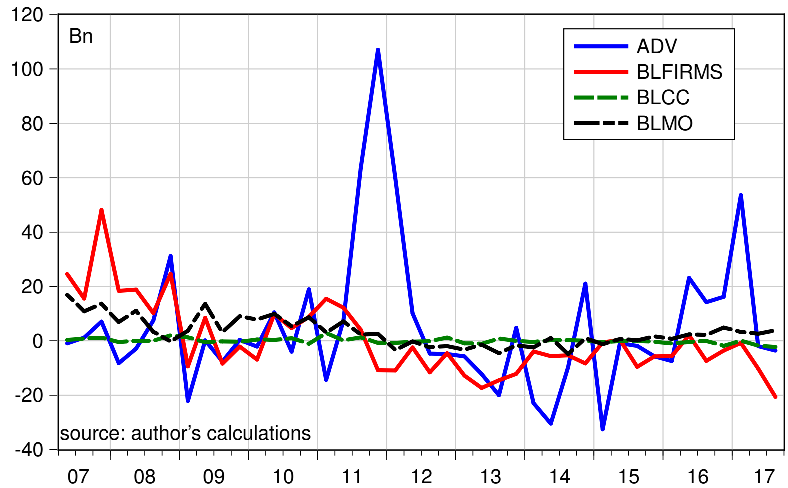


Despite all the efforts and the exceptional instruments utilized by the monetary authorities, during the summer of 2015 the financial conditions in the Area worsened, fueled by the uncertainty related to the negotiations between the Greek Government and its creditors on one side, and the slowdown of growth rates in emerging economies. In October, the Board reiterated its determination to use all available instruments, including the possibility to vary the size, composition and duration of the APP, if thought to be necessary. This was indeed the case. In March the BCE announced a new set of expansionary measures: starting from April, it would have raised the purchases under the PSPP to 80 Billion per month; the main rate and the marginal refinancing rate were both cut again to 0.0 and 0.25%, while that on the deposit facility reached negative territory at -0.4%; it finally introduced, starting from June 2016, a new set of Targeted Long Term Refinancing Operations (TLTRO2).

In this new round of refinancing operations, the ECB allowed counterparts to be entitled to "an initial TLTRO borrowing allowance (initial allowance) equal to 7% of the total amount of their loans to the euro area non-financial private sector, excluding loans to households for house purchase, outstanding on 30 April 2014. In two successive TLTROs to be conducted in September and December 2014, counterparts will be able to borrow an amount that cumulatively does not exceed this initial allowance" (ECB Press Release, June 2014[13]). Moreover, between March 2015 and June 2016 all counterparts were able to borrow additional amounts in a series of TLTROs conducted quarterly.

[13] `https://www.ecb.europa.eu/press/pr/date/2014/html/pr140605_2.en.html`.

Figure 4.14: Effects of QE on Credit Markets



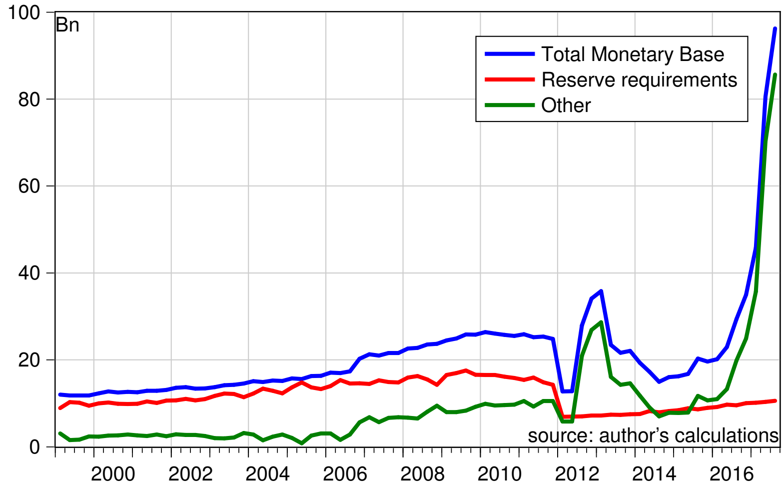
In the last part of 2016 there was a moderate acceleration in economic activity in some member countries, inflation rose slightly due to the pressures coming from rising commodity prices. The CPI's, however, did not moved as much, due to the poor performance of wages through the Area. In December 2016, the ECB Board extended the APP program for, at least, another year. Until present, for the APP the Eurosystem purchased securities for over 1800bn (1500 of Government Securities, of which 230 purchased by the BoI). The average residual life of the PSPP portfolio is now around 8 and-a-half years. Finally, the liquidity held at the ECB in excess of the reserve requirements increased, mainly due to the APP purchases and TLTRO2, reaching 1600bn by May 2016.

However, it is quite fascinating to see how, despite all the efforts of both the ECB and the Academic views behind it, monetary policy has not affected the economy as expected, with inflation anchored at very low levels throughout the eurozone and only timid increases in growth rates. In the plans of the ECB[14], the QE should have been working as follows:

1) ECB buys Bonds from Banks → 2) this increases the prices of these Bonds and creates money in the banking system → 3) as a consequence, interest rates fall so that loans become cheaper → 4) Firms and household are now able to borrow more and spend less to repay their debts → 5) which results in boosting consumption and investments → 6) higher consumption and growing investments support growth and job creation → 7) all this translates into a rise in inflation over the medium-term towards the ECB target inflation rate "below, but close to, 2%".

[14] https://www.ecb.europa.eu/explainers/show-me/html/app_infographic.en.html.

Figure 4.15: Effects of QE on FC Monetary Base



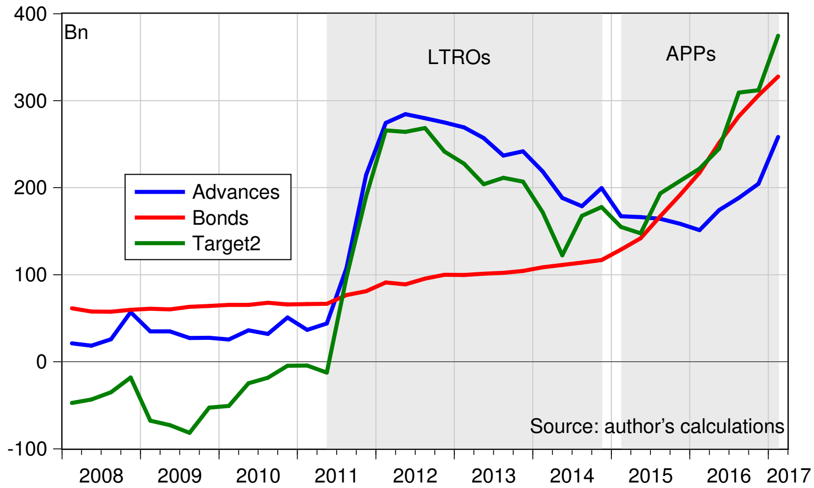
What in fact happened, as we have seen already here and in Chapter 3, and will see in much greater detail in Chapter 5 and 6 when dealing with model closures, estimations and simulations, was that the mechanism stopped at the second step, when banks increased exponentially their stocks of deposits at the ECB while credit plunged. This is shown in Figure 4.14 and 4.15, which displays the flows of credit and that of advances to the banking sector, and the monetary base held by banks, split between its two components (reserve requirement and excess reserves). The transmission mechanism between the QE operations and credit markets is thus worth further exploration. Moreover, as we detailed in Chapter 3, the QE has affected the Target2 balances, as displayed in Figure 4.16. In the first phase of QE, the ECB launched the Long Term Refinancing Operations, which provided advances to banks in exchange of financial instruments. The *indirect* effect in this case was from ADV to Target2 through inter-bank settlements, usually with foreign banks operating with their branches or subsidiaries in countries with access to Target (as detailed by Bank of Italy). In the second phase, in contrast, when the ECB launched the Asset Purchase Program, and especially when it started to buy government bonds, the effect was *direct*, going from CB purchases of bonds from financial actors which were not necessarily domestic. We will describe the portfolio behavior of the Central Bank in Section 5.3.

4.4 Introducing the labor market

The treatment of the labor market is rather rudimentary at this stage.

Population (POP) is projected exogenously, and the share of working-age population is obtained through exogenous parameters, identifying those below

Figure 4.16: Effects of QE on Target2



working age ($pop014$, (4.85)) and retired people ($retired$, (4.86)). Retired people are estimated from the difference between the population above 64, and those above 64 who are reported as employed or unemployed.

The size of the labor force (LF, 4.87) is given by an exogenous participation rate. Our attempts to model the participation rate as a function of the state of the business cycle, or other labor market indicators, has not been successful yet. The participation rate has been increasing over time since the 1980s, from around 58 percent to the current 66 percent, but the increase in the employment rate has not been as substantial.

Employment (EMP, (4.88)) is determined from a simple relation to real GDP, through average labor productivity. Again, we plan to relate productivity to its main determinants in future model revisions. Unemployment ($UNEMP$, (4.90)) is thus a residual, and the unemployment rate (ur, (4.91)) follows. We also compute the U6 measure of unemployment ($ur6$, (4.92)) by considering those marginally attached to the labor force (lfp), and those working part-time for economic reasons ($npti$). However, these two categories are left exogenous at this stage, so that changes in employment have the same effect on the traditional unemployment rate (ur) and the extended unemployment rate ($ur6$).

The level of employment, together with the average wage ($wageu$), determines the wage bill (WB, (4.93)). The average wage, finally, is estimated as a function of domestic and foreign prices (through the imports deflator), and the past unemployment rate (4.94). Two dummies for the third quarter of 2003, and the fourth quarter of 2005, are introduced to consider two outliers (upward jumps in wages). The long-run elasticity of nominal wages to prices is one, while import prices do not seem to have a long-run impact. An increase in the unemployment rate is found to have an impact on the level of wages (rather than on wage inflation, as in the Phillips curve). More on this will be said in Section 5.4.

$$pop014 = par_{ypop} \cdot POP \tag{4.85}$$

$$retired = par_{retired} \cdot POP \tag{4.86}$$

$$LF = partrate \cdot (POP - pop014 - retired) \tag{4.87}$$

$$EMP = GDPK/prod \tag{4.88}$$

$$prod = f(GDPK, DUMEURO, servshare, XGSK/GDPK) \tag{4.89}$$

$$UNEMP = LF - EMP \tag{4.90}$$

$$ur = UNEMP/LF \tag{4.91}$$

$$ur6 = \frac{(UNEMP + lfp + npti)}{(LF + lfp)} \tag{4.92}$$

$$WB = wageu \cdot EMP \tag{4.93}$$

$$wageu = f(pfoi, pmgs, ur) \tag{4.94}$$

4.5 Conclusions

In this Second Part of the Thesis we have made the first steps toward the construction of an applied SFC model for the Italian economy.

In Chapter 3, after a snapshot on Italy's economic performance in the last 30 years, we presented the main data which need to be used to properly build a *sound* accounting structure. These are made up, mainly, by ISTAT Non-Financial Accounts, which detail the sources and uses of incomes for the different institutional sectors, and the Financial Accounts from Bank of Italy, which deal with the Financial side of the economy, describing the balance sheets composition (both stocks and flows) and relations. From this (and other) data sources, we have constructed the Transaction and Balance sheet Matrices for our model.

In Chapter 4, in turn, we have showed how to merge the two sets of data we have. We started from the Real-Financial interactions of the model, computing Net Capital Gains for all our assets, and used these to connect our variables regarding Net Financial Assets from FAIS to the Net Lending from NFA. We then turned back to the "real" side of our model, in Section 4.2, where we linked our Assets in the Balance Sheets to the respective income flows in the Transaction Matrix, replacing all the respective entries relative to capital income flows. Then, we explained how to introduce the Central Bank sector into the model, and make a short digression to explain the different phases of the Quantitative Easing programs carried out by the ECB and SECB. Finally, we introduced, in Section 4.4, all other variables relevant to our model, in particular those regarding the Labor Market.

However, even though we already have a complete accounting structure which, as we said, already sheds some light on various aspects and dynamics of the Italian economy, the model is still *incomplete*. To close the model, we need indeed to define the sectors behavior with respect to their demand for assets and liabilities, consumption, investments and so on. This will be done in Chapter 5. Finally, before starting with policy simulations on our model, we will have to make a number of assumptions regarding the behavior of the exogenous variables to construct the Baseline, which we will do in Chapter 6.

Part III

Applications

Chapter 5

A SFC quarterly Model of the Italian Economy

Macroeconomists and political officers need rigorous, albeit *realistic*, quantitative models to forecast the future paths and dynamics of some variables of interest while being able to evaluate the effects of alternative scenarios. In particular, research centers, government agencies, banks, unions etc. make use of econometric models tailored at answering the different questions relative to their focus of interest. However, at the heart of all these models lies a more or less standard macroeconomic module which, depending on the degree of sophistication and the research questions to answer, represents *how* the economy works.

After the stagflation of the 80's, "structural" models were relatively abandoned in favor of the DSGE types in most Central Banks (see Hendry and Muellbauer, (2018)). Since then, however, it is quite unquestionable, that the models in use in policy-making agencies (more or less everywhere in the developed world) have failed to detect the two last recessions. The complete absence of a realistic monetary framework along with the abstraction of banks and more generally of real-financial interactions in DSGE models made it impossible to detect the uprising financial fragility that led to the Great Recession.

The SFC methodology, as we detailed in Chapter 2 is rooted in the "structural" tradition (see Fair, 2012), as Godley was himself the chief economist conducting maroeconomic forecasts for the UK Treasury in the 60s. These were medium-to-large scale macroeconometric models, generally of a "pragmatic" Keynesian flavor, where Flow of Funds and "real" analysis were combined.

In this Chapter, we will show how to address the missing links between the real and the financial sector in mainstream models and how to address all the research questions we need within a post-Keynesian SFC framework (in the spirit of Godley and Lavoie, 2007), describing our quarterly SFC structural model for the Italian economy, based on the data and sources presented in Chapter 3 and the accounting structure developed in Chapter 4.

First, after a brief review of the existing models for the Italian economy, in

Section 5.2 we will set up the accounting structure of the sectoral transactions describing our *Real Economy*, i.e the *Behavioral Transaction Matrix*. Then, in Section 5.3 we will "close" all sectoral financial accounts, describing the portfolio choices and defining the buffer stocks for each class of assets and for each sector. In this way, we will end up with a complete system comprising both real and financial relations and transactions. Finally, in Section 5.4 we will describe our estimation strategy and present the main stochastic equations of the model. We will close the Chapter with a brief overview of the main channels of transmissions in the model (i.e. interest rates and monetary policy, production, trade and productivity etc).

5.1 Structural models for the Italian economy

In this Section we will give a brief overview of the major models currently in use for the analysis of the Italian economy.

Originally developed in the mid-eighties by a team from the Research Department of Bank of Italy led by Albert Ando (1986), the Bank of Italy Quarterly Model (BIQM), which is continuously updated and evolves to capture the new features (i.e. changed institutional frameworks, policy rules, expectation formation mechanisms etc.) of the system and data sources, is still the main running tool of the Bank for medium-term policy analysis.

As most Central Banks macroeconometric models, the BIQM[1] is (New) Keynesian in the short-run, with the level of economic activity primarily determined by the behavior of aggregate demand, and neo-classical in the long-run, akin to Solow's model of exogenous growth. Thus, while in a steady-state growth path the dynamics of the model stem solely from capital accumulation, productivity growth, foreign demand, inflation and demographics, in the short-run, in turn, there are a number of additional features(i.e. stickiness of prices and wages, the putty-clay nature of the production process, inflation surprises etc.). The model, which makes large use of survey data pertaining to expectation formation, is made up of some 900 equations of which some 100 are stochastic and estimated by means of limited information techniques, primarily OLS.

To close with Central Banks models, we find the Italian block of the ECB multi-country model (E. Angelini, 2006). The Italian MCM, being part of the bigger Area-Wide Model, follows closely the specifications and accounting structures of the AWM and of other MCM blocks. It is a quarterly estimated structural macro-model that treats the economy as *relatively* closed. As for the BIQM, it is demand-led in the short-run, but fully supply-led in the long-run, with a vertical Phillips curve and employment converging to the exogenously given NAIRU. Stock-flow adjustments are (limited) accounted for by the interactions between the stock of capital and the level of output and investment, and the impact of (an exogenous) financial wealth on consumption. The model has

[1]A detailed description of the theoretical underpinnings of the BIQM is in Banca d'Italia (1986). Another useful description of the main features of the model can be found in Galli et al. (1989)

some 130 equations of which some 20 structural equations estimated by means of cointegration analysis.

There are then a number of public sector-run models within research departments and Institutions. First, there is the Italian Treasury Econometric Model (ITEM), developed by the Treasury Department of the Ministry of Economics and Finance. It is a structural medium-size model consisting of some 300 variables, 250 equations/accounting identities of which some 30 are behavioral equations. It is estimated over quarterly National Accounts data and it is used for projections and evaluations of domestic economic policies and changes in external/exogenous variables. As for its CB counterparts, also the ITEM belongs to the class of macroeconomic models that assign a prominent role to the supply side of the economy, with frictions in wages and price settings only (relatively) affecting demand in the short-run. Secondly, there is the MeMo-It model developed by ISTAT (2013; 2013). This model, which is one of the three main tool used by ISTAT for its economic projections, makes use of global economic indicators and micro-simulation models, together with current domestic economic indicators to forecast short-run scenarios for the main aggregates of the National Accounts. While it is relatively simple in terms of real-financial connections, it is worth noting the recent efforts to include an Environment block in the model structure.

Finally, there are a number of models run by think-thanks, such as the CSC model by Confindustria, the Italian employers' federation (Pappalardo et al., 2007); the PROMETEIA model by the privately-run research center Prometeia (Welfe 2013, Section 8.7.1) and the annual model developed by A/simmetrie (Bagnai and Ospina, 2014).

This is not the place to go into a deeper theoretical analysis on which much has already been written. A couple of remarks, that pertains to *all* models cited above, are anyway needed. "In equilibrium, [...] the BIQM describes a *full employment* economy, in which output, employment and the capital stock are consistent with an *aggregate production function*, relative prices are constant and inflation equals the exogenous rate of growth of foreign prices. *Money is neutral*, though not super-neutral, and the model is stable." (Busetti et al. (2005), emphasis added). First, post-Keynesian models, as previously said, do not assume full employment and are demand-led also in the long-run; second, a large empirical literature has longly argued against the use of aggregate production functions (see Shaikh 2015 and Lavoie 2014 for a detailed reconstruction); finally, we already argued against the non-neutrality of money in Chapter 1 and 3 and, moreover, it is quite striking how, especially in Central Banks, the endogeneity of money is explicitly discussed in numerous policy briefs and monetary policy bulletins but, when it comes to modelling choices, *monetarism* re-enters from the backdoor. With respect to the Italian MCM, again, it is worth stressing that post-Keynesians refuse even the *existence* of a NAIRU[2], and much has been written against the empirical underpinnings of the Neo-Classical Phillips curve (see Shaikh 2016 for a detailed survey). Moreover, all the models here

[2]see Stockhammer (2008) for a detailed critique and Stockhammer, Guschanski and Kohler (2014) for a post-Keynesian alternative.

are not *fully* SFC from our perspective. First, in most of the cases wealth only impacts the *long-run* behavior of consumption. Secondly, households are assumed to hold all financial assets in the system (which we stress, again, *are not relevant in the short-run*) and debit-credit streams are not precisely modeled. Moreover, the feedback effects of stocks on flows are not precisely addressed, as well as the overall effects on portfolio behavior and financial stability.

In the next two sections we will show how to deal with all the problems highlighted above within the SFC framework we have built.

5.2 The Real economy

In this Section we will describe, sector by sector, all accounting identities and behavioral equations[3] of the model that we have built, block by block, in Chapter 4.

Households Households collect their income from production (HH.01) which is the sum of domestic salaries (*wages*), mixed income ($MIXY$) and operating surplus (ops_{hh}). Following the description made in Section 4.2.1, *wages* and $MIXY$ are given by the production account (HH.02, HH.03 and HH.04), while the amount of profits accruing to households are given by an exogenous share (HH.05):

$$INCP_{hh} = WAGES + MIXY + OPS_{hh} \tag{HH.01}$$

$$WB = WAGEU \cdot EMP \tag{HH.02}$$

$$WAGES = WB + WAGESFROW - WAGES2ROW \tag{HH.03}$$

$$MIXY = ratio^{mixy} \cdot GDP \tag{HH.04}$$

$$OPS_{hh} = \pi_{hh} \cdot OPS \tag{HH.05}$$

We add the transaction in capital incomes, defined in Section 4.2.2, to incomes from production, so to get to households disposable income (HH.06). We report here the equations, while we refer the reader to the mentioned section for the descriptive details. Thus:

[3] A detailed description of stochastic equations will be given in Section 5.4.

$$YP_{hh} = INCP_{hh} + (INTR_{hh} + DIVR_{hh} + KYNET_{hh}) - (INTP_{hh} + RENTLN_{hh}) \tag{HH.06}$$

$$INTR_{hh} = (r_t^{deps} \cdot DEPS_{HH,t-1} + r_t^{b} \cdot B_{HH,t-1} + r_t^{bb} \cdot BB_{hh,t-1} + r_t^{f} \cdot F_{hh,t-1}) - DISC\_INTR_{hh} \tag{HH.07}$$

$$DIVR_{hh} = (r_t^{en} \cdot EN_{hh,t-1} + r_t^{eb} \cdot EB_{hh,t-1}) + DISC\_DIVR_{hh} \tag{HH.08}$$

$$KYNET_{hh} = KINCO\_R_{hh} \tag{HH.09}$$

$$INTP_{hh} = (r_t^{blcc} \cdot BLCC_{t-1} + r_t^{blmo} \cdot BLMO_{t-1}) - DISC\_INTP_{hh} \tag{HH.10}$$

$$RENTLN_{hh} = RENTLN_{gvt} - RENTLN_{nfc} \tag{HH.11}$$

We now need to add the transactions related to Taxes, Benefits & Social contributions, defined in Section 4.2.3, that, added to primary income, results in the disposable income of the household sector (HH.12). Thus, households receive pension payments by the government according to the number of retired people[4] times an average ex-post benefit, linked to average wages (HH.13), and other current net transfers from other sectors (NFC.11). Moreover, they pay out direct taxes on their primary income plus the pensions received (HH.15), and contributions depending on their income from production (HH.16).

$$YD_{hh} = YP_{hh} + (PENSPAYM + OTCN_{hh}) - (TAXP_{hh} + SOCCON) \tag{HH.12}$$

$$PENSPAYM = \theta^{pens} \cdot WAGEU \cdot RETIRED \tag{HH.13}$$

$$OTCN_{hh} = OTCN\_TOT_{hh} \tag{HH.14}$$

[4] Which, at this stage of model development, is determined as an exogenous share in total population.

$$TAXP_{hh} = \theta^{d}_{hh} \cdot (YP_{hh} + PENSPAYM) \tag{HH.15}$$

$$SOCCON = \theta^{sc} \cdot (WAGES + MIXY + OPS_{hh}) \tag{HH.16}$$

Households savings (SAV_{hh}), in turn, are the result of what is left of disposable income after consumption and the revaluations in pension entitlements (HH.17). The variations in pension entitlements are completely determined by the payments of the other productive sectors (HH.18). Finally, households final consumption (HH.19) (as obtained from the Sectoral Accounts) is given by consumption from NIPA and a discrepancy.

$$SAV_{hh} = YD_{hh} + PENSR_{hh} - CONSF \tag{HH.17}$$

$$PENSR_{hh} = PENSR_{nfc} + PENSR_{fc} \tag{HH.18}$$

$$CONSF = cons + DISC\_CONS \tag{HH.19}$$

The exact functional form of the Consumption function will be given in Section 5.4[5]. Following Godley and Lavoie (2007) and the common practice in the SFC literature, we use a common functional form where, in the long-run, consumption depends on disposable income and net wealth (including dwellings) (HH.20)[6]. In the short-run, in turn, the rate of growth of consumption depends positively on current disposable income YD_{hh} and changes in domestic share prices sp^{it} and negatively on the interest rate on short-term loans to households r^{blcc} (HH.21).

$$cons\_ce = f(YD_{hh,t-1}/p^{cons}, NW_{hh,t-1}/p^{cons}) \tag{HH.20}$$

where $NW_{hh}/p^{cons} = NFA_{hh}/p^{cons} + KHK$

$$cons = f(cons\_ce, YD_{hh}/p^{cons}, sp^{it}, r^{blcc}) \tag{HH.21}$$

[5] We will use here lowercase labels for Constant prices variables and capital letters for variables in nominal amounts. See 5.4 for the full description of Prices and Deflators.

[6] Notice that, first, we abstract from expectations formations and, secondly, that in this specification we do include liquid and illiquid assets into Net Wealth, even though there is rising awareness about the implications that this treatment of wealth may have on estimations (see Muellbauer, 2016). More on this will be said in Section 5.4.

Finally, the net lending position ($NETLEND_{hh}$ in HH.22) of the household sector is obtained by adding (subtracting) the transactions related to taxes and transfers on capital accounts (TRK_TAX and TRK_O), and subtracting investments in real assets, which are split between Gross Fixed Capital formation ($GFCF_{hh}$), changes in inventories ($DINV_{hh}$) and the acquisitions of non-produced non-financial assets ($OTHDNA_{hh}$). Following the discussion made in Section 4.2.5, households investment in dwellings and in inventories depends on exogenous shares in total housing investments (HH.23) and total changes in inventories (HH.24), respectively.

$$NETLEND_{hh} = SAV_{hh} + (TRK\_OR_{hh} - TRK\_TAXP_{hh} - TRK\_OP_{hh}) - GFCF_{hh} - DINV_{hh} - OTHDNA_{hh} \tag{HH.22}$$

$$GFCF_{hh} = ratio_{hh}^{gfcf} + gfcf_h \tag{HH.23}$$

$$DINV_{hh} = ratio_{hh}^{dinv} + dinv \tag{HH.24}$$

$$NETLENDF_{hh} = NETLEND_{hh} + DISC\_NETLEND_{hh} \tag{HH.25}$$

The portfolio behavior, in turn, will be discussed in Section 5.3.

Non-financial Corporations Recall from Chapter 3 that Non-financial Corporations profits are determined residually from total profits generated in production (NFC.01).

$$OPS_{nfc} = OPS - (OPS_{hh} + OPS_{fc} + OPS_{gvt}) \tag{NFC.01}$$

Firms primary income, as before, is given by adding (and subtracting) to the profits originated in production (ops_{nfc}) the incomes from capital described in 4.2.2.

$$\begin{aligned} YP_{nfc} = {} & OPS_{nfc} + (INTR_{nfc} + FDIY_{nfc} + KYNET_{nfc}) \\ & - (INTP_{nfc} + DIVP_{nfc} + FDIY_{row} + RENTLN_{nfc}) \end{aligned} \tag{NFC.02}$$

$$\begin{aligned} INTR_{nfc} = {} & (r_t^{deps} \cdot DEPS_{nfc,t-1} \\ & + r_t^b \cdot B_{nfc,t-1}) - DISC\_INTR_{nfc} \end{aligned} \tag{NFC.03}$$

$$FDIY_{nfc} = r_t^{fdio} \cdot FDIO_{t-1} \quad \text{(NFC.04)}$$

$$KYNET_{nfc} = KINCOR_{nfc} + (REINVFDI\_R_{nfc} - REINVFDI\_P_{row}) - (REINVFDI\_P_{nfc} - REINVFDI\_R_{row}) \quad \text{(NFC.05)}$$

$$INTP_{nfc} = r_t^{blfirms} \cdot BLFIRMS_{t-1} - DISC\_INTP_{nfc} \quad \text{(NFC.06)}$$

$$DIVP_{nfc} = r_t^{en} \cdot EN_{t-1} \quad \text{(NFC.07)}$$

$$FDIY_{row} = r_t^{fdii} \cdot FDII_{t-1} \quad \text{(NFC.08)}$$

$$RENTLN_{nfc} = RENTLN_{gvt} - RENTLN_{hh} \quad \text{(NFC.09)}$$

Non-financial Corporations disposable income (YD_{nfc}) is equal to the sum of primary income and other current net transfers ($OTCN_{nfc}$), and deducting the direct taxes paid domestically and abroad ($TAXPD$ and $TAXPW$, respectively), as described in 4.2.3.

$$YD_{nfc} = YP_{nfc} + OTCN_{nfc} - (TAXPW_{nfc} + TAXPD_{nfc}) \quad \text{(NFC.10)}$$

$$OTCN_{nfc} = OTCN\_TOT_{nfc} + BENR_{nfc} - BENP_{nfc} \quad \text{(NFC.11)}$$

$$NFC\_TAX\_P = \theta_{nfc}^{dt} \cdot OPS_{nfc} \quad \text{(NFC.12)}$$

$$NFC\_TAX\_PW = \theta_n^{dtw} fc \cdot WAGES2ROW \quad \text{(NFC.13)}$$

$$NFC\_TAX\_PD = NFC\_TAX\_P - NFC\_TAX\_PW \quad \text{(NFC.14)}$$

Non-financial Corporations savings (SAV_{nfc}), in turn, are the result of the addition to disposable income of the revaluations in pension entitlements (NFC.15). The variations in pension entitlements are given by an exogenous ratio for the share of NFC payments in total payments in Pensions (NFC.16).

$$SAV_{nfc} = YD_{nfc} + PENSR_{nfc} \tag{NFC.15}$$

$$PENSR_{nfc} = ratio_{nfc}^{pensr} \cdot PENSPAYM \tag{NFC.16}$$

Finally, firms net lending position is obtained by adding (and subtracting) from savings the transfers related to other transactions in capital accounts paid by the government ($TRKO\_GN$), the other net transfers ($NTRK_{nfc}$) and the taxes on capital transactions paid domestically ($TRKTAX\_PD$) and abroad ($TRKTAX\_PW$) in (NFC.20).

$$\begin{aligned} NETLEND_{nfc} = SAV_{nfc} + (&TRKO\_GN + NTRK_{nfc} - TRKTAX_PW_{nfc} \\ &- TRKTAX\_PD_{nfc}) - GFCF_{nfc} - DINV_{nfc} - OTHDNA_{nfc} \end{aligned} \tag{NFC.17}$$

$$TRKO\_GN = TRKO\_R_{nfc} \tag{NFC.18}$$

$$NTRK_{nfc} = -TRKO\_P_{nfc} \tag{NFC.19}$$

$$TRKTAX\_PD_{nfc} = TRKTAX\_P_{nfc} - TRKTAX\_PW_{nfc} \tag{NFC.20}$$

We then need to further subtract firms investment, as before, in gross fixed capital ($GFCF_{nfc}$), changes in inventories ($DINV_{nfc}$) and other non-produced non-financial assets. Firms investments in physical capital $GFCF_M$, which is later split among investment in machinery and non-residential buildings through an exogenous (fixed) ratio. A complete description of the estimations results will be given in Section 5.4.

$$GFCF_{nfc} = ratio_{nfc}^{gfcf} \cdot (gfcf_m + gfcf_{nr}) \tag{NFC.21}$$

$$DINV_{nfc} = DINV - (DINV_{hh} + DINV_{fc} + DINV_{gvt}) \quad \text{(NFC.22)}$$

$$NETLENDF_{nfc} = NETLEND_{nfc} + DISC\_NETLEND_{nfc} \quad \text{(NFC.23)}$$

Central Bank The Central Bank only collects interest on the stocks of advances lent to banks, and on the stocks of government bonds and foreign liabilities it holds (CB.01). We assumed that all this interest streams are passed to the government sector (CB.02), so that the net lending position of the Central Bank is zero.

$$\begin{aligned} INTR_{cb} = (&r_t^{adv} \cdot ADV_{t-1} \\ &+ r_t^b \cdot B_{cb,t-1} + r_t^f \cdot F_{cb,t-1}) \end{aligned} \quad \text{(CB.01)}$$

$$OTCP_{cb} = INTR_{cb} \quad \text{(CB.02)}$$

Financial corporations As before, Financial Corporations profits (ops_{fc}) from production are determined by their profit share in total profits (FC.01). Adding the incomes from capital described in Section 4.2.2 yields primary income (YP_{fc}) in (FC.02).

$$OPS_{fc} = \pi_{fc} \cdot OPS \quad \text{(FC.01)}$$

$$\begin{aligned} YP_{fc} = &OPS_{fc} + (INTR_{fc} + DIVR_{fc} \\ &+ KYNET_{fc}) - (INTP_{fc} + DIVP_{nfc}) \end{aligned} \quad \text{(FC.02)}$$

$$\begin{aligned} INTR_{fc} = (&r_t^{blcc} \cdot BLCC_{t-1} + r_t^{blmo} \cdot BLMO_{t-1} + r_t^{blfirms} \cdot BLFIRMS_{t-1} \\ &+ r_t^b \cdot B_{fc,t-1} + r_t^f \cdot F_{fc,t-1}) - DISC\_INTR_{fc} \end{aligned} \quad \text{(FC.03)}$$

$$DIVR_{fc} = (r^{en} \cdot EN_{fc,t-1}) + DISC\_DIVR_{fc} \quad \text{(FC.04)}$$

$$\begin{aligned} KYNET_{fc} = &KINCO\_R_{fc} - KINCO\_P_{fc} \\ &+ REINVFDI\_R_{fc} - REINVFDI\_P_{fc} \end{aligned} \quad \text{(FC.05)}$$

$$INTP_{fc} = (r_t^{adv} \cdot ADV_{t-1} + r_t^{deps} \cdot DEPS_{t-1} + r_t^{bb} \cdot BB_{t-1}) - DISC\_INTP_{fc} \quad \text{(FC.06)}$$

$$DIVP_{fc} = (r^{eb} \cdot EB_{t-1}) \quad \text{(FC.07)}$$

Adding the other current net transfers ($OTCN_{fc}$), and deducting the direct taxes paid ($TAXP_{fc}$) gives banks disposable income in (FC.08).

$$YD_{fc} = YP_{fc} + OTCN_{fc} - TAXP_{fc} \quad \text{(FC.08)}$$

$$OTCN_{fc} = OTCN\_TOT_{fc} + BENR_{fc} - BENP_{fc} \quad \text{(FC.09)}$$

$$TAXP_{fc} = \theta_{fc}^{dt} \cdot ops_{fc} \quad \text{(FC.10)}$$

Financial Corporations savings (SAV_{fc}) are the result of the addition to disposable income of the revaluations in pension entitlements (FC.11). The variations in pension entitlements are given by an exogenous ratio times the total payments in Pensions (FC.12).

$$SAV_{fc} = YD_{fc} + PENSR_{fc} \quad \text{(FC.11)}$$

$$PENSR_{fc} = ratio_{fc}^{pensr} \cdot PENSPAYM \quad \text{(FC.12)}$$

Finally, banks net lending position ($NETLEND_{fc}$ in FC.13) is obtained by adding (subtracting) the transactions related to taxes and transfers on capital accounts ($TRKTAXP_{fc}$ and $TRKO\_GF$), and subtracting investments in real assets, split as usual between Gross Fixed Capital formation ($GFCF_{fc}$), changes in inventories ($DINV_{fc}$) and the acquisitions of non-produced non-financial assets ($OTHDNA_{fc}$). Following what we said in 4.2.5, banks investment in machinery and non-residential dwellings are given by an exogenous ratio (FC.16), while the changes in inventories depends on exogenous shares in total changes in inventories (FC.17), respectively.

$$NETLEND_{fc} = SAV_{fc} + (TRKO\_GF + NTRK_{fc} - TRKTAXP_{fc}) - GFCF_{fc} - DINV_{fc} - OTHDNA_{fc}$$

(FC.13)

$$TRKO\_GF = TRKO\_R_{fc} \tag{FC.14}$$

$$NTRK_{fc} = -TRKO\_P_{fc} \tag{FC.15}$$

$$GFCF_{fc} = ratio_{fc}^{gfcf} \cdot (gfcf\_m + gfcf\_nr) \tag{FC.16}$$

$$DINV_{fc} = ratio_{FC}^{dinv} \cdot dinv \tag{FC.17}$$

$$\begin{aligned} NETLENDF_{fc} = {} & NETLEND_{fc} + DISC\_NETLEND_{fc} \\ & - NETLENDF_{cb} \end{aligned} \tag{FC.18}$$

Government The public sector income from production (GVT.01) is the outcome of the indirect taxes collected (*indtax*) and the profits generated in production (ops_{gvt}), and subsidies to production payments ($subs_{gvt}$). Following the description made in 4.2.1, both the indirect taxes and the subsidies paid by the government are computed residually from total payments after deducting foreign institutions receipts in (GVT.02) and GVT.03.

$$INCP_{gvt} = INDT_{gvt} - SUBS_{gvt} + OPS_{gvt} \tag{GVT.01}$$

$$INDT_{gvt} = INDTAX - INDT_{row} \tag{GVT.02}$$

$$SUBS_{gvt} = SUBS - SUBS_{row} \tag{GVT.03}$$

$$OPS_{gvt} = \pi_{gvt} \cdot OPS \tag{GVT.04}$$

To incomes from production, we add the transaction in capital incomes defined in 4.2.2, so to get to Government disposable income. Again, we report here the equations, while we refer the reader to the mentioned section for the descriptive details. Thus:

$$YP_{gvt} = (OPS_{gvt} + INDT_{gvt}) - (SUBS_{gvt}) + (INTR_{gvt} \\ (INTR_{gvt} + DIVR_{gvt} + RENTLN_{gvt}) - (INTP_{gvt}) \quad \text{(GVT.05)}$$

$$INTR_{gvt} = (r_t^{deps} \cdot DEPS_{gvt,t-1}) - DISC\_INTR_{gvt} \quad \text{(GVT.06)}$$

$$DIVR_{hh} = (r_t^{en} \cdot EN_{gvt,t-1}) + DISC\_DIVR_{gvt} \quad \text{(GVT.07)}$$

$$RENTLN_{gvt} = RENTLN\_P_{nfc} + RENTLN\_P_{hh} \quad \text{(GVT.08)}$$

$$INTP_{gvt} = (r_t^b \cdot B_{t-1}) - DISC\_INTP_{gvt} \quad \text{(GVT.09)}$$

Government disposable income (GVT.10) is given by adding, to primary income, direct taxes received ($TAXNR_{gvt}$), social contributions collected and the sum of other current net transfers ($OTCN_{gvt}$) and Central Bank seignorage ($OTCP_{cb}$) and deducting pension payments (*penspaym*), as detailed in 4.2.3.

$$YD_{gvt} = YP_{gvt} + TAXNR_{gvt} + SOCCON \\ - PENSPAYM + (OTCN_{gvt} + OTCP_{cb}) \quad \text{(GVT.10)}$$

$$TAXNR_{gvt} = (TAXP_{hh} + TAXPD_{nfc} \\ + TAXP_{fc} + TAXP_{row}) + DISC\_TAX \quad \text{(GVT.11)}$$

$$SOCCON = \theta^{sc} \cdot (WAGES + MIXY + OPS_{hh}) \quad \text{(GVT.12)}$$

$$penspaym = \theta^{pens} \cdot WAGEU \cdot RETIRED \quad \text{(GVT.13)}$$

$$OTCN_{gvt} = OTCN\_TOT_{gvt} + (BENR_{gvt} - SOCCON) \\ - (BENP_{gvt} - PENSPAYM) \quad \text{(GVT.14)}$$

$$OTCP_{cb} = INTR_{cb} \tag{GVT.15}$$

Public sector savings (ROW.13), in turn, are the result of what is left of disposable income after the outlays in individual and collective consumption (GVT.17 and GVT.18, which are determined as a fixed share in total government expenditures G.

$$SAV_{gvt} = YD_{gvt} - (CONSCOLL_{gvt} + CONSIND_{gvt}) \tag{GVT.16}$$

$$CONSCOLL_{gvt} = \eta^{cc}_{gvt} \cdot g \tag{GVT.17}$$

$$CONSIND_{gvt} = \eta^{ic}_{gvt} \cdot g \tag{GVT.18}$$

Finally, the net lending position of the public sector is, as before, the difference between savings and investments (GVT.19), taking into account transfers and taxes on Capital Account (as detailed in Section 4.2.4). Government investments (GVT.25) and changes in inventories (GVT.26) are both determined by exogenous ratios.

$$\begin{aligned} NETLEND_{gvt} = {} & SAV_{gvt} + (TRKTAX\_R_{gvt} + NTRK_{gvt} + TRKO\_WG \\ & - TRKO\_GN - TRKO\_GF) - GFCF_{gvt} - DINV_{gvt} - OTHDNA_{gvt} \end{aligned} \tag{GVT.19}$$

$$\begin{aligned} TRKTAX\_R_{gvt} = {} & (TRKTAX\_P_{hh} \\ & + TRKTAX\_PD_{nfc} + TRKTAX\_P_{fc}) \end{aligned} \tag{GVT.20}$$

$$\begin{aligned} NTRK_{gvt} = {} & (TRKO\_R_{gvt} - TRKO\_GW) \\ & - (TRKO\_P_{gvt} - TRKO\_GN - TRKO\_GF) \end{aligned} \tag{GVT.21}$$

$$TRKO\_WG = TRKO\_P_{gvt} \tag{GVT.22}$$

$$TRKO\_GN = TRKO\_R_{nfc} \tag{GVT.23}$$

$$TRKO\_GF = TRKO\_R_{fc} \tag{GVT.24}$$

$$GFCF_{gvt} = ratio_{gvt}^{gfcf} \cdot gfcf\_g \tag{GVT.25}$$

$$DINV_{gvt} = ratio_{gvt}^{dinv} \cdot dinv \tag{GVT.26}$$

$$NETLENDF_{gvt} = NETLEND_{gvt} + DISC\_NETLEND_{gvt} \tag{GVT.27}$$

The Rest of the World As detailed in Section 4.2.1, the Rest of the World collects wages and incomes from trade, indirect taxes[7], interest and other capital incomes income and returns from FDI's, while pays interests on the issued liabilities and dividends in the forms of FDI's returns.

$$\begin{aligned} YP_{row} = {} & (MGS + XGS + DSIC\_TRADE) + (WAGES2ROW + INDT_{row}) \\ & + (INTR_{row} + FDIY_{row} + KYNET_{row}) - (INTP_{row} + FDIY_{nfc}) \end{aligned} \tag{ROW.01}$$

$$WAGES2ROW = WB - WAGES \tag{ROW.02}$$

$$indt_{row} = \theta^{iw} \cdot INDTAX \tag{ROW.03}$$

$$\begin{aligned} INTR_{row} = {} & (r_t^{deps} \cdot DEPS_{row,t-1} \\ & + r_t^b \cdot B_{row,t-1}) - DISC\_INTR_{row} \end{aligned} \tag{ROW.04}$$

$$FDIY_{row} = DIVR_{row} + REINVFDI\_R_{row} \tag{ROW.05}$$

$$\begin{aligned} KYNET_{row} = {} & KINCOR_{row} - KINCOP_{row} \\ & + DIVR_{nfc} - DIVP_{nfc} \end{aligned} \tag{ROW.06}$$

[7] Which, recall, are only paid by Non-Financial Corporations.

$$INTP_{row} = (r_t^f \cdot F_{t-1}) - DISC\_INTP_{row} \quad \text{(ROW.07)}$$

$$FDIY_{nfc} = r_t^{fdii} \cdot FDII_{t-1} \quad \text{(ROW.08)}$$

To Primary incomes, we add the incomes from taxation (ROW.10 and ROW.11) and the other transfers in current account (ROW.12) to get to disposable income. Net lending, as usual, is determined by adding to RoW savings the taxes paid and received and the other transfers on capital accounts.

$$YD_{row} = YP_{row} + (TAXPW_{nfc} - TAXP_{row}) + OTCN_{row} \quad \text{(ROW.09)}$$

$$TAXPW_{nfc} = \theta_n^{dtw} fc \cdot WAGES2ROW \quad \text{(ROW.10)}$$

$$TAXP_{row} = \theta_{row}^{d} \cdot WAGESFROW \quad \text{(ROW.11)}$$

$$OTCN_{row} = -(OTCN_{hh} + OTCN_{nfc} + OTCN_{fc} + OTCN_{gvt}) \quad \text{(ROW.12)}$$

$$SAV_{row} = YD_{row} \quad \text{(ROW.13)}$$

$$NETLEND_{row} = SAV_{row} + (TRKTAX\_PW_{nfc} + NTRK_{row} - TRKO\_WG) - OTHDNA_{row} \quad \text{(ROW.14)}$$

$$NETLENDF_{row} = NETLEND_{row} + DISC\_NETLEND_{row} \quad \text{(ROW.15)}$$

5.3 Modelling Financial Accounts: Portfolio choices

In this Section we will "close" all sectors Financial Accounts, defining the buffer stocks for each asset classes and sectors. We will start from the private non-financial sector, then we will deal with the Central bank and the financial sector, next we will move to the Government and, finally, we will detail the foreign sector.

Households As for all other sectors, net financial assets are determined in HH.26 by accumulating net lending (NETLEND) and net capital gains (NKGAINS). We also measure –in HH.27 –net financial assets at historical prices, i.e. without net capital gains, since experience for other countries suggest that consumption responds more to this latter measure than to the more volatile measure of financial assets at current market prices.

Table 5.1: FA - Households

Assets		Liabilities	
MB_{hh}	Banknotes	$BLCC$	Consumer Credit
$DEPS_{hh}$	Bank deposits	$BLMO$	Mortgages
BB_{hh}	Bank's debt		
EB_{hh}	Banks' equities		
B_{hh}	Government bonds		
EN_{hh}	Firms' equities		
$ONFA_{hh}$	Other net financial assets		

The end-of-period stock of banknotes held by households is estimated as a function of consumption, and the interest rate on bank deposits (HH.28).

The stock of bank deposits is determined as the buffer stock for the household sector (HH.29), given the overall stock of net financial assets and decisions on other financial assets and liabilities.

The demand for other financial assets is determined as portfolio adjustment, although the shares of each asset in the portfolio will be rudimentary - or exogenous - in the current version of the model (eqs. HH.30 to HH.35)[8].

The demand for consumer credit depends on consumption relative to income, and from the interest rate on consumer credit (HH.36). The net flow of mortgages is driven by household residential investment, the interest rate on mortgages, the existing stock of mortgage debt, and mortgages

[8]We tried to model the share of financial assets in households portfolio with reference to the respective rate of return. However the statistical support for this approach was weak.

write-offs (HH.36).

$$NFA_{hh} = NFA_{hh,t-1} + NETLENDF_{hh} + NKGAINS_{hh} \quad \text{(HH.26)}$$

$$NFA\_HP_{hh} = NFA\_HP_{hh,t-1} + NETLENDF_{hh} \quad \text{(HH.27)}$$

$$MB_{hh} = f(CONS, RDEPS) \quad \text{(HH.28)}$$

$$\begin{aligned} DEPS_{hh} = NFA_{hh} - (&MB_{hh} + BB_{hh} + EB + B_{hh} \\ &+ EN_{hh} + F_{hh} + ONFA_{hh} - BLCC - BLMO) \end{aligned} \quad \text{(HH.29)}$$

$$OTHFA_{hh} = NFA_{hh} - (MB_{hh} + DEPS_{hh} - BLCC - BLMO) \quad \text{(HH.30)}$$

$$BB_{hh} = ratio_{hh}^{BB} \cdot OTHFA_{hh} \quad \text{(HH.31)}$$

$$B_{hh} = ratio_{hh}^{B} \cdot OTHFA_{hh} \quad \text{(HH.32)}$$

$$EN_{hh} = ratio_{hh}^{EN} \cdot OTHFA_{hh} \quad \text{(HH.33)}$$

$$F_{hh} = ratio_{hh}^{F} \cdot OTHFA_{hh} \quad \text{(HH.34)}$$

$$ONFA_{hh} = ratio_{hh}^{ONFA} \cdot OTHFA_{hh} \quad \text{(HH.35)}$$

$$\Delta BLCC/YD_{hh} = f(r^{blcc}, \Delta CONS/YD_{hh}) \quad \text{(HH.36)}$$

$$VBLMO/YDhh = f(GFCF_{HH}, RBLMO, BLMOWO) \quad \text{(HH.37)}$$

Non Financial Corporations Portfolio adjustments for the non-financial business sector are meant to determine the additional demand for credit from banks (BLFIRMS). On the asset side, the stock of bank deposits is modeled as a ratio to the wage bill (NFC.25). This ratio is increasing since the start of the Eurozone crisis, but it will be projected exogenously in this version of the model.

Table 5.2: FA - Non Financial Corporations

Assets		Liabilities	
$DEPS_{nfc}$	Bank deposits	$BLFIRMS$	Bank loans to firms
B_{nfc}	Government bonds	EN	Firms' equities
$FDIO$	Foreign Direct Investments	$FDII$	Foreign Direct Investments
$ONFA_{nfc}$	Other net financial assets		

The demand for government bonds is interpreted as an additional demand for liquid assets, and it is therefore modeled with respect to the stock of deposits (NFC.26). In other words, firms demand liquid assets with respect to their current expenses on labor, splitting their liquid assets between deposits and government bonds. In principle, a higher interest rate on bonds relative to the rate on deposits should increase the share of bonds in firms' portfolio, but the data are not congruent with this prior, so that this ratio will also be projected exogenously.

The flows of outgoing foreign direct investment ($VFDIO$) and incoming foreign direct investment ($VFDII$) are both projected exogenously, as the result of domestic and foreign firms strategies ruled by animal spirits (in NFC.27 and NFC.28 respectively).

Other net financial assets ($ONFA_{nfc}$) are negative and growing in size, and therefore in the next version of the model they should deserve a better treatment as additional sources of funding. For the time being, they are projected exogenously (NFC.29).

New issues of equities (VEN) are projected exogenously, as an autonomous decision of firms (NFC.30).

$$NFA_{nfc} = NFA_{nfc,t-1} + NETLENDF_{nfc} + NKGAINS_{nfc} \quad \text{(NFC.24)}$$

$$DEPS_{nfc} = ratio^{deps}_{nfc} \cdot (WB_{t-1}) \quad \text{(NFC.25)}$$

$$B_{nfc} = ratio^{B}_{nfc} \cdot DEPS_{nfc,t-1} \quad \text{(NFC.26)}$$

$$FDIO = FDIO_{t-1} + VFDIO + p^{fdio} \cdot FDIO_{t-1} \tag{NFC.27}$$

$$FDII = FDII_{t-1} + VFDII + p^{fdii} \cdot FDII_{t-1} \tag{NFC.28}$$

$$ONFA_{NFC} = ONFA_{NFC,t-1} + VONFA_{NFC} + NKG\_ONFA_{NFC} \tag{NFC.29}$$

$$EN = EN_{t-1} + VEN + p^{en} \cdot VEN_{t-1} \tag{NFC.30}$$

$$BLFIRMS = BLFIRMS_{t-1} + (\Delta DEPS_{nfc} + \Delta B_{nfc} + \Delta FDIO + \Delta ONFA_{nfc} - \Delta NFA_{nfc}) - \Delta EN - \Delta FDII \tag{NFC.31}$$

The Central Bank The balance sheet of the Bank of Italy is simplified as in the table. Following the current accounting conventions and the discussions we made in the previous Chapters, some operations made by the Central Bank as part of the system of European Central Banks are treated as operations with the Rest of the world, but the monetary liabilities in Target2 appear as part of the liabilities of the national Central Bank.

Table 5.3: FA - Central Bank

Assets		Liabilities	
$GOLD$	Gold at BoI	$MB = MB_{fc} + MB_{hh} + MB_{T2}$	Monetary Base
ADV	Advances to Financial sector		
B_{cb}	Government bonds		
F_{cb}	Foreign assets		
$ONFA_{cb}$	Other net financial assets		

As discussed before, in normal times, it is reasonable to assume that the demand for monetary base, coming from household, banks and foreign institutions, is accommodated by the Central Bank (CB.03*). The change in the monetary base is in turn related to changes on the asset side. In such cases, the first component would be determined by the demand for liquidity coming from households, the reserve requirement needed by banks, and that part of external imbalances which is not covered by changes in other net assets vis-a-vis the rest of the world. However, as discussed in 4.3, when modeling Central Bank operations and unconventional monetary policies in times of QE, thus, we need to make some further assumptions on how these transmission mechanisms work.

We have seen that, with the APP programs, the European system of Central Banks has been purchasing Treasuries and other assets from the financial system, in exchange for monetary base, so that some components of MB are the mirror of QE operations, rather than arising from the demand for liquidity. We therefore tentatively assume that the end-of-period stock of monetary base is determined by the asset side in the CB balance sheet (CB.04), with net CB financial assets (NFA_{cb}) determined exogenously, but taking into account net capital gains (CB.05).

The value of gold reserves is computed taking into account the international price of gold, while the changes in the stock, i.e. net acquisition of gold, are treated as exogenous, and are relatively rare (CB.06). A discrepancy ($DISC\_VGOLD$) is needed because the revaluation of the stock of gold is not exactly equal to the theoretical estimate.

Changes in central bank advances (CB.07) have been split into two components: the first one ($DADVNET$) is estimated as a function of the cost of borrowing on domestic market ($SPREAD$), while the second part ($DADVQE1$) is exogenously given by the first QE phase (see chapter 4.

We assume that the Central Bank acquisition of government bonds is partly given by the second phase of the QE program ($DADVQE2$), and for the rest ($DBCBNET$) is such that the net supply of bonds (the flow VB) is equal to the sum of the net acquisition of bonds[9]. This assumption does not imply that the Central Bank is purchasing Treasuries on the primary market, nor that it is controlling the interest rate on Treasuries, which is governed by another equation in the model, linking the interest rate on Italian bonds to the German rate, plus a spread which depends on financial conditions.

The net demand for foreign financial assets from the CB (VF_{cb}) is currently left exogenous, as well as the net change in other financial assets ($VONFA_{CB}$), while the end-of-period stocks will be given by the usual accounting relationship.

$$MB = MB_{hh} + MB_{fc} + MB_{T2} \qquad \text{(CB.03*)}$$

$$MB = (GOLD + B_{cb} + F_{cb} + ONFA_{cb} + ADV) - NFA_{cb} \qquad \text{(CB.04)}$$

[9]We are aware that this assumption is not realistic, and that we would need to better model the demand and supply for Government Bonds and we temporarily adopted this closure as a short-cut.

$$NFA_{cb} = NFA_{cb,t-1} + NETLENDF_{cb} + NKGAINS_{cb} \quad \text{(CB.05)}$$

$$GOLD = GOLD_{t-1} + VGOLD + p^{gold} \cdot GOLD_{t-1} + DISC\_VGOLD \quad \text{(CB.06)}$$

$$ADV = ADV_{t-1} + DADVNET + DADVQE1 \quad \text{(CB.07)}$$

$$DADVNET = ADVNET - ADVNET_{t-1} \quad \text{(CB.08)}$$

$$ADVNET/DEPS = f(SPREAD) \quad \text{(CB.09)}$$

$$VB_{cb} = DBCBNET + ADVQE2 \quad \text{(CB.10)}$$

$$DBCBNET = VB - (VB_{hh} + VB_{nfc} + VB_{fc} + VB_{row}) - ADVQE2 \quad \text{(CB.11)}$$

$$B_{cb} = B_{cb,t-1} + VB_{cb} + p^{b} \cdot B_{cb,t-1} + DISC\_VB_{cb} \quad \text{(CB.12)}$$

$$F_{cb} = F_{cb,t-1} + VF_{cb} + p^{f} \cdot F_{cb,t-1} \quad \text{(CB.13)}$$

$$ONFA_{cb} = ONFA_{cb,t-1} + VONFA_{cb} + NKG\_ONFA_{cb} \quad \text{(CB.14)}$$

Financial corporations We follow Godley-Lavoie (2007) in assuming that banks fulfill the demand for loans from household and non-financial firms, and adjust their level of reserves accordingly, with the Central bank accommodating. The model becomes more complex when QE starts, since banks will adapt their portfolio whenever cheap credit is available from

QE Central bank operations.

Table 5.4: FA - Financial Corporations

Assets		Liabilities	
MB_{fc}	Deposits at CB	$DEPS$	Deposits
$BLCC$	Consumer credit	ADV	Central Bank advances
$BLMO$	Mortgages	BB	Banks' securities
$BLFIRMS$	Loans to firms	EB	Banks' equities
B_{fc}	Government bonds		
EN_{fc}	Firms' equities		
F_{fc}	Foreign assets		
$ONFA_{fc}$	Other net financial assets		

The monetary base on the asset side of banks' balance sheet (MB_{fc}) is split into two components (FC.01): the reserve requirement (MB_CR_{fc}), which vary with the reserve ratio to deposits ($coef^{res}$), and the share of sight deposits on total deposits ($coef^{sdeps}$, eq.FC.02), and the residual liquidity (MB_O_{fc}). Residual liquidity may be driven, on the one hand, by the demand for excess liquidity connected to financial instability, but on the other it has been the outcome of unconventional monetary policy (QE). As the ECB buys government bonds and other financial assets from banks, in exchange for liquidity, the banking sector as a whole cannot but accumulate such liquidity, when there are no prospects for profitable loans. We therefore model the 'excess' stock of monetary base (MB_O_{fc}) as the residual in banks' portfolio adjustment (FC.03). As discussed in Chapter 4, this increase in excess reserves translates mechanically into a worsening of the overall Target2 balance, since most of QE operations involve cross-border transactions.

As discussed above, consumer credit, mortgages and loans to firms are all supplied by banks on demand. For firms equities, we assume that the financial sector is the residual buyer, although this has no implication on how the market price of equities is determined in the model.The issues of new Bank equities (VEB), in turn, are projected exogenously as an independent decision of Banks (FC.24), and we assumed that the supply of equities is matched by households demand.

We model the Banks' demand for Government bonds estimating the flow as a function of our ($SPREAD$) measure and the acquisition of bond related to the second phase of QE ($DADVQE2$) (NFC.30 and NFC.31). With respect to the demand for foreign assets (F_{fc}), we model the flow VF_{fc} as a function of the interest rate on government bonds (r^B) and the spread between Italian and German Treasuries ($SPREAD$), the (changes in) exchange rate against the US \$ (xr^{it_us}) and the implicit rate of return on foreign assets (r^f).

Finally, as for all other sectors, the net change in other financial assets ($VONFA_{fc}$) will be left exogenous, and the end-of-period stocks will be given by the usual accounting relationship.

$$MB_{fc} = MB\_CR_{fc} + MB\_O_{fc} \tag{FC.19}$$

$$MB\_CR_{fc} = coef^{res} \cdot coef^{sdeps} \cdot DEPS \tag{FC.20}$$

$$\begin{aligned}\Delta MB\_O_{fc} = \Delta(NFA_{fc}) - \Delta(BLCC + BLMO + BLFIRMS + B_{fc} \\ + EN_{fc} + F_{fc} + ONFA_{fc}) + \Delta(FC\_liab) - \Delta(MB\_CR_{fc})\end{aligned} \tag{FC.21}$$

$$VEN_{fc} = VEN - (VEN_{hh} + VEN_{gvt}) \tag{FC.22}$$

$$EN_{fc} = EN_{fc,t-1} + VEN_{fc} + p^{en} \cdot EN_{fc,t-1} \tag{FC.23}$$

$$EB = EB_{t-1} + VEB + p^{eb} \cdot EB_{t-1} \tag{FC.24}$$

$$B_{fc} = B_{fc,t-1} + VB_{fc} + p^{b} \cdot B_{fc,t-1} \tag{FC.25}$$

$$VB_{fc} = f(SPREAD, DADVQE2) \tag{FC.26}$$

$$F_{fc} = F_{fc,t-1} + VF_{fc} + p^{f} \cdot F_{fc,t-1} + DISC\_VF_{fc} \tag{FC.27}$$

$$VF_{fc} = f(r^{B}, SPREAD, xr^{it\_us}/xr^{it\_us}_{t-1}, r^{f}) \tag{FC.28}$$

$$ONFA_{fc} = ONFA_{fc,t-1} + VONFA_{fc} + NKG\_ONFA_{fc} \tag{FC.29}$$

Government Regarding the Government sector, its operations are quite straightforward when compared to those discussed above.

Table 5.5: FA - Government

Assets		Liabilities	
$DEPS_{gvt}$	Deposits	B	Government bonds
EN_{gvt}	Firms' equities		
$ONFA_{gvt}$	Other net financial assets		

Indeed the government holds deposits, mainly to pay out wages to public employees, and the flows are estimated as a function of government expenditures over deposits (GVT.28 and GVT.29)[10]. We assumed that the government buys all the residual shares of domestic firms (GVT.30 and GVT.31) while other net financial assets are, as usual, left exogenous. It issues new bonds to cover the sum of the public Deficit (GVT.33).

$$DEPS_{gvt} = DEPS_{gvt,t-1} + VDEPS_{gvt} + DEPS\_WO_{gvt} \quad \text{(GVT.28)}$$

$$VDEPS_{gvt} = f(G) \quad \text{(GVT.29)}$$

$$VEN_{gvt} = VEN - (VEN_{hh} + VEN_{fc}) \quad \text{(GVT.30)}$$

$$EN_{gvt} = EN_{gvt,t-1} + VEN_{gvt} + p^{en} \cdot EN_{gvt,t-1} + DISC\_VEN_{gvt} \quad \text{(GVT.31)}$$

$$ONFA_{gvt} = ONFA_{gvt,t-1} + VONFA_{gvt} + NKG\_ONFA_{gvt} \quad \text{(GVT.32)}$$

$$VB = -NETLENDF_{gvt} + VDEPS_{gvt} + VEN_{gvt} + VONFA_{gvt} \quad \text{(GVT.33)}$$

[10] We computed an exogenous components for Deposits write-offs so as to offset the discrepancies between the flow and stock measures.

Rest of the World We have finally arrived to the discussion of the foreign sector. At this stage of model development, we decided to treat the foreign sector as the residual buyer for most of our assets. This aspect will have to be improved in future releases. The rest of the world holds deposits of domestic banks as liquidity for trade (ROW.16). It buys the residual supply of domestic Banks' securities (ROW.17), while the acquisition of new government bonds VB_{ROW} is currently left exogenous (ROW.18). Moreover, we assumed that the demands for foreign assets coming from the domestic sectors are completely matched (ROW.19).

Table 5.6: FA - RoW

Assets		Liabilities	
MB_{T2}	Monetary Base	$GOLD$	Gold
$DEPS_{row}$	Deposits	$FDIO$	Foreign Direct Investment
BB_{row}	Banks' securities	F	Foreign liabilities
B_{row}	Government bonds		
$FDII$	Foreign Direct Investment		
$ONFA_{row}$	Other net financial assets		

Finally, other net financial assets of the rest of the world are determined as the sum of all other sectors $ONFA$'s (ROW.20), while the buffer stock is represented here by the Target2 balance MB_{T2} (ROW.21).

$$DEPS_{row} = ratio_{row}^{deps} \cdot 4 \cdot (XGS + MGS) \quad \text{(ROW.16)}$$

$$BB_{row} = BB - BB_{HH} \quad \text{(ROW.17)}$$

$$VB_{row} = d(B_{row} - p^b \cdot B_{row,t-1}) - DISC\_VB_{row} \quad \text{(ROW.18)}$$

$$VF = VF_{hh} + VF_{fc} + VF_{cb} \quad \text{(ROW.19)}$$

$$\begin{aligned} ONFA_{row} = -(&ONFA_{hh} + ONFA_{nfc} \\ &+ ONFA_{fc} + ONFA_{cb} ONFA_{gvt}) \end{aligned} \quad \text{(ROW.20)}$$

$$\begin{aligned} MB_{T2} = NFA_{row} - (&DEPS_{row} + BB_{row} \\ &+ B_{row} + FDII + ONFA_{row}) + (GOLD + FDIO + F) \end{aligned} \quad \text{(ROW.21)}$$

5.4 Estimations

In this Section, we will describe the main stochastic equations of the model. As we said previously, the model contains over 400 variables, of which 253 endogenous, and 43 stochastic equations. The latter are divided between equations describing the demand block (i.e. consumption, investments and trade), interest rates and rates of return, asset prices and deflators, and the stocks and flows of financial assets (i.e. asset demand).

When working with such large models, some methodological remarks regarding the estimation strategy are needed.

As for the discussion we made in Chapter 3 and 4, also the number of stochastic equations and how these are modeled will impact the complexity, tractability and overall model dynamics. In this sense, the choices one makes regarding how many behaviors need to be modeled have to be "pragmatic". Regarding households portfolio choices set up in Section 5.3, for example, we decided to only model the demand for money and loans, leaving all other demand for assets determined by exogenous ratios or by other sectors equations. This not only simplifies our model in terms of the number of equations needed, but also eases the analysis of the results in terms of the main transmission channels. However this comes at some costs. Of course a higher level of detail regarding financial behaviors would improve the "realism" of the model. As we showed in Section 3.2, some of these variables present structural breaks, some others exhibit strange or highly unpredictable patterns. All these issues, together with the high number of variables, most of which are cointegrated, makes the estimations "trickier".

Our estimation strategy, thus, is led by the same "pragmatic" approach that we used since the beginning. We will prefer "simplicity", in terms of both the number of variables entering the regressions and their "system-wide" implications, over "complexity" and statistical robustness. Moreover, as we said many times, this is a somewhat "circular" methodology, in the sense that one goes back and forth in estimating relations and checking the implications with simulation exercises, modifying and reshaping the single equations in order to have meaningful, a more realistic, results.

We use cointegration techniques and Vector Error Correction Models, whenever possible, to estimate both "long" and "short-run" parameters for our equations[11]. These parameters, which act as long-run attractors, are in some way connected to our discussion of a stock-flow "norm" dictating the behaviors of an economic system. In general, we will thus first search for the order of integration using Unit Root Tests and then use the appropriate techniques to get to the final estimated equation. We will resort to Dummy Variables (dum_x from now on) *only* if these are needed to eliminate outliers which severely reduce the variance of our estimators, or to model structural breaks.

The next Sections illustrates the main stochastic equations and the estima-

[11]A detailed description of the econometric methodology will be given in Appendix C.

tion results[12].

5.4.1 The Production block: Consumption, Investments and Trade

We start from the Demand side of GDP. From Section 4.2.1, recall that gdp, in real terms[13], is split between consumption ($cons$), investments ($gfcf$) and changes in inventories ($dinv$), government expenditures (g), imports (mgs) and exports (xgs). We added a discrepancy variable to link GDP at nominal and current prices. We thus have:

$$gdp = cons + gfcf + dinv + g + mgs - xgs + gdpk\_res$$

As we said in Section 5.2, in the short-run, the rate of growth of consumption (EQ. CONSK) depends positively on current disposable income YD_{hh} and changes in domestic share prices sp^{it} and negatively on the interest rate on short-term loans to households r^{blcc}. The choice to use current disposable income instead of a lagged variable is led by the finding, when estimating the VECM, of the presence of a unique cointegrating vector and the weak exogeneity of income. The long-run reaction (EQ. CONSK_CE), in turn, is given by a consumption function which depends on disposable income and total wealth, split between net financial wealth and housing:

$$\begin{aligned} dlog(cons) &= a_1^{cons} \cdot cons\_ce/cons_{t-1} + a_2^{cons} \cdot dlog(cons_{t-1}) \\ &+ a_3^{cons} \cdot dlog(cons_{t-3}) + a_4^{cons} \cdot dlog(\frac{YD_{hh}}{p^{cons}}) \\ &+ a_5^{cons} \cdot dlog(sp^{it}) + a_6^{cons} \cdot r^{blcc} + a_0^{cons} \end{aligned} \qquad \text{(EQ. CONSK)}$$

$$\begin{aligned} d(cons\_ce_t) &= a_1^{cons\_ce} \cdot cons_{t-1} + a_2^{cons\_ce} \cdot \frac{YD_{t-1}}{p_{t-1}^{cons}} \\ &+ a_3^{cons\_ce} \cdot (KHK_{t-1} + \frac{NFA\_HP_{hh,t-1}}{p^{cons}}) + a_4^{cons\_ce} \cdot d(cons_{t-1}) \\ &+ a_5^{cons\_ce} \cdot d(\frac{YD_{hh,t-1}}{p_{t-1}^{cons}}) + a_6^{cons\_ce} \cdot d(KHK_{t-2} \\ &+ \frac{NFA\_HP_{hh,t-2}}{p_{t-1}^{cons}}) + a_0^{cons\_ce} \end{aligned}$$
$$\text{(EQ. CONSK\_CE)}$$

Below we report the estimation output of both $cons$ and $cons\_ce$, while the actual/residual Graph (for all estimated variables) will be reported in Appendix C.2. Tests on the residuals reject Auto Correlation and do not reject normality.

Table 5.7: Real Consumption

Dependent Variable: dlog(CONSK)
Method: Least Squares
Sample (adjusted): 1999Q2 2017Q3
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(a_1^{cons})	−0.199145	0.040489	−4.918461	0.0000
(a_2^{cons})	0.317901	0.091623	3.469649	0.0009
(a_3^{cons})	0.289254	0.086115	3.358909	0.0013
(a_4^{cons})	0.103860	0.034372	3.021654	0.0036
(a_5^{cons})	−0.000737	0.000360	−2.045778	0.0447
(a_6^{cons})	0.012139	0.004828	2.514192	0.0143
(a_0^{cons})	0.003559	0.001630	2.183641	0.0325

R-squared	0.635054	Mean dependent var	0.000999
Adjusted R-squared	0.602373	S.D. dependent var	0.005499
S.E. of regression	0.003468	Akaike info criterion	−8.400810
Sum squared resid	0.000806	Schwarz criterion	−8.182858
Log likelihood	317.8300	Hannan-Quinn criter.	−8.313867
F-statistic	19.43149	Durbin-Watson stat	2.046023
Prob(F-statistic)	0.000000		

Table 5.8: Real Consumption - VECM

Vector Error Correction Estimates
Sample (adjusted): 1999Q3 2017Q3
Included observations: 73 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1		
$(a_1^{cons\_ce})$	1.000000		
$(a_2^{cons\_ce})$	-0.510892		
	(0.04543)		
	[-11.2457]		
$(a_3^{cons\_ce})$	-0.013186		
	(0.00341)		
	[-3.86543]		
$(a_0^{cons\_ce})$	-30888.02		
R-squared	0.473656	0.319395	0.115182
Adj. R-squared	0.442694	0.279359	0.063134
Sum sq. resids	63115029	$6.28E+08$	$2.90E+10$
S.E. equation	963.4117	3038.504	20653.25
F-statistic	15.29825	7.977774	2.212988
Log likelihood	-602.5379	-686.3886	-826.2936
Akaike AIC	16.64487	18.94215	22.77517
Schwarz SC	16.80175	19.09903	22.93205
Mean dependent	202.4918	82.82592	5824.401
S.D. dependent	1290.521	3579.319	21337.79

Determinant resid covariance (dof adj.)	$3.31E+21$
Determinant resid covariance	$2.68E+21$
Log likelihood	-2111.596
Akaike information criterion	58.34509
Schwarz criterion	58.90986

We then move to investment. In our model, we have households investment in housing, $gfcf\_h$, and the firms investments in physical capital $gfcf_{TOT}$, which is later split among investment in machinery ($gfcf\_m$) and non-residential buildings ($gfcf\_nr$) through an exogenous (fixed) ratio. We start from the households sector.

In the short-run, the changes in real investments in new houses (EQ. GFCF_KH) reacts negatively to the existing stock of buildings KH and the interest rate on mortgages r^{blmo} and positively to the changes in disposable income in terms of the price of investments in new houses. We added three dummies to better capture major trends. Still, however (as it is clear from the Actual/Fitted graph in Appendix C.2), we only keep track of the underlying trend, but this specification for housing investments would benefit from further investigation.

$$\begin{aligned} dlog(gfcf\_h) = {} & a_1^{gfcfh} \cdot log(gfcf\_h) + a_2^{gfcfh} \cdot log(\frac{YD_{hh,t-1}}{p_{t-1}^{gfcf_h}}) \\ & + a_3^{gfcfh} \cdot log(kh) + a_4^{gfcfh} \cdot r^{blmo} + a_5^{gfcfh} \cdot dum_1 \text{“}2006q4\text{”} \\ & + a_6^{gfcfh} \cdot dum_2 \text{“}2008q1\text{”} + a_7^{gfcfh} \cdot dum_3 \text{“}2012q1\text{”} + a_0^{gfcfh} \end{aligned} \tag{EQ. GFCF\_KH}$$

Turning to non-financial corporations, the growth rate of real investments in machinery (relative to the existing stock) (EQ. GFCF_KM) is driven by an accelerator effect connected to changes in demand and to the flows of profits net of dividends paid (an effect which is rather puzzling) and negatively to the interest rate on loans to firms. As we said before, firms' investment in non-residential buildings are computed residually through an exogenous (fixed) ratio in total firms' investments. Residuals diagnostics reject AC while do not reject normality.

$$\begin{aligned} log(\frac{gfcf\_m}{km_{t-1}}) = {} & a_1^{gfcfm} \cdot log(\frac{gfcf\_m_{t-2}}{KMK_{t-2}}) + a_2^{gfcfm} \cdot log(\frac{gdp_{t-1}}{KMK_{t-2}}) \\ & + a_3^{gfcfm} \cdot \frac{ops_{nfc,t-1} - DIVP_{nfc,t-1})}{(km_{t-2} + knr_{t-2}) - r^{blfirms}/100} \\ & + a_4^{gfcfm} \cdot \frac{DIVP_{nfc,t-1}}{km_{t-2} + knr_{t-2}} + a_0^{gfcfm} \end{aligned} \tag{EQ. GFCF\_KM}$$

We then have the changes in inventories. We estimate the NIPA measure of the changes in inventories as a stock-flow adjustment towards a stable inventories-to-GDP ratio. We also link in (EQ. DINVK2) the sectoral account

[12] The rest of the estimation outputs are displayed in Appendix C.1.

[13] In this subsection, we will denote variables in real terms with lowercase letters labels. A description of prices and deflators is given later.

Table 5.9: Real Investments in Housing

Dependent Variable: dlog(GFCFK_H)
Method: Least Squares
Sample (adjusted): 1999Q2 2017Q3
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(a_1^{gfcfh})	−0.053667	0.025590	−2.097159	0.0398
(a_2^{gfcfh})	0.152570	0.082802	1.842588	0.0699
(a_3^{gfcfh})	−0.219516	0.065183	−3.367693	0.0013
(a_4^{gfcfh})	−0.011486	0.002975	−3.860208	0.0003
(a_5^{gfcfh})	0.058256	0.014479	4.023403	0.0002
(a_6^{gfcfh})	0.057149	0.014870	3.843124	0.0003
(a_7^{gfcfh})	−0.050960	0.014348	−3.551790	0.0007
(a_0^{gfcfh})	1.894243	1.624698	1.165904	0.2478

R-squared	0.575377	Mean dependent var	−0.000866
Adjusted R-squared	0.530342	S.D. dependent var	0.020617
S.E. of regression	0.014129	Akaike info criterion	−5.579383
Sum squared resid	0.013175	Schwarz criterion	−5.330295
Log likelihood	214.4372	Hannan-Quinn criter.	−5.480019
F-statistic	12.77602	Durbin-Watson stat	2.131150
Prob(F-statistic)	0.000000		

Table 5.10: Real Investments in Machinery

Dependent Variable: $log(\frac{gfcf\_m}{km_{t-1}})$
Method: Least Squares
Sample (adjusted): 2005Q3 2017Q3
Included observations: 49 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(a_1^{gfcfm})	0.680262	0.089574	7.594413	0.0000
(a_2^{gfcfm})	0.374259	0.149924	2.496332	0.0164
(a_3^{gfcfm})	1.118853	0.326804	3.423615	0.0013
(a_4^{gfcfm})	4.964469	1.854503	2.676981	0.0104
(a_0^{gfcfm})	−0.783275	0.231274	−3.386775	0.0015

R-squared	0.939900	Mean dependent var	−2.936037
Adjusted R-squared	0.934437	S.D. dependent var	0.083491
S.E. of regression	0.021378	Akaike info criterion	−4.756444
Sum squared resid	0.020109	Schwarz criterion	−4.563401
Log likelihood	121.5329	Hannan-Quinn criter.	−4.683203
F-statistic	172.0294	Durbin-Watson stat	1.928426
Prob(F-statistic)	0.000000		

measure of changes in inventories with the NIPA definition[14].

$$\frac{dinv}{gdp} = a_1^{dinv} \cdot \frac{dinv_{t-1}}{gdp_{t-1}} + a_2^{dinv} \cdot \frac{inv_{t-1}}{GDPK_{t-1}} + a_0^{dinv} \qquad \text{(EQ. DINVK)}$$

$$\frac{dinv2}{gdp} = a_1^{dinv2} \cdot \frac{dinv}{gdp} + a_2^{dinv2} \cdot \frac{dinv_{t-1}}{gdp_{t-1}} + a_0^{dinv2} \qquad \text{(EQ. DINVK2)}$$

Since the government expenditures component G is left exogenous, we may directly step towards the trade block of Demand which, at the current stage of model development, we decided to keep as simple as possible. Starting from imports, the change in the growth rate depends, in the short-run, positively on domestic demand and negatively on relative prices and, in the long-run, on domestic demand. We also added a dummy for a structural break occurring in the second quarter of 2009.

[14]Inventories, in National Accounts, are obtained residually, and are not a good indicator for inventories in theoretical models. Therefore we used a simple approach which ensures convergence to a stable stock-flow ratio of inventories-to-GDP. In future developments of the model, we will try to verify if inventories can be treated as a buffer when expectations on demand are introduced.

Table 5.11: Real Changes in Inventories

Dependent Variable: $\frac{dinv}{gdp}$
Method: Least Squares
Sample (adjusted): 1996Q2 2017Q3
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(a_1^{dinv})	0.493212	0.084167	5.859890	0.0000
(a_2^{dinv})	−0.099075	0.023458	−4.223432	0.0001
(a_0^{dinv})	0.036194	0.008294	4.363786	0.0000

R-squared	0.460326	Mean dependent var	0.003152
Adjusted R-squared	0.447322	S.D. dependent var	0.005106
S.E. of regression	0.003796	Akaike info criterion	−8.275703
Sum squared resid	0.001196	Schwarz criterion	−8.190086
Log likelihood	358.8552	Hannan-Quinn criter.	−8.241246
F-statistic	35.39830	Durbin-Watson stat	2.006469
Prob(F-statistic)	0.000000		

Table 5.12: Real Changes in Inventories - NIPA

Dependent Variable: $\frac{dinv2}{gdp}$
Method: Least Squares
Sample (adjusted): 1996Q2 2017Q3
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(a_1^{dinv2})	1.017286	0.060635	16.77724	0.0000
(a_2^{dinv2})	−0.163071	0.060921	−2.676776	0.0090
(a_0^{dinv2})	−0.002336	0.000306	−7.636014	0.0000

R-squared	0.812576	Mean dependent var	0.000337
Adjusted R-squared	0.808060	S.D. dependent var	0.005275
S.E. of regression	0.002311	Akaike info criterion	−9.267964
Sum squared resid	0.000443	Schwarz criterion	−9.182347
Log likelihood	401.5224	Hannan-Quinn criter.	−9.233507
F-statistic	179.9233	Durbin-Watson stat	1.519808
Prob(F-statistic)	0.000000		

$$dlog(mgs) = a_1^{mgs} \cdot log(mgs_{t-1}) + a_2^{mgs} \cdot log(gdp_{t-1}) + a_3^{mgs} \cdot dum_4\text{“}2009q2\text{”} \cdot log(gdp_{t-1}) + a_4^{mgs} \cdot log\left(\frac{p_{t-1}^{mgs}}{p_{t-1}^{gdp}}\right) + dlog(gdp_{t-1,t-2}) + a_0^{mgsk} \tag{EQ. MGSK}$$

Table 5.13: Real Imports of Goods and Services

Dependent Variable: $dlog(mgs)$
Method: Least Squares
Sample (adjusted): 1996Q4 2017Q3
Included observations: 84 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(a_1^{mgs})	−0.193061	0.052344	−3.688344	0.0004
(a_2^{mgs})	0.419260	0.160539	2.611583	0.0108
(a_3^{mgs})	0.002182	0.000616	3.541314	0.0007
(a_4^{mgs})	−0.173895	0.042497	−4.091907	0.0001
(a_5^{mgs})	1.451850	0.293930	4.939434	0.0000
(a_6^{mgs})	0.760155	0.316108	2.404730	0.0186
(a_0^{mgsk})	−3.189731	1.499084	−2.127786	0.0366

R-squared	0.569990	Mean dependent var	0.007220
Adjusted R-squared	0.536483	S.D. dependent var	0.022568
S.E. of regression	0.015365	Akaike info criterion	−5.433815
Sum squared resid	0.018178	Schwarz criterion	−5.231247
Log likelihood	235.2202	Hannan-Quinn criter.	−5.352385
F-statistic	17.01095	Durbin-Watson stat	1.838369
Prob(F-statistic)	0.000000		

With respect to Exports, in light of the importance that export dynamics have always had for the Italian economic performance, we decided to model separately the exports of goods xg and services xs. The determinants are found to be the same, with the change in the growth rate of exports in goods (or services) depending positively on foreign demand $LWDEM$ and negatively on the competitivity index $COMP\_IT$. Estimation outputs are reported below.

$$dlog(xg) = a_1^{xg} \cdot log(xg_{t-1}) + a_2^{xg} \cdot LWDEM_{t-1} + a_3^{xg} \cdot dlog(xg_{t-1}) + a_4^{xg} \cdot d(LWDEM) + a_5^{xg} \cdot d(LWDEM_{t-1}) + a_6^{xg} \cdot log(COMP\_IT_{t-1}) + a_7^{xg} \cdot dlog(COMP\_IT) + a_0^{xg} \tag{EQ. XGK}$$

$$dlog(xs) = a_1^{xs} \cdot log(xs_{t-1}) + a_2^{xs} \cdot LWDEM_{t-1} + a_3^{xs} \cdot dlog(xs_{t-1}) + a_4^{xs} \cdot d(LWDEM) + a_5^{xs} \cdot d(LWDEM_{t-1}) + a_6^{xs} \cdot log(COMP\_IT_{t-1}) + a_7^{xs} \cdot dlog(COMP\_IT) + a_0^{xs} \quad \text{(EQ. XSK)}$$

Table 5.14: Real Exports of Goods

Dependent Variable: $dlog(xg)$
Method: Least Squares
Sample (adjusted): 1996Q3 2017Q3
Included observations: 85 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(a_1^{xg})	−0.156626	0.037890	−4.133734	0.0001
(a_2^{xg})	0.196949	0.040036	4.919264	0.0000
(a_3^{xg})	−0.262201	0.097059	−2.701442	0.0085
(a_4^{xg})	2.713977	0.453082	5.990039	0.0000
(a_5^{xg})	2.759808	0.626883	4.402431	0.0000
(a_6^{xg})	−0.146058	0.049499	−2.950744	0.0042
(a_7^{xg})	−0.373361	0.122722	−3.042317	0.0032
(a_0^{xg})	0.991829	0.302459	3.279217	0.0016

R-squared	0.755390	Mean dependent var	0.006458
Adjusted R-squared	0.733153	S.D. dependent var	0.026340
S.E. of regression	0.013607	Akaike info criterion	−5.667140
Sum squared resid	0.014256	Schwarz criterion	−5.437243
Log likelihood	248.8534	Hannan-Quinn criter.	−5.574669
F-statistic	33.96953	Durbin-Watson stat	2.109382
Prob(F-statistic)	0.000000		

5.4.2 Wages and Productivity

In this section we will estimate the equations related to the Labor Market. First, recalling the discussion we made in Section 4.4, we need here to estimate three distinct equations: one defining the ratio between the number of (unintended) part time workers ($ratio^{npti}$) and total employees, another for the average unit monetary wage ($wageu$) and, finally, one for productivity ($prod$).

Starting from the former, the changes in the ratio between unintended part time and total workers is estimated against its lagged level and the unemployment rate (both at their previous year levels), and on their differences. We also added a deterministic "TREND" and an IV for 2015q3. Residual Diagnostics reject AC. Normality is not rejected. We thus have:

Table 5.15: Real Exports of Services

Dependent Variable: $dlog(xg)$
Method: Least Squares
Sample (adjusted): 1996Q3 2017Q3
Included observations: 85 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(a_1^{xs})	−0.181444	0.058280	−3.113331	0.0026
(a_2^{xs})	0.078539	0.031425	2.499211	0.0146
(a_3^{xs})	−0.270205	0.111910	−2.414488	0.0181
(a_4^{xs})	2.667270	0.563716	4.731581	0.0000
(a_5^{xs})	1.651455	0.518252	3.186586	0.0021
(a_6^{xs})	−0.207856	0.113970	−1.823777	0.0721
(a_7^{xs})	−0.523411	0.224095	−2.335662	0.0221
(a_0^{xs})	2.161733	0.634718	3.405817	0.0011

R-squared	0.469203	Mean dependent var	0.004106
Adjusted R-squared	0.420949	S.D. dependent var	0.032876
S.E. of regression	0.025017	Akaike info criterion	−4.449142
Sum squared resid	0.048190	Schwarz criterion	−4.219246
Log likelihood	197.0885	Hannan-Quinn criter.	−4.356671
F-statistic	9.723549	Durbin-Watson stat	1.977040
Prob(F-statistic)	0.000000	Wald F-statistic	16.34297
Prob(Wald F-statistic)	0.000000		

$$d(ratio^{npti}) = lm_1^{npti} \cdot ratio_{t-4}^{npti} + lm_2^{npti} \cdot ur_{t-4} + lm_3^{npti} \cdot @TREND \\ + lm_4^{npti} \cdot d(ratio_{t-1}^{npti} + lm_5^{npti} \cdot d(ur) + lm_6^{npti} \cdot d(ur_{t-1}) \\ + lm_7^{npti} \cdot dum_5 \text{“2015}q3\text{”} + lm_0^{npti}$$

(EQ. RATIO_NPTI)

Table 5.16: Ratio of Part Time Workers in Total Employment

Dependent Variable: $d(ratio^{npti})$
Method: Least Squares
Sample (adjusted): 2005Q1 2017Q3
Included observations: 51 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(lm_1^{npti})	−0.436622	0.115390	−3.783887	0.0005
(lm_2^{npti})	0.235699	0.067104	3.512422	0.0011
(lm_3^{npti})	0.000463	0.000132	3.517727	0.0010
(lm_4^{npti})	−0.342244	0.109760	−3.118129	0.0032
(lm_5^{npti})	0.407830	0.090417	4.510573	0.0000
(lm_6^{npti})	0.360218	0.090537	3.978697	0.0003
(lm_7^{npti})	0.007566	0.001639	4.615883	0.0000
(lm_0^{npti})	−0.062379	0.018200	−3.427405	0.0014

R-squared	0.629251	Mean dependent var	0.001341
Adjusted R-squared	0.568896	S.D. dependent var	0.002277
S.E. of regression	0.001495	Akaike info criterion	−10.03015
Sum squared resid	$9.61E-05$	Schwarz criterion	−9.727119
Log likelihood	263.7688	Hannan-Quinn criter.	−9.914353
F-statistic	10.42590	Durbin-Watson stat	1.962944
Prob(F-statistic)	0.000000		

Unit nominal wages (EQ. WAGEU) are estimated with an ECM mechanism depending on the price level and the unemployment rate in the long-run and the changes in domestic and import prices in the short-run. We also added two dummy variables, one for 2003q3 and one for 2005q4. Residual Diagnostics reject AC. Normality is not rejected.

$$dlog(wageu) = lm_1^{wag} \cdot log(wageu_{t-1}) - log(p_{t-1}^{foi}) + lm_2^{wag} \cdot ur_{t-1} + lm_3^{wag} \cdot dlog(wageu_{t-1}) \\ + lm_4^{wag} \cdot dlog(p_{t-1}^{foi} + lm_5^{wag} \cdot dlog(p^{mgs}) + lm_6^{wag} \cdot dum_6 \text{“2003}q3\text{”} \\ + lm_7^{wag} \cdot dum_7 \text{“2005}q4\text{”} + lm_0^{wageu}$$

(EQ. WAGEU)

Table 5.17: Average Monetary Unit Wages

Dependent Variable: $dlog(wageu)$
Method: Least Squares
Sample (adjusted): 1999Q3 2017Q3
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(lm_1^{wag})	−0.152910	0.033375	−4.581521	0.0000
(lm_2^{wag})	−0.266861	0.055137	−4.840000	0.0000
(lm_3^{wag})	−0.331232	0.075591	−4.381902	0.0000
(lm_4^{wag})	−0.650246	0.288401	−2.254657	0.0275
(lm_5^{wag})	0.081981	0.043877	1.868439	0.0662
(lm_6^{wag})	0.027568	0.006026	4.574903	0.0000
(lm_7^{wag})	0.037095	0.005994	6.188789	0.0000
(lm_0^{wageu})	−0.377107	0.085654	−4.402671	0.0000

R-squared	0.629369	Mean dependent var	0.004944
Adjusted R-squared	0.589455	S.D. dependent var	0.009222
S.E. of regression	0.005909	Akaike info criterion	−7.321549
Sum squared resid	0.002270	Schwarz criterion	−7.070540
Log likelihood	275.2365	Hannan-Quinn criter.	−7.221517
F-statistic	15.76811	Durbin-Watson stat	1.742164
Prob(F-statistic)	0.000000		

Finally, we have the equation describing the changes in the growth rate of productivity (EQ. PROD). This is estimated as a function of real GDP, the export share in GDP and our dummy for the euro ($DUMEURO$). The error correction term (l_3) and related parameters are estimated with a VECM with one lag over the whole sample, and ($servshare$) stands for the share of services in value added. AC is rejected by residual diagnostics, Normality is not. Output is reported below.

$$\begin{aligned} dlog(prod) &= lm_1^{prod} \cdot dlog(GDPK_{t-1}) + lm_2^{prod} \cdot dlog(GDPK_{t-4}) \\ &\quad + lm_3^{prod} \cdot DUMEURO \cdot (log(prod_{t-1}) + lm_{b1}^{prod} \cdot log(servshare_{t-1}) \\ &\quad + lm_{b2}^{prod} \cdot log(GDPK_{t-1}) + lm_0^{prod\_var}) + lm_4^{prod} \cdot dlog\left(\frac{XGSK_{t-1}}{GDPK_{t-1}}\right) \\ &\quad + lm_0^{prod} \end{aligned} \tag{EQ. PROD}$$

where $lm_{b1}^{prod} = +0.879520658273$, $lm_{b2}^{prod} = -0.176856938416$, and $lm_0^{prod\_var} = -0.319885503781$.

Table 5.18: Productivity

Dependent Variable: DLOG(PROD)
Method: Least Squares
Sample (adjusted): 1997Q2 2017Q3
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(lm_1^{prod})	0.300701	0.107118	2.807189	0.0063
(lm_2^{prod})	−0.216927	0.089882	−2.413454	0.0182
(lm_3^{prod})	−0.238835	0.081449	−2.932322	0.0044
(lm_4^{prod})	0.092350	0.040891	2.258426	0.0267
(lm_0^{prod})	−0.000758	0.000677	−1.120827	0.2658

R-squared	0.335345	Mean dependent var	0.000115
Adjusted R-squared	0.300817	S.D. dependent var	0.006824
S.E. of regression	0.005706	Akaike info criterion	−7.435685
Sum squared resid	0.002507	Schwarz criterion	−7.288934
Log likelihood	309.8631	Hannan-Quinn criter.	−7.376767
F-statistic	9.712381	Durbin-Watson stat	1.994673
Prob(F-statistic)	0.000002		

5.4.3 Prices and Deflators

We now have to detail the specifications for a number of equations describing price formation. We need to estimate, first, a deflator for consumption, that we will use to compute the purchasing power of disposable income and wealth and, then, to specify the behaviors of domestic inflation, import and export prices (for goods and services) and, finally, the effects that these have on the country's international competitiveness. As before, outputs ore reported along with the equations, while Graphs for residuals are displayed in Appendix C.2.

Domestic Prices To increase the coherence of the model to the official index for inflation, we model the price level using the price index of the representative basket of goods for blue-collars. We adopt an ECM mechanism where these price indexes depend, in the long-run, from ULC and the indirect tax rate θ^i.

$$dlog(p^{foi}) = b_1^{pfoi} \cdot (log(p^{foi}) + b_{b1}^{pfoi} \cdot log\left(\frac{wageu_{t-1}}{prod_{t-1}}\right) + b_{b2}^{pfoi} \cdot \theta_{t-1}^{i} + b_0^{pfoi\_var}) + b_2^{pfoi} \cdot dlog(p_{t-1}^{foi} + b_3^{pfoi} \cdot d(\theta^i) + b_4^{pfoi} \cdot d(\theta_{t-1}^i) + b_0^{pfoi} \quad \text{(EQ. PFOI)}$$

where the parameters $b_{b1}^{pfoi} = -0.704206706967$, $b_{b2}^{pfoi} = -3.08307653954$, and $b_0^{pfoi\_var} = -4.81942562745$ are estimated with a VAR with one lag over the whole sample.

Consumption Deflator The deflator for consumption p^{cons}, is linked to our main price index through an ECM mechanism with a long-run elasticity of unity. We included a dummy for 2009q1, which is found to be statistically significant. Residuals are Normal, and AC is rejected. Estimation output is reported below.

$$dlog(p^{cons}) = b_1^{pcons} \cdot (log(p_{t-1}^{cons}) - log(p_{t-1}^{foi})) + b_2^{pcons} \cdot dlog(p_{t-1}^{foi}) + b_3^{pcons} \cdot dlog(p_{t-1}^{mgs}) + b_4^{pcons} \cdot dum_8\text{“}2009q1\text{”} + b_0^{pcons} \quad \text{(EQ. PCONS)}$$

Imports & Exports Deflators and Competitiveness We then have the imports and exports prices. Starting with the former, the imports deflator is modeled as an ECM depending from foreign prices in foreign currencies ($LPLC$) and the exchange rate against the US$. We find Structural break in the growth rate of import prices with the introduction of the Euro in 1999 and we use a dummy variable for the first quarter of 2009 to account for the extraordinary drop in trade after the Financial Crisis, which are both found to be statistically significant. Estimation output is

Table 5.19: Domestic Inflation

Dependent Variable: $dlog(p^{foi})$
Method: Least Squares
Sample (adjusted): 1999Q3 2017Q3
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(b_1^{pfoi})	−0.036293	0.020080	−1.807377	0.0751
(b_2^{pfoi})	0.719204	0.085417	8.419891	0.0000
(b_3^{pfoi})	0.156760	0.087955	1.782272	0.0792
(b_4^{pfoi})	−0.184827	0.088431	−2.090072	0.0404
(b_0^{pfoi})	0.001129	0.000463	2.438050	0.0174

R-squared	0.533015	Mean dependent var	0.004383
Adjusted R-squared	0.505545	S.D. dependent var	0.003177
S.E. of regression	0.002234	Akaike info criterion	−9.304022
Sum squared resid	0.000339	Schwarz criterion	−9.147141
Log likelihood	344.5968	Hannan-Quinn criter.	−9.241502
F-statistic	19.40371	Durbin-Watson stat	2.229335
Prob(F-statistic)	0.000000		

Table 5.20: Consumption Deflator

Dependent Variable: $dlog(p^{cons})$
Method: Least Squares
Sample (adjusted): 1996Q2 2017Q3
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(b_1^{pcons})	−0.037907	0.017899	−2.117849	0.0373
(b_2^{pcons})	0.861105	0.066520	12.94505	0.0000
(b_3^{pcons})	0.048084	0.012732	3.776651	0.0003
(b_4^{pcons})	−0.008289	0.001785	−4.643112	0.0000
(b_0^{pcons})	−0.173826	0.082464	−2.107901	0.0381

R-squared	0.839971	Mean dependent var	0.004684
Adjusted R-squared	0.832068	S.D. dependent var	0.003857
S.E. of regression	0.001581	Akaike info criterion	−10.00576
Sum squared resid	0.000202	Schwarz criterion	−9.863063
Log likelihood	435.2476	Hannan-Quinn criter.	−9.948329
F-statistic	106.2894	Durbin-Watson stat	2.113915
Prob(F-statistic)	0.000000		

reported below. Residual Diagnostics reject AC. Normality is not rejected.

$$\begin{aligned} dlog(p^{mgs}) = {} & b_1^{pmgs} \cdot d(LPLC) + b_2^{pmgs} \cdot (1 - DUMEURO) \cdot dlog(xr_{t-1}^{it\_us}) \\ & + b_3^{pmgs} \cdot dum_9\text{“}2009q1\text{”} + b_4^{pmgs} \cdot dlog(p_{t-1}^{mgs}) + b_5^{pmgs} \cdot log(p_{t-1}^{mgs}) \\ & + b_6^{pmgs} \cdot (LPLC_{t-1}) + b_7^{pmgs} \cdot log(xr_{t-1}^{it\_us}) + b_0^{pmgs} \end{aligned} \quad \text{(EQ. PMGS)}$$

Table 5.21: Prices of Import Goods and Services

Dependent Variable: $dlog(p^{mgs})$
Method: Least Squares
Sample (adjusted): 1996Q3 2017Q3
Included observations: 85 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(b_1^{pmgs})	2.218854	0.555930	3.991248	0.0001
(b_2^{pmgs})	−0.422129	0.128173	−3.293438	0.0015
(b_3^{pmgs})	−0.035515	0.013758	−2.581381	0.0117
(b_4^{pmgs})	0.337915	0.085186	3.966805	0.0002
(b_5^{pmgs})	−0.105402	0.037331	−2.823453	0.0060
(b_6^{pmgs})	0.077830	0.030042	2.590742	0.0115
(b_7^{pmgs})	−0.025120	0.011445	−2.194866	0.0312
(b_0^{pmgs})	−0.014692	0.004154	−3.536415	0.0007

R-squared	0.508624	Mean dependent var	0.003347
Adjusted R-squared	0.463954	S.D. dependent var	0.016900
S.E. of regression	0.012373	Akaike info criterion	−5.857208
Sum squared resid	0.011788	Schwarz criterion	−5.627312
Log likelihood	256.9313	Hannan-Quinn criter.	−5.764737
F-statistic	11.38613	Durbin-Watson stat	2.272734
Prob(F-statistic)	0.000000		

As we said previously, we model separately exports of goods from that of services, and the same applies to their deflators[15]. Starting from the former, the export deflator is modeled as an ECM depending, in the long-run, on ULC and, from foreign prices only in the short-run. Residual Diagnostics reject AC while normality is not rejected.

On the contrary, we find that the deflator of exports of services depends solely on foreign prices in the long-run, while it depends also on the exchange rate in the short-run, with a significant effect from the introduction

[15]It is worth noting, however, that the price elasticities that we found need more in-depth analysis.

of the euro. Estimation outputs are given below.

$$dlog(p^{xg}) = b_1^{pxg} \cdot log(p_{t-1}^{xg}) + b_2^{pxg} \cdot log(\frac{wageu_{t-1}}{prod_{t-1}}) + b_3^{pxg} \cdot dlog(p_{t-1}^{xg}) + b_4^{pxg} \cdot d(LPLC) + b_0^{pxg} \quad \text{(EQ. PXG)}$$

$$dlog(p^{xs}) = b_1^{pxs} \cdot log(p_{t-1}^{xs}) + b_2^{pxs} \cdot LPLC_{t-1} + b_3^{pxs} \cdot dlog(p_{t-1}^{xs}) + b_4^{pxs} \cdot dlog(p_{t-4}^{xs}) + b_5^{pxs} \cdot d(LPLC) + b_6^{pxs} \cdot (1 - DUMEURO) \cdot dlog(xr_{t-1}^{it_i s}) + b_0^{pxs} \quad \text{(EQ. PXS)}$$

Table 5.22: Prices of Export Goods

Dependent Variable: $dlog(p^{xg})$
Method: Least Squares
Sample (adjusted): 1999Q2 2017Q3
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(b_1^{pxg})	−0.059616	0.028900	−2.062865	0.0429
(b_2^{pxg})	0.033722	0.016451	2.049898	0.0442
(b_3^{pxg})	0.384378	0.093945	4.091523	0.0001
(b_4^{pxg})	1.084421	0.249108	4.353222	0.0000
(b_0^{pxg})	0.028272	0.015724	1.797972	0.0766

R-squared	0.458441	Mean dependent var	0.003290
Adjusted R-squared	0.427047	S.D. dependent var	0.006771
S.E. of regression	0.005125	Akaike info criterion	−7.644242
Sum squared resid	0.001812	Schwarz criterion	−7.488562
Log likelihood	287.8369	Hannan-Quinn criter.	−7.582139
F-statistic	14.60251	Durbin-Watson stat	2.249508
Prob(F-statistic)	0.000000		

Finally, the index for Italian competitiveness is found to depend, from the same index for German competitiveness and from the deflator of exports of good in both the short and the long-run. Residuals are not AC, but normality is rejected.

$$dlog(COMP^{it}) = b_1^{comp} \cdot dlog(COMP^{de}) + b_2^{comp} \cdot dlog(p^{xg}) + b_3^{comp} \cdot log(COMP_{t-1}^{it}) + b_4^{comp} \cdot log(COMP_{t-1}^{de}) + b_5^{comp} \cdot log(p_{t-1}^{xg}) + b_0^{compit}$$

Table 5.23: Prices od Export Services

Dependent Variable: $dlog(p^{xs})$
Method: Least Squares
Sample (adjusted): 1997Q2 2017Q3
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(b_1^{pxs})	−0.096056	0.032673	−2.939887	0.0044
(b_2^{pxs})	0.077256	0.025579	3.020311	0.0035
(b_3^{pxs})	0.169987	0.082646	2.056803	0.0432
(b_4^{pxs})	0.559838	0.082542	6.782442	0.0000
(b_5^{pxs})	0.677360	0.124714	5.431326	0.0000
(b_6^{pxs})	−0.074011	0.031154	−2.375646	0.0201
(b_0^{pxg})	−0.002357	0.000757	−3.112404	0.0026

R-squared	0.586202	Mean dependent var	0.003929
Adjusted R-squared	0.553098	S.D. dependent var	0.004086
S.E. of regression	0.002732	Akaike info criterion	−8.886378
Sum squared resid	0.000560	Schwarz criterion	−8.680926
Log likelihood	371.3415	Hannan-Quinn criter.	−8.803892
F-statistic	17.70795	Durbin-Watson stat	2.101065
Prob(F-statistic)	0.000000		

(EQ. IT_COMP)

Table 5.24: Competitiveness

Dependent Variable: $dlog(COMP^{it})$
Method: Least Squares
Sample (adjusted): 1996Q2 2017Q3
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(b_1^{comp})	0.850521	0.051435	16.53568	0.0000
(b_2^{comp})	0.491561	0.127828	3.845473	0.0002
(b_3^{comp})	−0.349408	0.042727	−8.177739	0.0000
(b_4^{comp})	0.438365	0.050674	8.650695	0.0000
(b_5^{comp})	0.185315	0.025234	7.343766	0.0000
(b_0^{compit})	−0.377500	0.102292	−3.690405	0.0004

R-squared	0.837263	Mean dependent var	0.000301
Adjusted R-squared	0.827092	S.D. dependent var	0.013231
S.E. of regression	0.005502	Akaike info criterion	−7.500296
Sum squared resid	0.002422	Schwarz criterion	−7.329062
Log likelihood	328.5127	Hannan-Quinn criter.	−7.431382
F-statistic	82.31828	Durbin-Watson stat	1.633984
Prob(F-statistic)	0.000000		

5.4.4 Interest Rates and Rates of Return

We now have a number of equations describing interest rate, and implicit interest rates and rates of return for our assets. These will be used to link our variables to the main rates and variables, in order to give a system-wide dynamics. Of course, most of these specifications may well be improved, but it is not the purpose of this work to come out with the "best" econometric outcomes, but rather to capture the major inter-relations among our sectors and overall financial dynamics.

Bank Deposits and Loans The interest rate on deposits (r^{deps}) is estimated with an ECM depending, in the long-run, on the interest rate on ECB refinancing, the three-months $EURIBOR3$ and the interest rate on Government Bonds, normalized to reduce multi-collinearity among regressors. Heteroskedastic residuals are taken care of with the Huber-White-Hinkley method. Diagnostics shows that AC is rejected, but residuals display non-normality. Estimation output is reported below. It is worth noting that we track the 2008 downturn without resorting to dummies[16].

[16] In this regard, adding a dummy for 2011q4 would improve the R^2 up to 74%. However, our strategy will be not to resort to IV as long as we can keep track of the major dynamics without them.

$$d(r^{deps}) = c_1^{rd} \cdot r_{t-1}^{deps} + c_2^{rd} \cdot r_{t-1}^{adv} + c_3^{rd} \cdot (EURIBOR3_{t-1} - r_{t-1}^{adv}) \\ + c_4^{rd} \cdot (r_{t-1}^{b} - EURIBOR3_{t-1}) + c_5^{rd} \cdot d(r_{t-1}^{adv}) + c_0^{rdeps} \quad \text{(EQ. RDEPS)}$$

Table 5.25: Interest Rate on Deposits

Dependent Variable: D(RDEPS)
Method: Least Squares
Sample (adjusted): 1999Q3 2017Q4
Included observations: 74 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(c_1^{rd})	−0.194817	0.044621	−4.366055	0.0000
(c_2^{rd})	0.119628	0.028486	4.199564	0.0001
(c_3^{rd})	0.224368	0.144772	1.549805	0.1258
(c_4^{rd})	0.112290	0.034527	3.252275	0.0018
(c_5^{rd})	0.667039	0.118625	5.623077	0.0000
(c_0^{rdeps})	0.002406	0.065447	0.036769	0.9708

R-squared	0.677990	Mean dependent var	−0.019748
Adjusted R-squared	0.654312	S.D. dependent var	0.288745
S.E. of regression	0.169768	Akaike info criterion	−0.631159
Sum squared resid	1.959849	Schwarz criterion	−0.444342
Log likelihood	29.35287	Hannan-Quinn criter.	−0.556635
F-statistic	28.63466	Durbin-Watson stat	1.793512
Prob(F-statistic)	0.000000	Wald F-statistic	15.85540
Prob(Wald F-statistic)	0.000000		

Next, we have the interest rates on our three different types of Bank Loans to domestic productive sectors: i.e. for Mortgages, Consumer Credit and Firms production.

We begin with the interest rate on mortgage credit (EQ. RBLMO), which depends on the same determinants of the rate on deposits, albeit with different coefficients, plus the spread between Italian and German 10-year Treasuries. the same approach is used for the interest rate on consumer credit and interest rate on non loans to non-financial Firms.

$$d(r^{blmo}) = c_1^{rmo} \cdot r_{t-1}^{blmo} + c_2^{rmo} \cdot r_{t-1}^{adv} + c_3^{rmo} \cdot EURIBOR3_{t-1} - r_{t-1}^{adv} + c_4^{rmo} \cdot SPREAD_{t-1} + c_5^{rmo} \cdot d(r_{t-1}^{blmo}) + c_6^{rmo} \cdot d(r^{adv}) + c_7^{rmo} \cdot d(EURIBOR3 - r^{adv}) + c_0^{rblmo}$$

(EQ. RBLMO)

$$d(r^{blcc}) = c_1^{rcc} \cdot r_{t-1}^{blcc} + c_2^{rcc} \cdot r_{t-1}^{adv} + c_3^{rcc} \cdot d(r_{t-1}^{blcc}) + c_4^{rcc} \cdot d(r^{adv}) + c_5^{rcc} \cdot IV\text{“}2009q1\text{”} + c_0^{rblcc}$$

(EQ. RBLCC)

$$d(r^{blfirms}) = c_1^{rlf} \cdot r_{t-1}^{blfirms} + c_2^{rlf} \cdot r_{t-1}^{adv} + c_3^{rlf} \cdot SPREAD_{t-1} + c_4^{rlf} \cdot d(r_{t-1}^{blfirms}) + c_5^{rlf} \cdot d(r^{adv}) + c_6^{rlf} \cdot d(EURIBOR3 - r^{adv}) + c_0^{rblfirms}$$

(EQ. RBLFIRMS)

Table 5.26: Interest Rate on Mortgages Credit

Dependent Variable: D(RBLMO)
Method: Least Squares
Sample (adjusted): 1999Q2 2017Q4
Included observations: 75 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(c_1^{rmo})	−0.047314	0.020880	−2.266025	0.0267
(c_2^{rmo})	0.049231	0.017294	2.846656	0.0059
(c_3^{rmo})	0.073676	0.023735	3.104179	0.0028
(c_4^{rmo})	0.014798	0.005489	2.695886	0.0089
(c_5^{rmo})	0.331596	0.053198	6.233180	0.0000
(c_6^{rmo})	0.366594	0.024841	14.75789	0.0000
(c_7^{rmo})	0.396270	0.054207	7.310272	0.0000
(c_0^{rblmo})	0.089701	0.051068	1.756489	0.0836

R-squared	0.944725	Mean dependent var	−0.059649
Adjusted R-squared	0.938950	S.D. dependent var	0.192068
S.E. of regression	0.047457	Akaike info criterion	−3.157451
Sum squared resid	0.150895	Schwarz criterion	−2.910252
Log likelihood	126.4044	Hannan-Quinn criter.	−3.058747
F-statistic	163.5878	Durbin-Watson stat	2.574008
Prob(F-statistic)	0.000000	Wald F-statistic	284.7883
Prob(Wald F-statistic)	0.000000		

Table 5.27: Interest Rate on Consumer Credit

Dependent Variable: $d(r^{blcc}$
Method: Least Squares
Sample (adjusted): 1999Q2 2017Q4
Included observations: 75 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(c_1^{rcc})	−0.041861	0.022200	−1.885644	0.0636
(c_2^{rcc})	0.034480	0.015549	2.217491	0.0299
(c_3^{rcc})	0.479457	0.048501	9.885564	0.0000
(c_4^{rcc})	0.291939	0.058138	5.021489	0.0000
(c_5^{rcc})	−0.979975	0.059951	−16.34613	0.0000
(c_0^{rblcc})	0.097664	0.058530	1.668600	0.0997

R-squared	0.911633	Mean dependent var	−0.056943
Adjusted R-squared	0.905230	S.D. dependent var	0.259079
S.E. of regression	0.079757	Akaike info criterion	−2.143046
Sum squared resid	0.438921	Schwarz criterion	−1.957647
Log likelihood	86.36422	Hannan-Quinn criter.	−2.069018
F-statistic	142.3672	Durbin-Watson stat	1.558217
Prob(F-statistic)	0.000000	Wald F-statistic	5106.366
Prob(Wald F-statistic)	0.000000		

Table 5.28: Interest Rate on Credit to Non-Financial Firms

Dependent Variable: $d(r^{blfirms})$
Method: Least Squares
Sample (adjusted): 2003Q3 2017Q4
Included observations: 58 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(c_1^{rlf})	−0.128544	0.028312	−4.540298	0.0000
(c_2^{rlf})	0.132094	0.023908	5.525111	0.0000
(c_3^{rlf})	0.083813	0.017653	4.747834	0.0000
(c_4^{rlf})	0.229688	0.046169	4.974942	0.0000
(vc_5^{rlf})	0.578250	0.044533	12.98488	0.0000
(c_6^{rlf})	0.633285	0.051111	12.39039	0.0000
$(c_0^{rblfirms})$	0.086691	0.061341	1.413257	0.1637

R-squared	0.914087	Mean dependent var	−0.049984
Adjusted R-squared	0.903980	S.D. dependent var	0.285793
S.E. of regression	0.088559	Akaike info criterion	−1.897537
Sum squared resid	0.399976	Schwarz criterion	−1.648862
Log likelihood	62.02856	Hannan-Quinn criter.	−1.800673
F-statistic	90.43776	Durbin-Watson stat	2.130188
Prob(F-statistic)	0.000000	Wald F-statistic	95.43175
Prob(Wald F-statistic)	0.000000		

Foreign Liabilities and FDI's We now have three more (implicit) interest rate to estimate: one for foreign issued liabilities and two for FDI's. We start with the changes in the (implicit) rate on foreign liabilities (EQ. RF), simply estimated as a function of its lagged level and that on the 10-Year German Bund. We thus have:

$$d(r^f) = c_1^{rf} \cdot r_{t-1}^f + c_2^{rf} \cdot r_{t-1}^{b10\_de} + c_0^{rf} \tag{EQ. RF}$$

For FDI's, recall that we have both FDI "incoming" and "outgoing", so that we need to estimate the (implicit) rates of returns for both. Starting from the former, the (current) RoE for incoming FDI's (EQ. RFDII) is estimated as function of its lagged level, the current level of the exchange rate against the US$ and the share price Index for US. Residuals ore not Normal and AC is not rejected. Finally, the changes in the (implicit) RoE on outgoing FDI's (EQ. RFDIO). This is simply estimated against its lagged values, the lagged interest rate on domestic Shares (r_{t-1}^e) and an IV for 2005q2. Both output are reported below.

$$r^{fdii} = c_1^{rfdii} \cdot r_{t-1}^{fdii} + c_2^{rfdii} \cdot xr^{it\_us} + c_3^{rfdii} \cdot sp^{us} + c_0^{rfdii} \tag{EQ. RFDII}$$

$$d(r^{fdio}) = c_1^{rfdio} \cdot d(r_{t-1}^{fdio}) + c_2^{rfdio} \cdot d(r_{t-2}^{fdio}) + c_3^{rfdio} \cdot d(r_{t-3}^{fdio}) + c_4^{rfdio} \cdot dum_{10}\text{“}2005q2\text{”} + c_5^{rfdio} \cdot d(r_{t-1}^e) + c_0^{rfdio} \tag{EQ. RFDIO}$$

5.4.5 Asset Prices

Here we report the equations describing Asset Prices. We decided to model only the prices for Shares, Banks' Equities and Shares, Foreign Liabilities and FDI's and Government Bonds, while leaving the other exogenous. This choice was led by the finding, first, that the dynamics of most of these prices are difficult to model and, secondly, that, as we said many times, the more behaviors one models, the "heavier" the model becomes, in terms of both the number of equations and the amount of dynamic links simultaneously at work. Of course a more descriptive specification would imply better estimates for the single equations, but this does not directly translates into more realistic system-wide dynamics and, moreover, it may well make the analysis of the results trickier, given the possible multiple contrasting behaviors.

The strategy, thus, is to track the major effects that interest rates, real flows and other assets prices have on our prices of assets. All estimation output are reported in Appendix C.1.

Table 5.29: (Implicit) Interest Rate on Foreign Issued Liabilities

Dependent Variable: $d(r^f)$
Method: Least Squares
Sample (adjusted): 1999Q4 2017Q3
Included observations: 72 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(c_1^{rf})	−0.271598	0.068155	−3.984984	0.0002
(c_2^{rf})	0.187038	0.046176	4.050498	0.0001
(c_0^{rf})	0.264604	0.089133	2.968630	0.0041

R-squared	0.223267	Mean dependent var	−0.069590
Adjusted R-squared	0.200753	S.D. dependent var	0.275966
S.E. of regression	0.246716	Akaike info criterion	0.079613
Sum squared resid	4.199932	Schwarz criterion	0.174474
Log likelihood	0.133950	Hannan-Quinn criter.	0.117377
F-statistic	9.916806	Durbin-Watson stat	2.052942
Prob(F-statistic)	0.000164	Wald F-statistic	8.313203
Prob(Wald F-statistic)	0.000583		

We start with the Prices of Government Bonds, which are estimated as a function of their lagged values and the current interest rate on Bonds:

$$1/(p^b) = \alpha_1^{pb} \cdot 1/p_{t-1}^b + \alpha_2^{pb} \cdot r^b + \alpha_0^{pb} \qquad \text{(EQ. PB)}$$

We then have the prices of Banks Bonds and Shares. Starting from the former, the growth in the price of Banks Bonds (EQ. PBB) is estimated against its lagged level, on the ratio between interest paid by banks relative to the existing stock and the lagged level of the price and that of domestic shares. the price of Banks Shares (EQ. PEB) is simply linked to the general price index for the Italian stock market (sp^{it}), allowing for a structural break in the first quarter of 2011. We have:

$$log(p^{bb}) = \alpha_1^{pbb} \cdot log(p_{t-1}^{bb}) + \alpha_2^{pbb} \cdot \frac{INTP_{fc,t-1} \cdot 4}{BB_{t-2}} + \alpha_3^{pbb} \cdot \frac{BB_{row,t-1}}{BB_{t-1}} + \alpha_4^{pbb} \cdot p_{t-1}^b + \alpha_5^{pbb} \cdot p_{t-1}^{en} + \alpha_0^{pbb} \qquad \text{(EQ. PBB)}$$

$$log(p^{eb}) = \alpha_1^{peb} \cdot log(p_{t-1}^{eb}) + \alpha_2^{peb} \cdot log(sp^{it}) + \alpha_3^{peb} \cdot dum_{11}\text{“2008q1”} + \alpha_4^{peb} \cdot dum_{12}\text{“2011q1}_b\text{”} + \alpha_5^{peb} \cdot dum_{12}\text{“2011q1}_b\text{”} \cdot log(sp^{it}) + \alpha_6^{peb} \cdot dum_{12}\text{“2011q1}_b\text{”} \cdot log(p_{t-1}^{eb} + \alpha_0^{peb}$$

Table 5.30: (Implicit) RoE on Incoming FDI's

Dependent Variable: r^{fdii}
Method: Least Squares
Sample (adjusted): 1999Q2 2017Q3
Included observations: 74 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(c_1^{rfdii})	0.155904	0.110090	1.416155	0.1612
(c_2^{rfdii})	6.267936	2.578810	2.430554	0.0176
(c_3^{rfdii})	−1.418929	1.141364	−1.243187	0.2179
(c_0^{rfdii})	1.202188	2.796874	0.429833	0.6686

R-squared	0.242473	Mean dependent var	5.855170
Adjusted R-squared	0.210007	S.D. dependent var	2.589649
S.E. of regression	2.301719	Akaike info criterion	4.557728
Sum squared resid	370.8538	Schwarz criterion	4.682272
Log likelihood	−164.6359	Hannan-Quinn criter.	4.607410
F-statistic	7.468639	Durbin-Watson stat	2.033562
Prob(F-statistic)	0.000208	Wald F-statistic	11.42282
Prob(Wald F-statistic)	0.000003		

Table 5.31: (Implicit) RoE on Outgoing FDI's

Dependent Variable: $d(r^{fdio})$
Method: Least Squares
Sample (adjusted): 2000Q1 2017Q3
Included observations: 71 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(c_1^{rfdio})	−0.681328	0.132347	−5.148036	0.0000
(c_2^{rfdio})	−0.443362	0.109949	−4.032453	0.0001
(c_3^{rfdio})	−0.322606	0.092081	−3.503509	0.0008
(c_4^{rfdio})	5.295667	2.616940	2.023611	0.0471
(c_5^{rfdio})	0.089999	0.169458	0.531099	0.5972
(c_0^{rfdio})	−0.294633	0.311906	−0.944620	0.3484

R-squared	0.386318	Mean dependent var	−0.050187
Adjusted R-squared	0.339111	S.D. dependent var	3.165210
S.E. of regression	2.573159	Akaike info criterion	4.808867
Sum squared resid	430.3746	Schwarz criterion	5.000080
Log likelihood	−164.7148	Hannan-Quinn criter.	4.884906
F-statistic	8.183599	Durbin-Watson stat	1.964346
Prob(F-statistic)	0.000005		

(EQ. PEB)

We then have the price of Shares issued by domestic Non-Financial Corporations. This price is linked to a price index for the US stock market, and the discrepancy between the Italian and US stock market price indexes. Residual are strongly auto-correlated, but Normality is not rejected.

$$log(p^{en}) = \alpha_1^{pen} \cdot log(p_{t-1}^{en}) + \alpha_2^{pen} \cdot log(sp^{us}) + \alpha_3^{pen} \cdot log(\frac{sp^{us}}{sp^{it}}) + \alpha_0^{pen} \quad \text{(EQ. PEN)}$$

We now have the final set of prices, i.e. those of foreign issued Liabilities (EQ. PF), and that of FDI's. Starting from the former, this is estimated as a function of its lagged value and that of the exchange rate against the US$, and on the current level of the interest rate on German 10-year Bund. The (changes in the rate of growth of) prices for FDI's are simply estimated as a function of p^F in equations (EQ. PFDII and EQ. PFDIO). We thus have:

$$log(p^f) = \alpha_1^{pf} \cdot log(p_{t-1}^f + \alpha_2^{pf} \cdot log(xr^{it\_us}) + \alpha_3^{pf} \cdot RB10^{de} + \alpha_0^{pf} \quad \text{(EQ. PF)}$$

$$dlog(p^{fdio}) = \alpha_1^{pfdio} \cdot dlog(p^f) + \alpha_0^{pfdio} \quad \text{(EQ. PFDIO)}$$

$$dlog(p^{fdii}) = \alpha_1^{pfdii} \cdot dlog(p^f) + \alpha_0^{pfdii} \quad \text{(EQ. PFDII)}$$

5.4.6 Asset Stocks & Flows

Finally, we only need to define the stochastic equations describing the demand and supply for Financial Assets set up in Section 5.3. We will indeed use the same numbering for the equations as in the reported Section so as to ease the reconstruction of the model description (adding a B to new equation tags).

Households We thus start with the households sector, for which we need to define the demand for monetary base (HH.28B), Consumer (HH. 36B) and Mortgages Credit (HH. 37B). Starting with the former, the monetary base held by households depends on nominal consumption, in the long-run and in the short-run, and on the interest rate on deposits only in the short-run.

Change in the rate of growth in the demand for liquidity is estimated as a function of the lagged changes in its growth rate and that of consumption, the difference in the interest rates on deposits and and an IV variable for 2002q1.

$$dlog(MB_{hh}) = \nu_1^{mbhh} \cdot dlog(MB_{hh,t-3}) + \nu_2^{mbhh} \cdot dlog(MB_{hh,t-4}) + \nu_3^{mbhh} \cdot dlog(CONS_{t-4}) + \nu_4^{mbhh} \cdot IV\text{“2002q1”} + \nu_5^{mbhh} \cdot IV\text{“2002q1”}_{t-1} + \nu_6^{mbhh} \cdot d(r^{deps}_{t-1}) + \nu_7^{mbhh} \cdot d(r^{deps}_{t-2}) + \nu_8^{mbhh} \cdot d(r^{deps}_{t-4}) + \nu_9^{mbhh} \cdot log(MB_{hh,t-1}) + \nu_1^{mbhh}0 \cdot log(CONS_{t-1}) + \nu_0^{mbhh} \quad \text{(HH.28B)}$$

Next, we have the demand for Consumer Credit (relative to disposable income), which is estimated as an adjustment function towards a stock of credit-to-disposable income which depends on the interest rate on Consumer Credit and on the changes in the propensity to consume. We thus have:

$$\Delta BLCC/YD_{hh} = \nu_1^{blcc} \cdot \frac{BLCC_{t-4}}{YD_{hh,t-4}} + \nu_2^{blcc} \cdot \frac{\Delta BLCC_{t-1}}{YD_{hh,t-1}} + \nu_3^{blcc} \cdot r_{blcc}) + \nu_4^{blcc} \cdot d(\frac{CONS_{t-1}}{YD_{hh,t-1}}) + \nu_0^{blcc} \quad \text{(HH. 36B)}$$

Finally, we have the demand for (new) Mortgage credit[17], i.e. the *flow* (which we denote with a V), which is also modeled as an adjustment function towards a target rate of the stock of mortgages relative to disposable income, depending on household investment, the interest rate on mortgages, the share of Mortgage write-offs, and the $SPREAD$ between Italian and German 10-year Treasuries.

$$VBLMO/YD_{hh} = \nu_1^{blmo} \cdot \frac{VBLMO_{t-4}}{YD_{hh,t-4}} + \nu_2^{blmo} \cdot \frac{GFCF\_H_{t-1}}{YD_{hh,t-1}} + \nu_3^{blmo} \cdot r_{blmo}) + \nu_4^{blmo} \cdot \frac{BLMO_{t-1}}{YD_{hh,t-1}}) + \nu_5^{blmo} \cdot \frac{BLMOWO_{t-1}}{BLMO_{t-1}}) + \nu_6^{blmo} \cdot SPREAD_{t-1} + \nu_0^{blcc} \quad \text{(HH. 37B)}$$

All residual diagnostics reject AC while Normality is not rejected. Outputs and Graphs for the estimated equations are displayed, once again, in Appendices.

Central Bank Next, we have the Central Bank, since all demand for assets regarding Non-Financial Corporations are accommodated. First, in (CB. 09B), we have the Supply of Advances to the Banking sector net of

[17]Relative to disposable income.

QE (relative to Deposits), which is estimated (pending better specifications) as a function of its lagged level and that of $SPREAD$.

$$ADVNET/DEPS = \nu_1^{advn} \cdot \frac{ADVNET_{t-1}}{DEPS_{t-1}} + \nu_2^{advn} \cdot SPREAD_{t-1} + \nu_0^{advn} \tag{CB. 09B}$$

Financial Corporations For Banks, We need to define the demands for Government Bills and Foreign issued Liabilities. It is worth noting, however, that our estimates for Financial corporations suffer greatly from the presence of various structural breaks (entrance in the Eurozone, financial Crisis, QE etc.). This is so because, first, there must have been changes in the behaviors related to the various phases through which Italy has been and, secondly, because our time series are too-short to capture these effects. Finally, as we will explain in more detail in Chapter 6, as long as QE is active (at least until October 2018), it would be very difficult to establish how shall Banks change their behavior when this is meant to end when building model simulations.

The flow of acquisitions of Government Bonds (FC. 26B) (relative to the existing stock) is thus estimated as a function of its lagged level, that of SPREAD and our dummy related to the Second Phase of QE. We then have the flow of acquisitions of Foreign issued Liabilities (FC. 28B), which are estimated against the (lagged) interest rate of domestic Bonds, our variable for $SPREAD$, the changes in the exchange rate against the dollar and the flows of interest paid by the foreign sector relative to the existing stock of Foreign issued Liabilities. Residual diagnostic shows that, for (FC. 26B) AC is rejected but residual are not normal, while the opposite is true for (FC. 28B). We have:

$$\begin{aligned} VB_{fc}/B_{fc,t-1} = {} & \nu_1^{bfc} \cdot \frac{VB_{fc,t-4}}{B_{fc,t-5}} + \nu_2^{bfc} \cdot SPREAD_{t-1} \\ & + \nu_3^{bfc} \cdot \frac{DADVQE2}{B_{fc,t-1}} + \nu_0^{bfc} \end{aligned} \tag{FC. 26B}$$

$$\begin{aligned} VF_{fc}/F_{fc,t-1} = {} & \nu_1^{ffc} \cdot r_{t-1}^{B} + \nu_2^{ffc} \cdot SPREAD_{t-1} + \nu_3^{ffc} \cdot \frac{xr^{it\_us}}{xr_{t-1}^{it\_us}} \\ & + \nu_4^{ffc} \cdot \frac{INTP_{row,t-1}}{F_{t-2}} + \nu_0^{ffc} \end{aligned} \tag{FC. 28B}$$

Government Finally, with respect to the Government sector, we only need to define the equation for the changes in the stock of Deposits (GVT. 29B), i.e. the demand for Banks Deposits by the public sector. These are simply estimated as a function of their lagged value and that of Total Government Expenditures G relative to the existing stock of Deposits. We find the expected positive effect for both. Residuals are Normally distributed, but AC is not rejected. We thus have:

$$VDEPS_{gvt}/DEPS_{gvt,t-1} = \nu_1^{dgvt} \cdot \frac{VDEPS_{gvt,t-4}}{DEPS_{gvt,t-5}} + \nu_2^{dgvt} \cdot \frac{G_{t-1}}{DEPS_{gvt,t-1}} + \nu_0^{dgvt} \tag{GVT. 29B}$$

Chapter 6

Model Simulations

In this chapter, we will make use of the model built in the Second Part of this work to simulate the medium-run effects of different economic policies.

The SFC structure we built will make sure that nothing gets lost when projecting our variables into the future, while enabling us to detect potentially unstable stock-flow dynamics. Moreover, in this model the balance sheets adjustments that follow a shock will have chain effects on the real side, in contrast with the Structural models that are usually utilized in Government Agencies and Central Banks, as we detailed in Chapter 5.

Before all this, however, it may be interesting to see how the model performs in replicating historical data. Thus, the rest of the Chapter is organized as follows. The first Section describes the validation of the model and discusses the issues that emerges. Then, in Section 6.2, we will develop the *Baseline* for the model, describing how we project exogenous variables in out-of-sample simulations. Finally, in Section 6.3 to 6.5, we will run economic policy simulations on our model and present overall results.

6.1 Model Validation

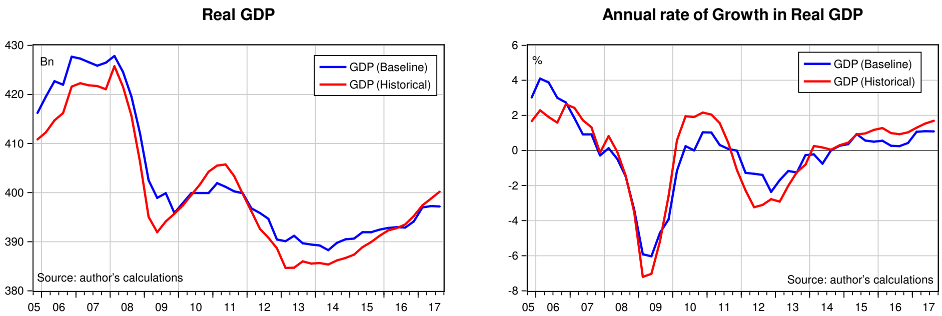
In this section, we will show how the model performs in replicating historical data. We will only look at the most important figures, and show some of the problems that emerges and discuss how to resolve them.

Starting with GDP, Figure 6.1 displays the evolution of Real GDP, in volumes and annual growth rates. Our estimate resembles historical data and indeed, as we will show later in the Chapter, our GDP out-of-sample forecasts for the first 3 quarters matches quite well new data releases (the model is indeed estimated on the period 2005q1-2017q3, while last data release by ISTAT is for 2018q2). The single components of GDP, in nominal values[1], are displayed in Figure 6.2. It shall be noted that, apart from consumption (which we overesti-

[1] We display here variables at current prices, instead of constant prices, so that the discrepancy is due to both the error in tracking the variable at constant prices, and to the error in simulating prices.

mate for the whole sample) and government expenditure (but only from 2014 onward), we track well the evolution of the single components.

Figure 6.1: Real GDP



Looking at the Net Lending of our institutional sectors, the figures do not look as good as those for GDP. We track well only the government, and only the overall dynamics with respect to other sectors. In particular, we underestimate net lending for the households sector in the second part of the sample, while we overestimate it for firms during the same period. Finally, we consistently underestimate that of the foreign sector. This may be due to accumulation of errors in previous lines of the Transaction Matrix, that accumulates into Net Lending. In future research the simulation error can be reduced by better econometric estimates.

With respect to the labor market, Figure 6.4 displays the dynamics of the unemployment rate and productivity, which we both track well. The same is true when looking at the evolution of wages and prices, displayed in Figure 6.5. Here, however, we have a first glance of the difficulties related to the estimation of prices. It is clear that, notwithstanding the dynamic captures the slowdown in inflation, we overestimate prices in the last three years of the sample.

When looking at financial assets and liabilities, however, things may get complicated. Take for example the left Figure in 6.6, which displays the stock of loans to firms. It is clear the divergence in the two series, but one may also notice that the overall dynamic looks *downward shifted*. If we analyze the right-hand Figure, displaying the *flows*, we find indeed that we start to consistently underestimate loans from 2009 onward, while tracking very well the dynamic. However, this underestimation, since it *accumulates* every quarter, implies this kind of evolution for the stock. For most of our asset we obtain better behaviors. As an example, Figures 6.7 displays the stocks of deposits (DEPS), FDI's (outgoing) (FDIO) and foreign liabilities (F). While we consistently underestimate deposits (apart from the first two years of the sample, where the model registers a faster increase than actual values), the opposite is true with respect to FDI's and foreign liabilities. The model, however, keeps very good track of the dynamics, and the errors are small enough (for FDIO, the largest difference is in the order of 100 billion euros).

Figure 6.2: GDP Components

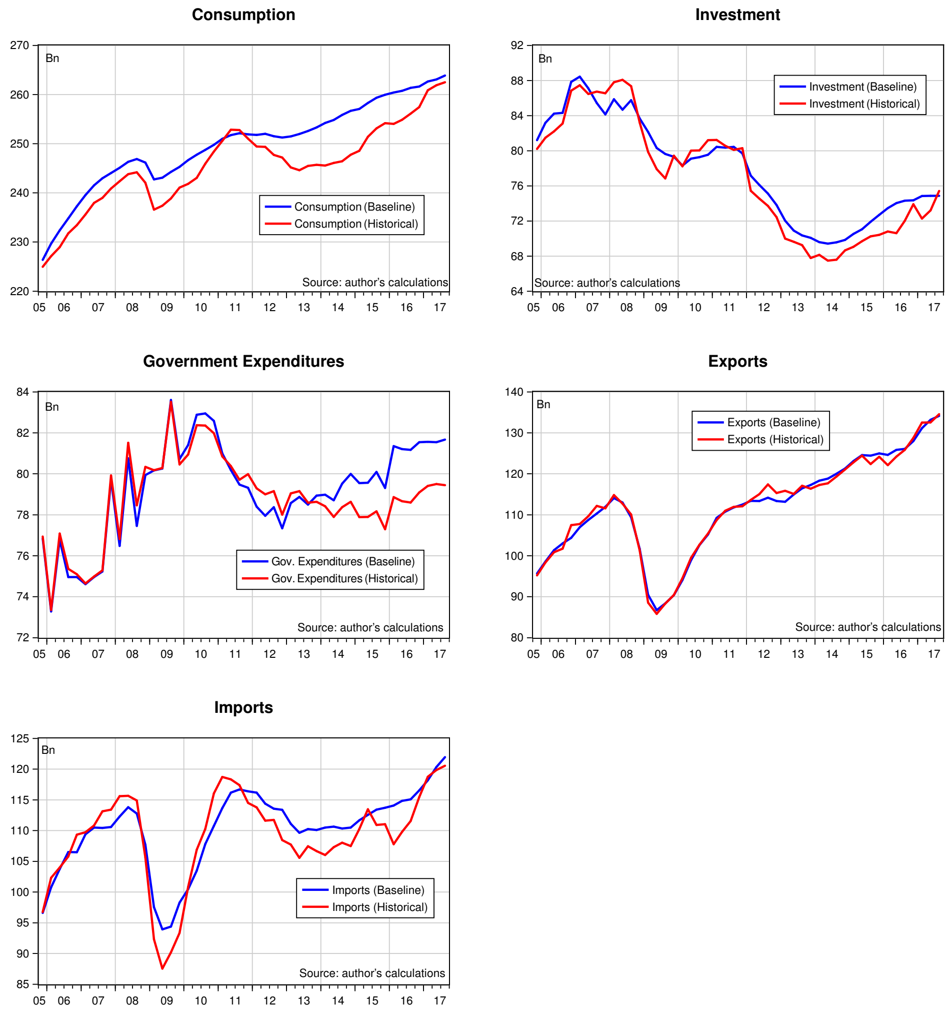


Figure 6.3: Net Lending of Institutional Sectors

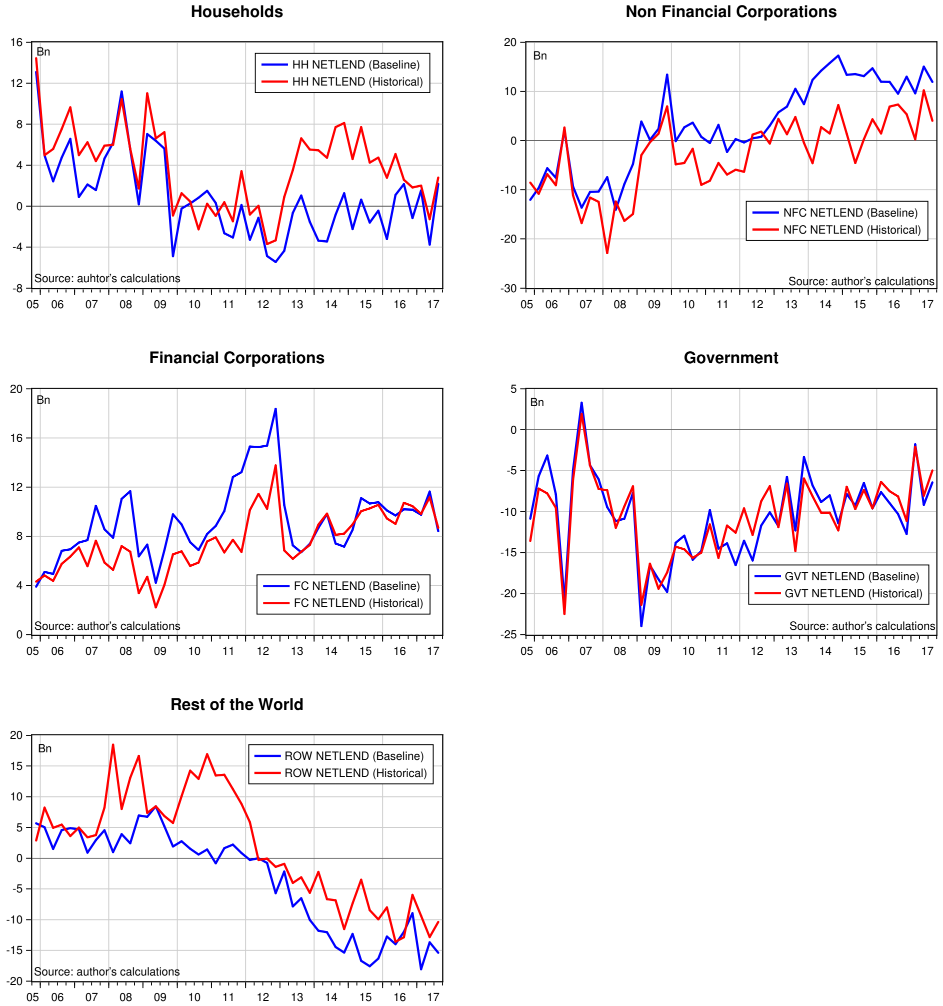


Figure 6.4: Labor Market. Unemployment and Productivity

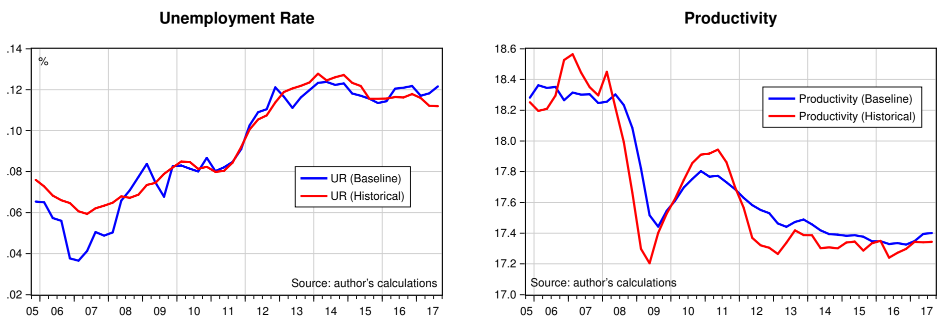


Figure 6.5: Labor Market. Wages and Prices

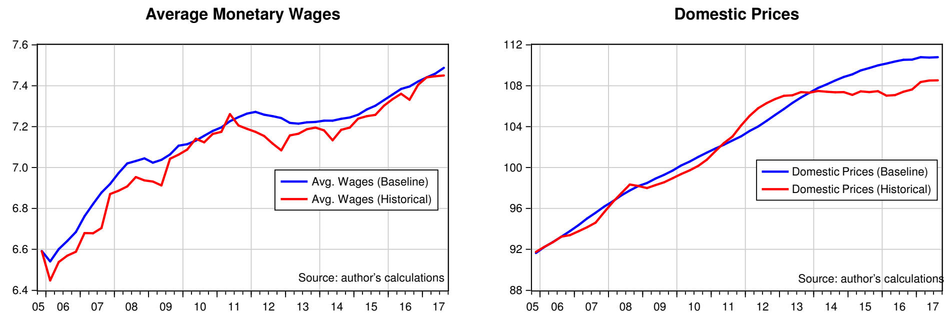
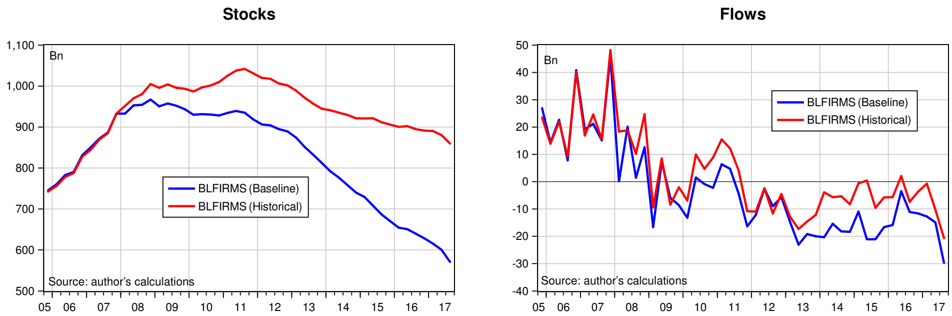


Figure 6.6: Loans to Firms



Finally, we then have prices, for capital and financial goods, and a number of interest rates. Starting from the former, Figure 6.8 displays the prices for our capital goods, namely dwellings (p^{kh}), machinery (p^{km}) and non-residential buildings (p^{knr}). It shall be noted that we overestimate all three categories in the last part of our sample. This will have to be worked out in future developments. Figure 6.9, in turn, shows the dynamics of some of our asset prices. Worth noting is the lower-right figure, which displays the price of government Bonds. Different from all our cases, here we miss completely the evolution of the price, due to the (very) simple mechanism that we used in the estimation. In particular, the coefficient for the interest rate (r^B) in equation EQ. PB is close to zero, so that movements in the interest rate will not affect the price of the Bond. This aspect will have to be, of course, implemented in future releases. Finally, Figure 6.10 displays the dynamics of some of our interest rates. We only decided to display some of the *important* rates, namely the Euribor3, the interest rate on government Bonds (r^B), that on Loans to firms ($r^{BLFIRMS}$) and that on foreign liabilities (r^F).

Figure 6.7: Stocks. Selected Assets

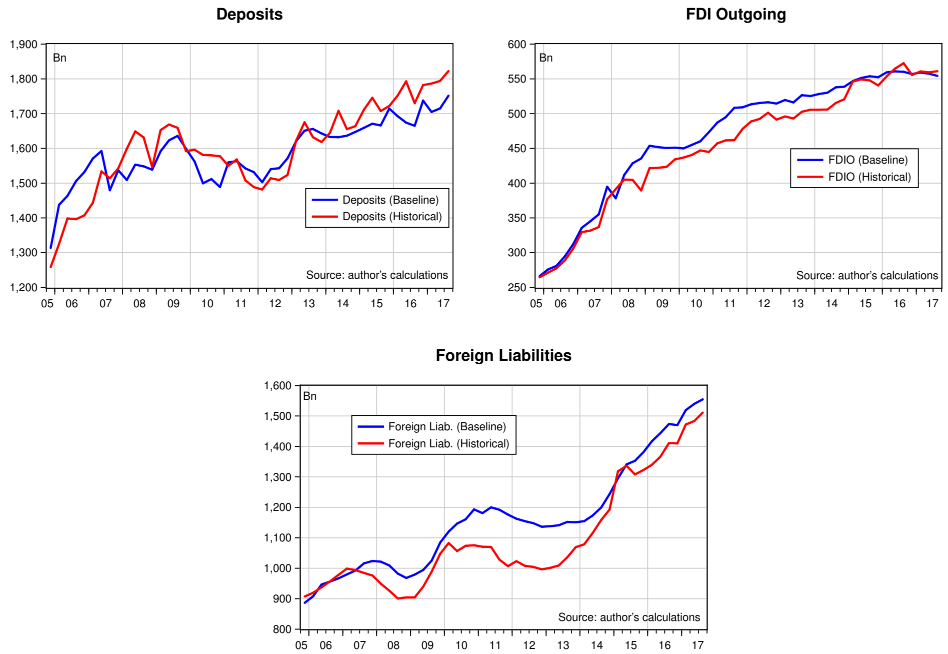


Figure 6.8: Price of Capital Goods

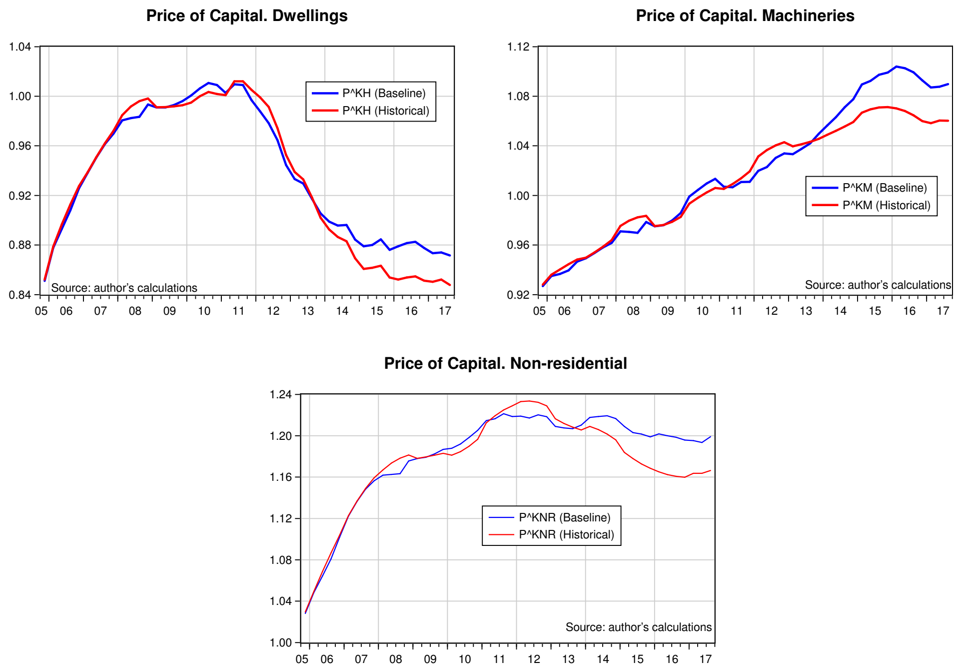


Figure 6.9: Price of Financial Assets

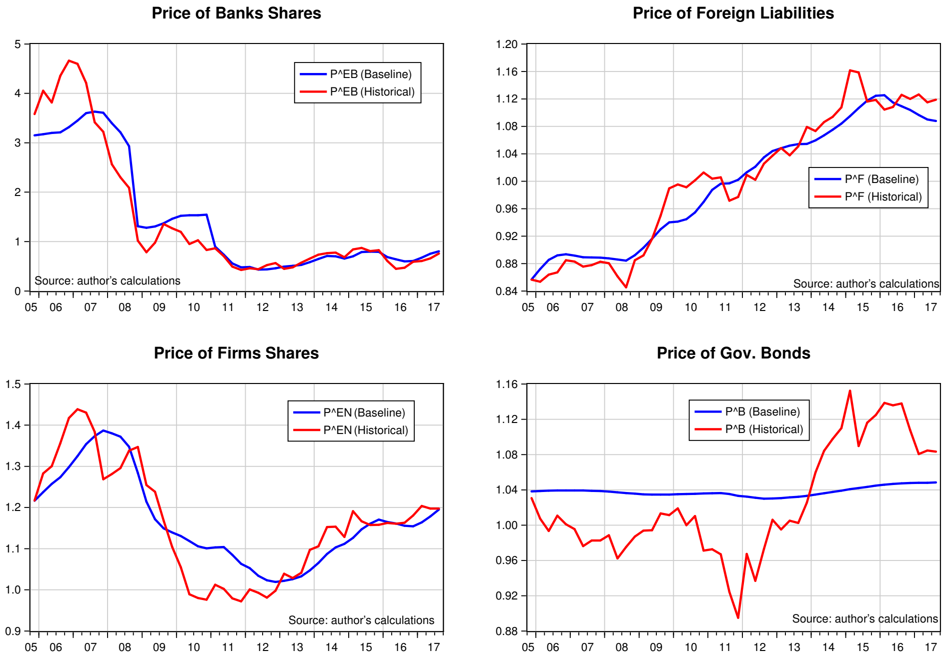
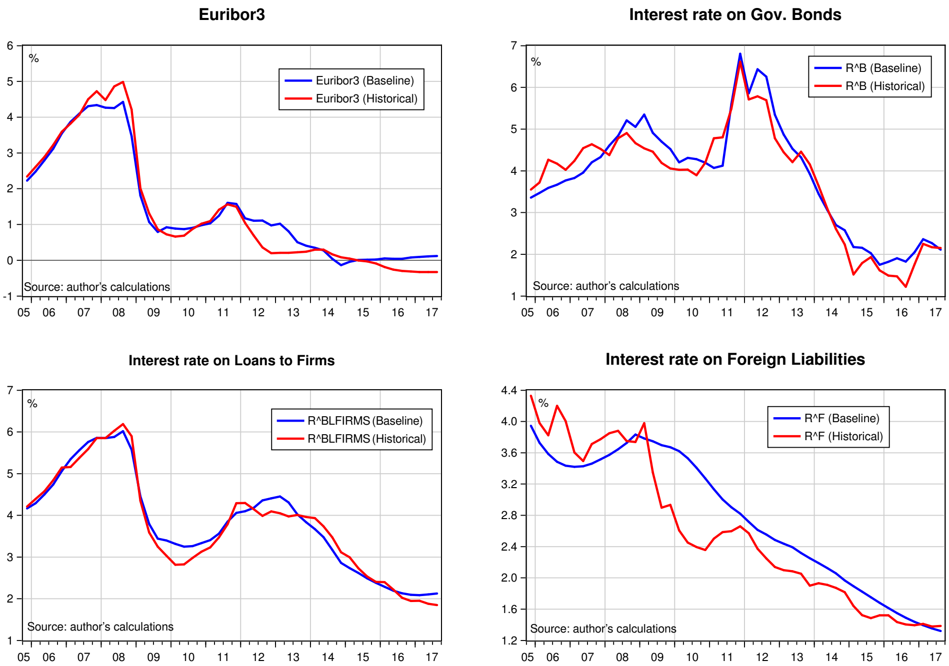


Figure 6.10: Selected Interest Rates



6.2 Projections

Before running simulation exercises, one needs to determine the *Baseline*. This means that we need to project our exogenous variables in the future (which in our case is 2020q4, i.e. the *medium-run*), for the model to be able to compute the endogenous ones. This means making a number of assumptions on the future behavior of such variables.

In theory, the best strategy would be to project them using auto-regressive models or other econometric techniques. However, in practice, when working with such large models, a shortcut may well be adopted. For example, as we detailed in Chapter 3 and 4, we have a number of variables that take account of "discrepancies". These, which are small and gravitating around zero, will be projected as nil[2]. We also set to zero the write-offs in financial assets as well as a number of unexplained financial flows[3] and , finally, all sectoral capital gains in financial assets.

We have a large majority of model variables for which the best strategy is to project them as stable at their current value[4]. Then, we need to make some more assumptions for the variables reflecting the behavior of foreign markets. In this regard, on the basis of their recent behavior, we set the share price index for US (sp^{us}) to grow at 5% per year, while the flows of Incoming and Outgoing FDI's will move (and stabilize) at 25bn. Finally, we have some small exogenous flow related to the net capital income of households the RoW ($KYNET_{hh}$ and $KYNET_{row}$, respectively) for which we chose an annual growth rate of 2%, while the net rent paid by domestic sectors to the Government will raise by 0,5% annually. Last but not least, and accordingly to the recent estimates made by ISTAT, we set the population to decrease at a 0,2% rate per year.

Table 6.1 report our main assumptions regarding out-of-sample variable projections.

A notable example, with respect to the "pragmatism" of our assumptions, is related to our treatment of the QE during the simulation period. While it is said that the QE operations shall end by October or December 2018 (but, still, there is no certainty about it and, in contrast, there are rising signals in the Press that its end will be postponed. The official ECB Annual Press release is scheduled for June 14^{th}), we assume instead that the ECB will continue to inject advances in the Banking system (through our variable $DADVQE2$) throughout our simulation period. This choice was led by multiple reasons. First and foremost, when building the Baseline Scenario, we found that, if setting $DADVQE2$ equal to zero from 2018q3, the stock of (excess) liquidity in Banks' balance sheets goes negative after 2 years as displayed in Figures 6.11 and 6.12, which depicts the various components of Monetary Base, with the red line denoting the beginning

[2]This, together with the *add-factors* that we will describe later in the section, will make sure that the buffer stocks gets all these discrepancies.

[3]These are: VEB, VEN, VF_{cb}, $VGOLD$, and all sectors (but households) $ONFA$, which also oscillate around zero in the last periods of our sample.

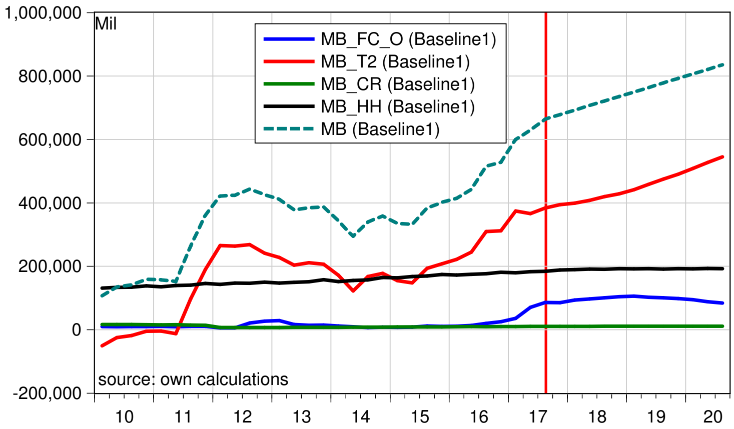
[4]Of course, one needs to look at the individual time-series and then make, case-by-case, the choice on how to project it.

Table 6.1: Out-of-Sample Projections

Variable	Projection	Variable	Projection	Variable	Projection	Variable	Projection
Fiscal Policy		*Write-Offs*		*Parameters*		*Discrepancies*	
GFCFK_G	t-1	BLCCWO	0	*Distribution of Profits among sectors*		disc_cons	t-1
GK	t-1	BLFIRMSWO	0	PAR_OPS_FC	t-1	disc_fc_div_r	t-1
OTCN_GVT	t-1	DEPSWO_HH	0	PAR_OPS_GVT	t-1	disc_fc_int_p	t-1
OTHDNA_GVT	t-1	DEPSWO_NFC	0	PAR_OPS_HH	t-1	disc_fc_int_r	t-1
TAUD_2OW	t-1	DEPSWO_GVT	0			disc_fc_netlend	t-1
TAUD_FC	t-1	DEPSWO	0	*Households*		disc_gfcfk	t-1
TAUD_HH	t-1	RATIO_BLMOWO	0	RATIO_DINV_HH	t-1	disc_gvt_div_r	t-1
TAUD_NFC	t-1			RATIO_GFCF_HH	t-1	disc_gvt_int_p	t-1
TAUD_ROW	t-1	*Population*		RATIO_MIXY	t-1	disc_gvt_int_r	t-1
TAUIW	t-1	POP	Decreases at 0.2% per year			disc_gvt_netlend	t-1
TAUPENS	t-1			*Non-Financial Corporations*		disc_hh_div_r	t-1
TAUS	t-1	*Small Exogenous Flows*		RATIO_GFCFK_NR	t-1	disc_hh_int_p	t-1
TAUSC	t-1	KYNET_FC	t-1	RATIO_GFCF_NFC	t-1	disc_hh_int_r	t-1
TAUSW	t-1	NTRK_FC	t-1	RATIO_PENSR_NFC	t-1	disc_hh_netlend	t-1
TAUI	Increases 0.5% in 2017q4	OTCN_FC	t-1			disc_nfc_int_p	t-1
		OTHDNA_FC	t-1	*Financial Corporations*		disc_nfc_int_r	t-1
Monetary Policy and QE		NTRK_HH	t-1	COEF_SDEPS	t-1	disc_nfc_netlend	t-1
DADVNET	t-1	OTCN_HH	t-1	COEFRES	t-1	disc_row_int_p	t-1
DADVQE2	t-1	OTHDNA_HH	t-1	RATIO_DINV_FC	t-1	disc_row_int_r	t-1
RADV	t-1	TRKOP_HH	t-1	RATIO_GFCF_FC	t-1	disc_row_netlend	t-1
SPREAD	t-1	TRKOR_HH	t-1	RATIO_PENSR_FC	t-1	disc_tax	t-1
DADVQE1	0	TRKTAXP_HH	t-1			disc_trade	t-1
DBCBNET	0	KYNET_NFC	t-1	*Government*		disc_vb_cb	t-1
		NTRK_NFC	t-1	PAR_CC_GVT	t-1	disc_vb_fc	t-1
RoW		OTCN_NFC	t-1	PAR_CI_GVT	t-1	disc_vb_hh	t-1
DE_COMP	t-1	OTHDNA_NFC	t-1	RATIO_DINV_GVT	t-1	disc_vb_nfc	t-1
PGOLD	t-1	TRKTAXPD_NFC	t-1	RATIO_GFCF_GVT	t-1	disc_vb_row	t-1
		TRKTAXPW_NFC	t-1			disc_vbb_hh	t-1
Stock Market		NTRK_ROW	t-1	*Labor Market*		disc_ven_fc	t-1
RE	t-1	OTHDNA_ROW	t-1	RATIO_LFP	t-1	disc_ven_gvt	t-1
REB	t-1	TRKO_GF	t-1	PAR_RETIR	t-1	disc_ven_hh	t-1
SP_IT	t-1	TRKO_GN	t-1	PAR_YPOP	t-1	disc_vf_cb	t-1
SP_US	Grows 5% per year	TRKO_WG	t-1	PARTRATE	t-1	disc_vf_fc	t-1
		WAGES2ROW	t-1	SERVSHARE	t-1	disc_vf_hh	t-1
Unexplained Financial Flows		WAGESFROW	t-1			disc_vgold	t-1
NETLENDF_CB	t-1	TRKTAXP_FC	0	*Parameters in Households Portfolio*		gdpkres	t-1
VEB	0	KYNET_HH	Grows 5% per year	RATIO_B_HH	t-1	xgskres	t-1
ven	0	RENTLNP_HH	Grows 5% per year	RATIO_BB_HH	t-1		
VEN_GVT	0	RENTLNP_NFC	Grows 5% per year	RATIO_EN_HH	t-1		
VF_CB	0	KYNET_ROW	Grows 2% per year	RATIO_F_HH	t-1		
VFDII	2.5 Bn			RATIO_ONFA_HH	t-1		
VFDIO	2.5 Bn	emphNet capital gains on *other financial assets*					
VGOLD	0	NKG_ONFA_CB	0	*Parameters in NFC Portfolio*			
VONFA_CB	0	NKG_ONFA_FC	0	RATIO_B_NFC	t-1		
VONFA_FC	0	NKG_ONFA_GVT	0	RATIO_DEPS_NFC	t-1		
VONFA_GVT	0	NKG_ONFA_HH	0				
VONFA_NFC	0	NKG_ONFA_NFC	0	*Parameters in RoW Portfolio*			
				RATIO_DEPSROW	t-1		
Relative Prices		*Capital consumption ratios*					
RPG	t-1	CCR_G	t-1				
RPGFCF_H	t-1	CCR_H	t-1				
RPGFCF_M	t-1	CCR_M	t-1				
RPGFCF_NR	t-1	CCR_NR	t-1				
RPKH	t-1						
RPKM	t-1						
RPKNR	t-1						

of the simulation period.

Figure 6.11: Baseline 1. QE Cont'd



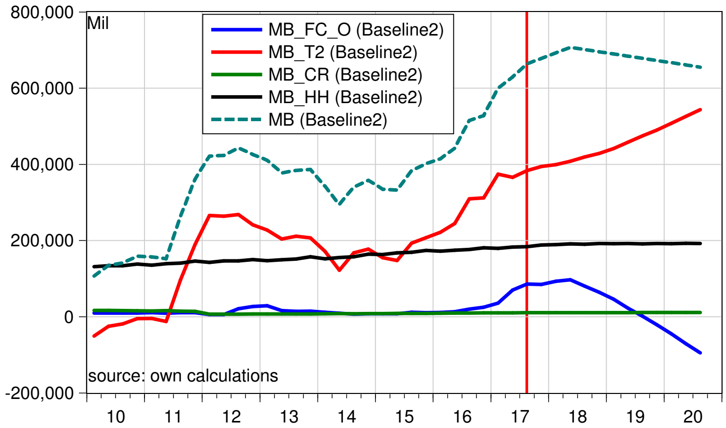
This is so because of the closures we have chosen for Banks and Central Bank, i.e. that the total Monetary base is determined on the Asset side of CB balance sheet and that the portfolio adjustment for Banks is made through the excess liquidity held (which *is* the case during QE operations, as detailed in Section 4.3). If QE operations end, as in Baseline2, Banks start firing up (excess) reserves and buy Government Bonds. However, since there is not a lower limit in Banks' reaction function nor any mechanism (a target-rate, a stock-flow norm etc.) signaling banks to start adopting another asset as counterpart, these will soon turn out negative, which is of course unrealistic. Exploration of possible reaction functions for the banking sector is left for future research.

Moreover, the data we have do not come too much in help. As we detailed in Chapter 3, the series we have last, at most, from 1995 to 2017q3 (which is the last data release). During these years, different "*structural breaks*" occurred. First, the entrance of the country in the Eurozone in 1999, preceded by the massive realignments of the end of the 1990s in the road to Maastricht. Then we had the dot.com crisis of 2001 and, most important, the Financial Crisis of 2007-8 and the Great Recession that started afterwards. Finally, from 2011 the ECB started adopting non-ordinary monetary policy measures. This comes, of course, with underlying changes in agents behavior in the face of different economic landscapes. These changes, however, are difficult to detect in the data. The (short) time span of our database does not allow, for example, to estimate banks' reaction by using a sub-sample and, even if we try this road, the coefficients we would get will, for, sure, not be robust enough.

Of course, future releases of the model will have to take care of this, as well as of other, complications.

To close with this preamble, thus, we just need to recall that this class of

Figure 6.12: Baseline 2. End of QE



models (and of course all other econometric models use for policy simulation) needs continuous refinements and updating, in order to be able to correctly track the changing behaviors and dynamics of model variables.

As we said, the rest of the Chapter is devoted to show the potential of this model in terms of the policy simulations it can perform. We will run two kinds of policy simulations, to explore the different transmission mechanisms at work. First, we will shock the base interest rate in the system, i.e. the ECB rate on advances to the banking sector, to see what are the main channel of transmission in our stylized financial system and its repercussions on the real economy. Then, we will run a series of fiscal policy simulations, to ascertain the possible effects of expansionary policies and their effects on growth, distribution and financial stability.

6.3 Scenario 1: Increasing ECB Base Rate

As we said previously, in our first experiment we simulate a 1% increase in the ECB base rate on bank advances (r^{adv}), to see what are the transmission mechanisms, the effects and dynamics at works in our stylized financial sector.

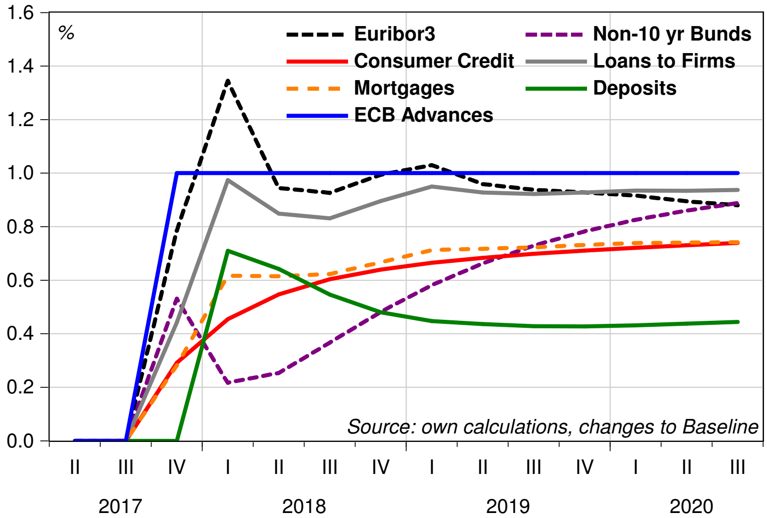
As we see in Figure 6.13, an increase in the base rate immediately (or within one quarter) impacts all other interest rates, which in turn generate a chain effect to all stocks and flows in the system.

The interest rate on deposits reacts less than other interest rates. In some cases, what matters is the distance between a foreign interest rate and the reference rate ($EURIBOR - r^{adv}$). According to our estimates[5], EURIBOR overshoots relative to changes to r^{adv}, so this interest rate differential is positive

[5]See Section 5.4.

in the same quarter of the shock, and turns negative in the following quarters. The other immediate impact (same quarter) is on interest paid by banks on advances to the Central Bank.

Figure 6.13: Scenario 1. Effects on interest rates



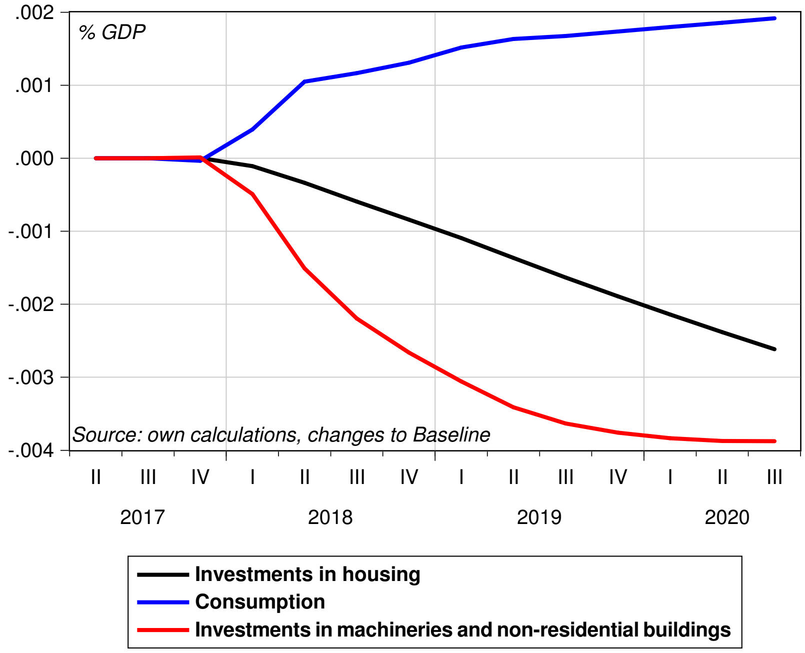
The increases in interest rates, as we said, have chain effects which affects our main flows and stocks. We will describe here the main channels of transmissions in the quarters following the shock.

Effects on Credit The increase in the interest rate on consumer credit (r^{blcc}), mortgages (r^{blmo}) and Loans to Firms ($r^{blfirms}$) have the following impacts on the Private sector balance sheets and transactions:

- An immediate, modest drop in household consumption. Consumption keeps falling because of other chain effects in the following quarters. A decrease in household investment in housing and firms investments in machinery and non-residential dwellings, which drops by about 1 percent after one year from the shock and keeps falling in the following quarters. These are shown in Figure 6.14.

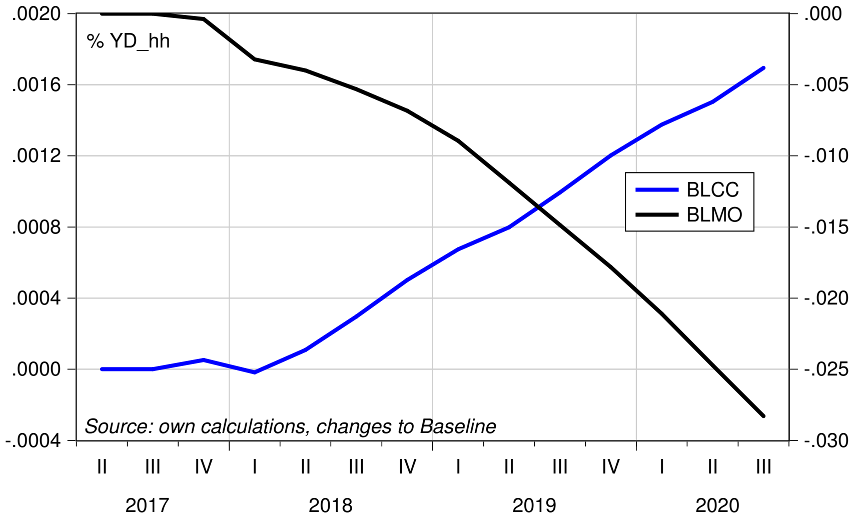
- An increase in the stock of consumer credit, relative to household income. This effect is unexpected, but we find a robust positive link between the interest rate and the stock of credit relative to income, which can be interpreted by the fact that a higher interest rate increases the debt burden, and the reaction of consumption is not big enough to offset this effect. Moreover, this effect is very small compared to the drop in the demand for mortgages. These are displayed

Figure 6.14: Scenario 1. Consumption and Investments



in Figure 6.15.

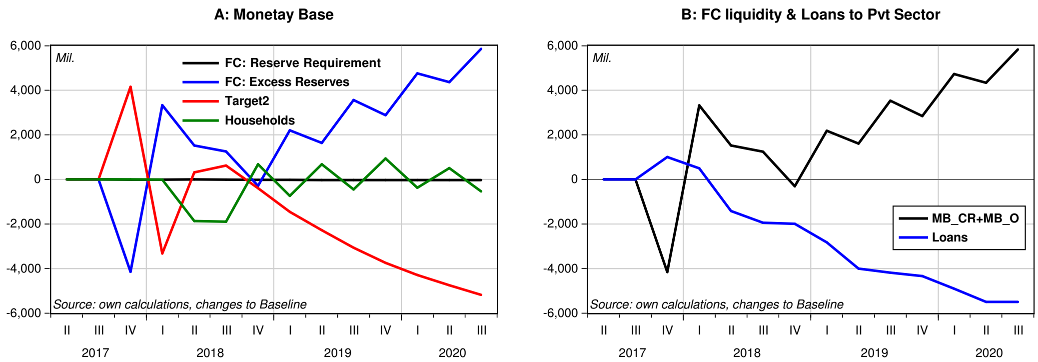
Figure 6.15: Scenario 1. Households loans to Disposable Income



- Higher payments from household and non-financial firms to the financial sector.

Finally, the increase in the interest rate on deposits (r^{deps}) implies higher payments from the financial sector to all other sectors holding bank deposits, and a decrease in the demand for cash from households MB_{hh}[6], which is shown in Figure 6.16.A along with the other components of Monetary Base. Moreover, as we may see from Figure 6.16.B, the increased liquidity of banks has no effect on the overall demand for loans, which are dictated, in contrast, by the deleveraging dynamics of the private sector.

Figure 6.16: Scenario 1. Monetary Base, Fin. Corp. Liquidity and Credit



Balance sheets adjustments

- Banks net interest income increases substantially. This implies an increase in the market value of banks issued debt p^{bb}. We don't find any link between profitability in the financial sector and dividends paid, which are quite stable relative to the stock of equities (or other scaling variables). Therefore net lending of the financial sector increases: ceteris paribus, this implies an (un-intended) increase in the monetary base held by the financial sectorMB_O_{fc}.

- Given the stocks of assets and liabilities of the household sector, the increase in interest rates implies a higher outflow of payments on mortgages and consumer credit, but higher inflows from government, banks and foreign securities, as well as from bank deposits. Net interest payments increase substantially, and so does disposable income, but not enough to offset the impact of interest rates on consumption and investment, at least in the "short" run. Household saving and net lending therefore increase. The stock of net financial assets of households increases in the long run, but decreases somewhat in the short run due to capital losses on the market value of government

[6]Note that the dynamics of MB_{hh} are dictated by the (negative) short-run reaction parameter in eq. HH.28B.

and foreign securities.

As discussed above, the stock of consumer credit increases, but the stock of mortgages falls dramatically[7], as household demand turn negative for the higher interest rate (mortgages are extinguished), so that the stock of overall household liabilities falls. Given the modest changes to net lending, the stock of bank deposits of household - which acts at the buffer variable for this sector - also falls. As a consequence, the monetary base demanded by banks as a reserve requirement MB_CR also falls. This last effect, however, is very small, as can be ascertained from Figure 6.16 (by the end of the simulation period, the increase in the stock is less than 300 Mil).

- Banks' balance sheets adjust both on the asset side and the liability side. On the liability side, the main impact is on the stock of deposits, which falls. On the asset side, mortgage reimbursement generate an undesired increase in banks liquidity MB_O_{fc}.
- The decrease in GDP implies a (small) fall in government tax revenues, and the increase in interest rates implies a large increase in the public debt burden, increasing government deficit, and therefore the stock of public debt. By construction, the additional stock of public debt is demanded by the Central Bank[8].
- Given the composition of the balance sheet of the foreign sector, interest paid to foreigners increase more than interest received from abroad. This section of the current account balance deteriorates. On the other hand, the fall in GDP implies a large fall in imports, which more than compensate net interest flows, so that the current account balance, after a short period of deterioration, improves. Ceteris paribus, this implies a reduction in the Target2 balance.

NAFA and Net Wealth The deleveraging processes in action in the private sector are evident when looking at the dynamics of Net financial Wealth after the shock. Given our estimates, the overall negative changes in balance sheets of households, banks and firms are driven by mortgage reimbursement, the sales of foreign liabilities and the fall in foreign sources of finance for domestic firms (FDI).

GDP, Wages and Prices The fall in real GDP implies a fall in employment, and an increase in the unemployment rate. This in turns generates a fall in unit money wages, and therefore in the price level. In the current stage of model development, however, this has very little impact on price competitiveness (through the fall in export prices).

[7] The reaction of the stock of mortgages to the interest rate requires further investigation.

[8] The model should be modified to include a mechanism for determining the price of public bonds from market clearing, rather than assuming an accommodating Central Bank. So far we have been unable to find robust determinants of the variable related to market clearing, SPREAD.

Figure 6.17: Scenario 1. Balance sheets Adjustments

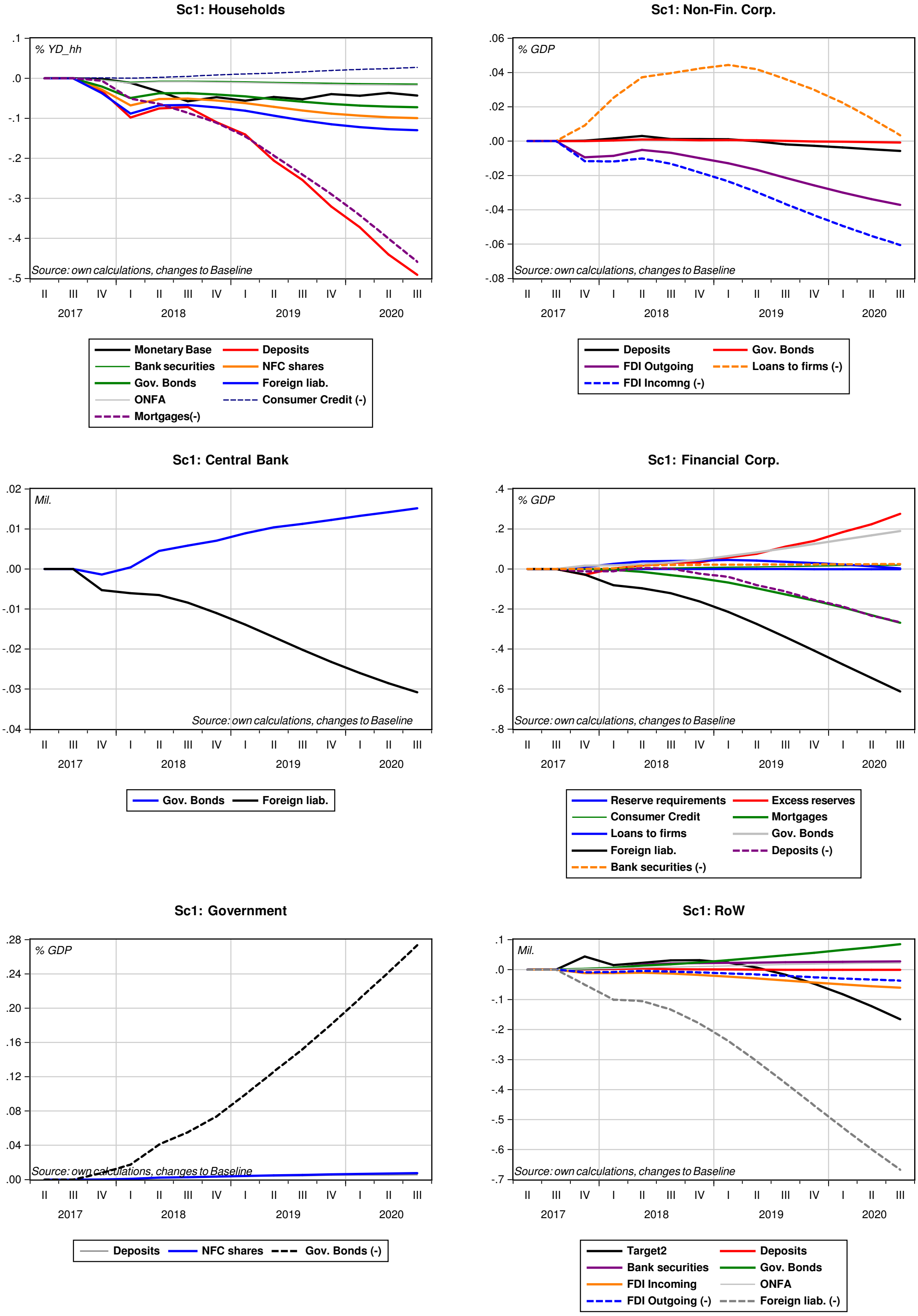


Figure 6.18: Scenario 1. NAFA and Three Balances

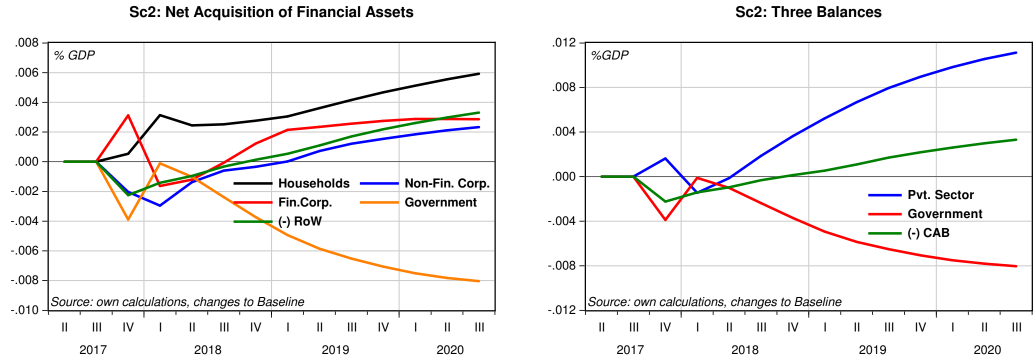


Figure 6.19: Scenario 1. Net Financial Wealth

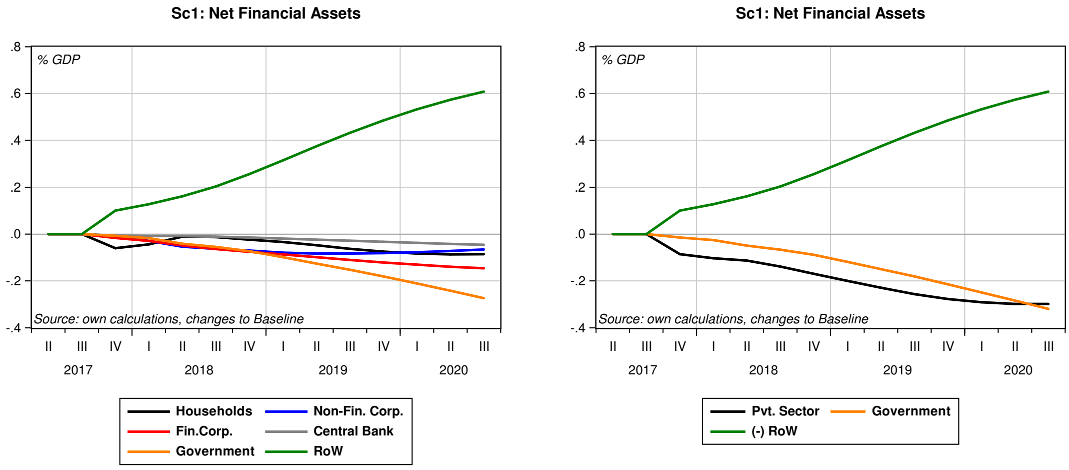


Figure 6.20: Scenario 1. Real GDP and components

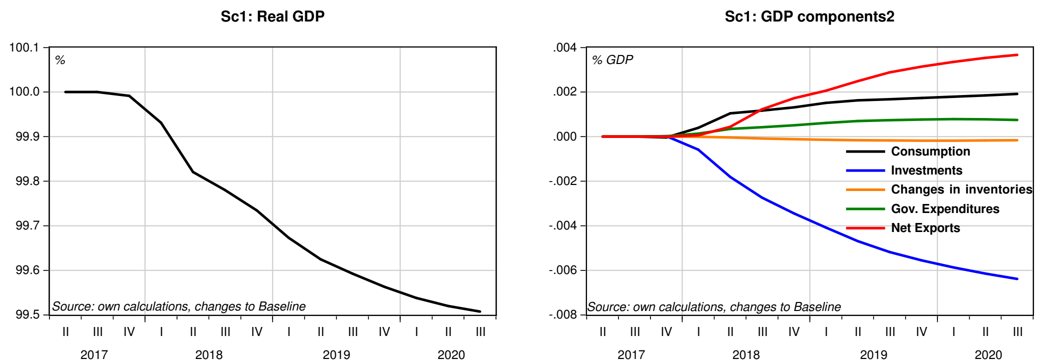
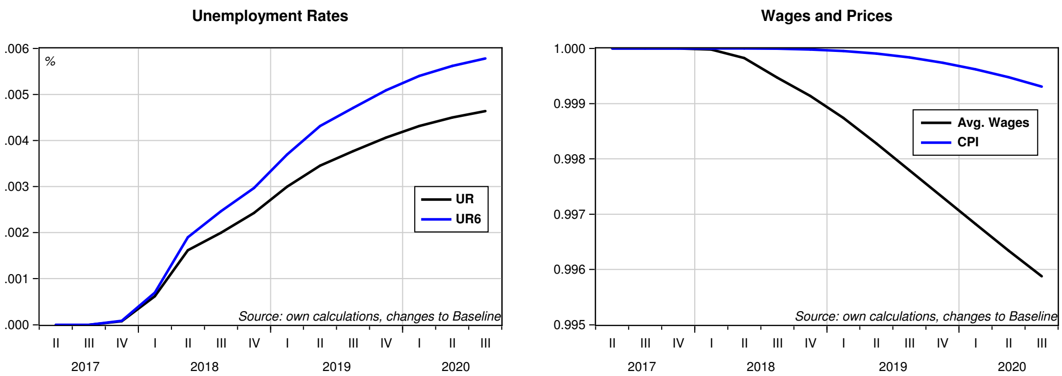


Figure 6.21: Scenario 1. Unemployment, Wages and Prices



6.4 Scenario 2-4: Expansionary Fiscal Policy

In this last part of the Chapter, we will run three distinct Expansionary Fiscal Policies simulations, to see what are the best strategies in terms of different economic policies, i.e. 1) Increased Government Spending, 2) (indirect) tax-cuts and 3) a Fiscal Expansion accompanied by the full political accommodation of the ECB (i.e. we set the $SPREAD$ equal to zero, so that the interest burden decreases, implying that the ECB will do, once again (!), "*Whatever it Takes*".). We will analyze the medium-run effects of such policies, and ascertain their effects on growth, distribution, financial stability, Maastricht parameters (Gov.Debt/GDP, Gov.Deficit/GDP, CAB/GDP, etc), employment, productivity, wages, price dynamics and competitiveness.

All simulations will be built trying to achieve the same, or at least as close as possible (but, still, using "concrete" amounts) end of sample government deficit (in nominal terms)[9]. In this way, it will be easier to compare the different outcomes and identify the best strategies for Italian development.

6.4.1 Scenario 2: Increasing Government Expenditures

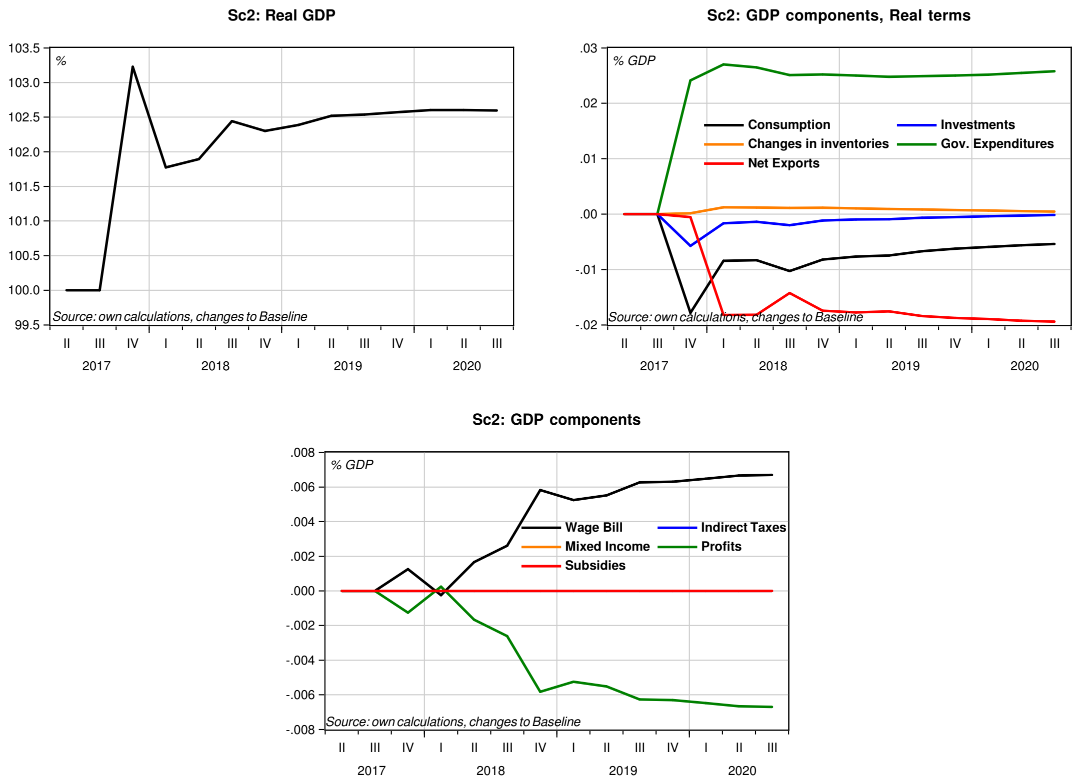
In Scenario 2, we simulate the effects of a one-time increase in real government expenditures of 12.5 Billion euros[10] in 2017q3.

The boost in demand generates an increase in real GDP. Consumption and investments react slowly, while net exports turn negative following the increase in households disposable income. The initial boost to profits slows down the first year after the shock, while the wage bill gets most of the increase in GDP.

[9]Technically, this is simply done through a step-by-step procedure. First, we set the tax cut Scenario and, then, build the other two accordingly, i.e. we try different shocks to G until we achieve the same end-of-sample government deficit.

[10]As we said, the shock to G is constructed so as to equal the end-of-sample government deficit of Scenario 3, which will be discussed shortly.

Figure 6.22: Scenario 2. Real GDP and components



The increase in spending translates into higher government consumption, both individual and collective. This imply an increase in the flows of deposits (as wages paid by the government increase). The higher government spending generates an acceleration in production (which signals to the other sectors the higher Government demand) and, therefore, an increase in private consumption and investments and, thus, employment (and a decrease in the number of part-time workers).

Figure 6.23: Sencario 2. Government Expenditures, Consumption and Investments

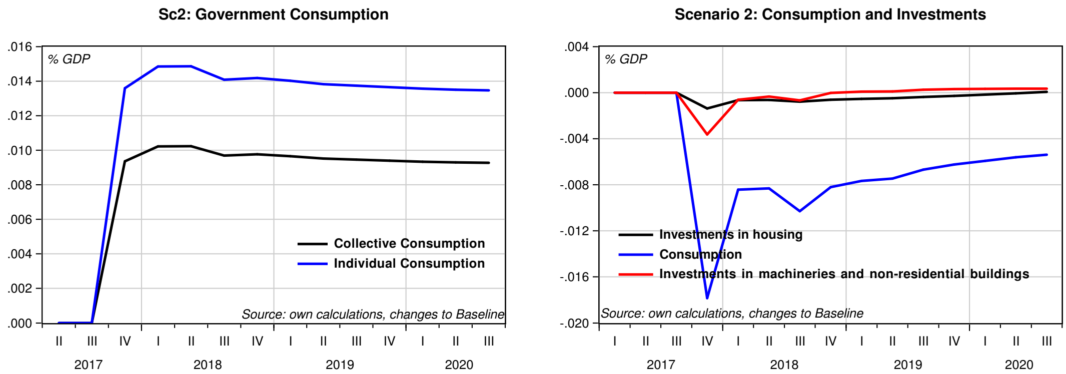
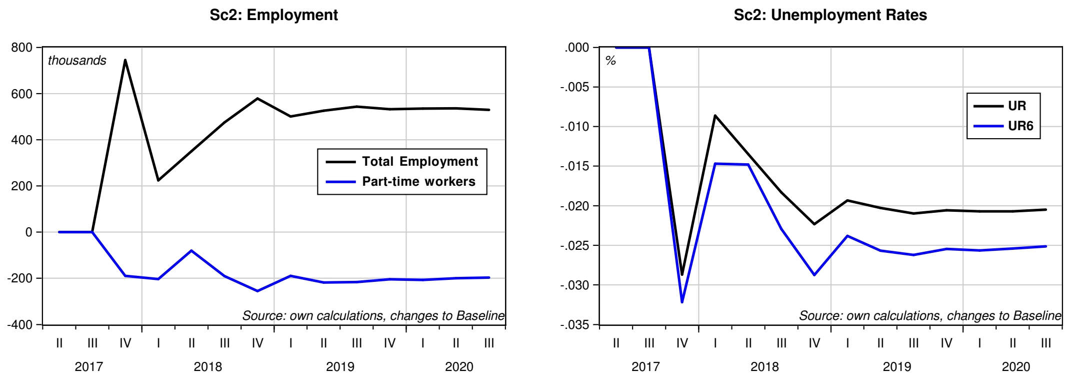
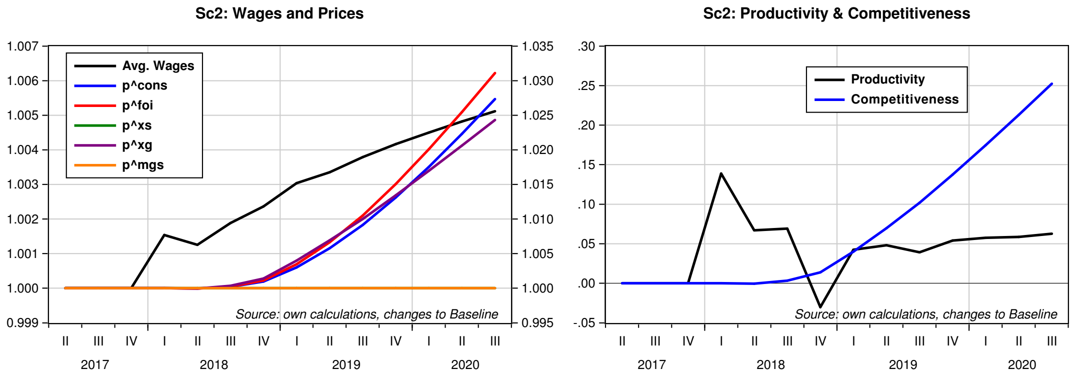


Figure 6.24: Scenario 2. Employment



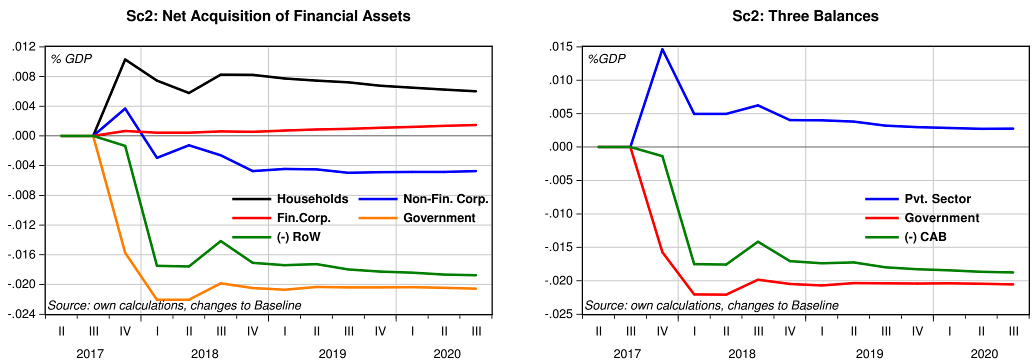
However, the rise in employment and wages, together with the stronger demand, pushes prices upwards, as displayed in Figure 6.25. The rise in the prices of export goods, in particular, determines a worsening of export performances. It is worth noting that, even though there is a rise in productivity, the rise in wages is higher so that external competitiveness worsen. Moreover, the rising incomes for households determines increases in imports that, overall, contribute to the worsening of the trade balance. This is so because, given our estimates, the effects of rising productivity on prices are not strong enough to offset the increases in wages.

Figure 6.25: Scenario 2. Wages, Prices, Productivity and Competitiveness



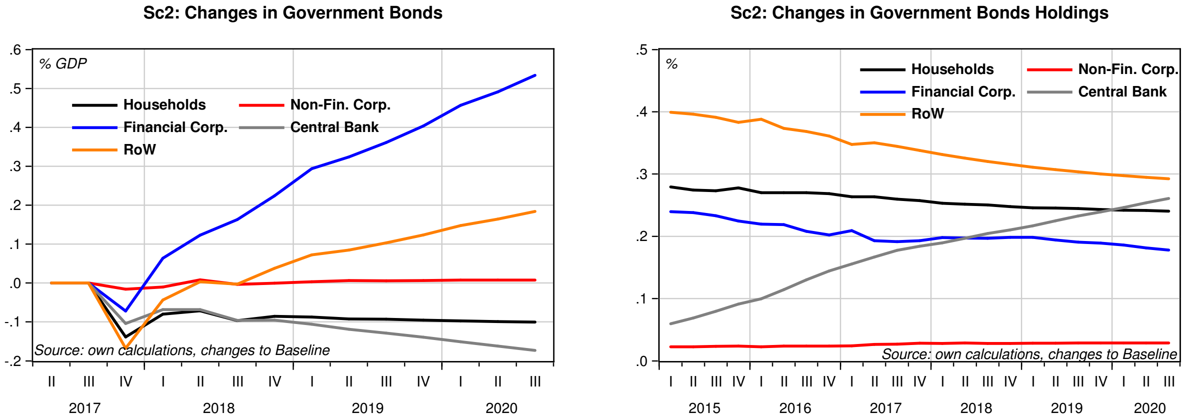
As we said, the rise in GDP translates into higher imports, while there are no effects at all on exports, so that the Current Account Balance goes negative. The higher domestic demand generates an increase in Government revenues, which are however more than offset by the rising pension and interest payments which contribute to the rise of government deficit. A situation, as we have detailed in Chapter 2, known as "*Twin Deficit*". The private sector as a whole, therefore, registers a surplus, driven by the rising households NAFA. The net financial position of firms goes indeed negative, given the rising interest burden related to the rise on loans, while banks only mildly increase their position, since the rise in interest streams from government treasuries offset the higher outflows on deposits.

Figure 6.26: Scenario 2. NAFA and Three Balances



Turning to the financial side of our system, the rising government deficit translates into an increase in the stock of debt, which implies higher interest payment to its holders. Some things are worth stressing. First, given their balance sheet composition, only a small part of households increasing NAFA goes into government debt, so that the new supply of bonds is matched by the demand by banks and the foreign sector. Second, since we assumed the ECB to continue with the extraordinary monetary policies, most of this new debt goes to Bank of Italy, which will see its role increasing even more, as it is clear from the Figure 6.27, which displays the holders of government debt. Again, this is due to our unrealistic assumption on the Central Bank clearing the market for Treasuries.

Figure 6.27: Scenario 2. Government Debt



Given the balance sheet composition of the various sectors and our estimates[11], we see, in Figure 6.28, that most of the action, in nominal terms, revolves around the government and the banking sector, via the increases in deposits and Government debt. For the households sector, the increase in mortgage credit is accompanied by the increase in liquidity held, while the rest of acquisitions splits between the other assets given the exogenous ratios, notably into Foreign liabilities. Non-financial corporations, following the rise in investments, start increasing their demand for loans. Finally, the rest of the world matches the demand for liabilities coming from households, while accumulates government bonds. The Target2 balance, in turn, goes positive, following the increase in excess reserves in the banking sector, as displayed in Figure 6.37. The increases in loans, in turn, are modest.

6.4.2 Scenario 3: Decreasing (direct) Tax rates

In our third Scenario, we simulate the effects of a decrease in the direct tax rates for the private sector of 2% (i.e. in θ^{dt}). It is worth noting in (left) Figure 6.30, which displays the dynamics of the tax rates, the huge decrease in the rate for Banks already put in place in the early 2000s.

The increase in disposable income coming from the tax-cuts boosts private consumption and, only mildly, investments, as displayed in (right) Figure 6.30. The impact on real GDP is indeed lower than in Scenario 2, as we may see

[11] Which, we stress, denote that a general deleveraging process is still ongoing in our private sector.

Figure 6.28: Scenario 2. Balance sheets Adjustments

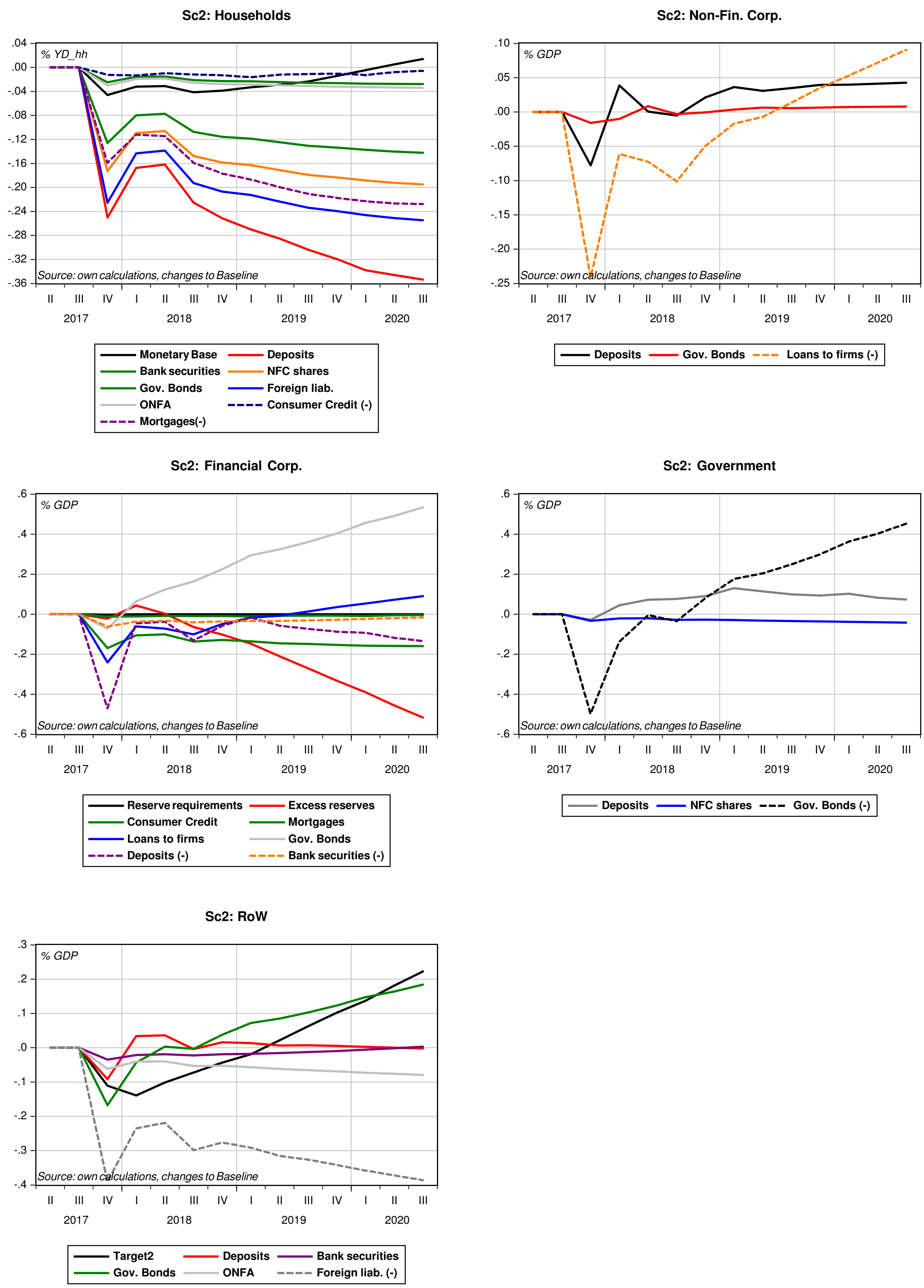


Figure 6.29: Scenario 2. Monetary Base, Fin. Corp. Liquidity and Credit

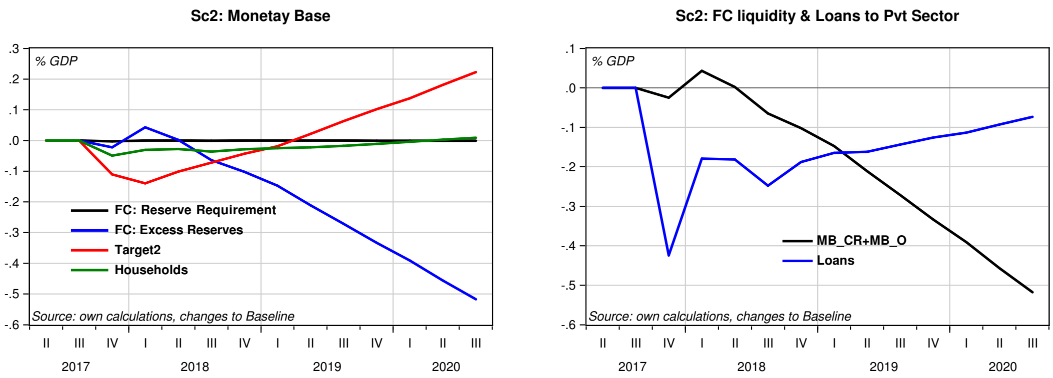
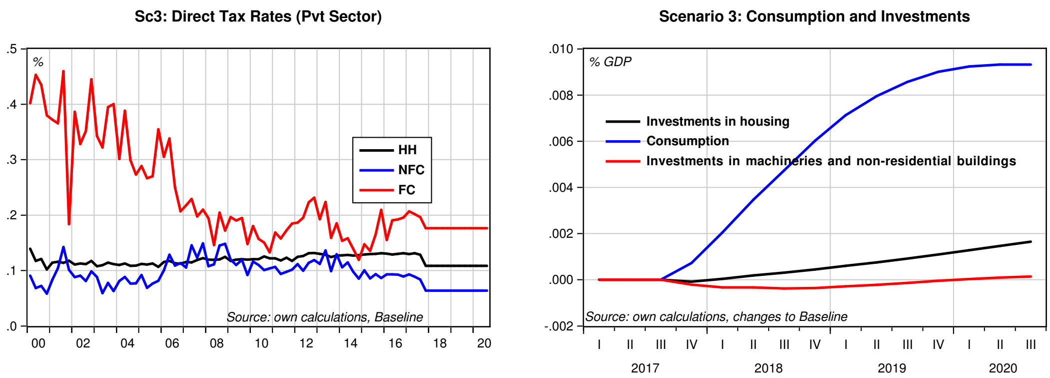


Figure 6.30: Scenario 3. Tax Rates, Consumption and Investments



from Figure 6.31. As before, most of the rise in GDP is due to the rise in the wage bill, and thus consumption, which determines an increase in imports that translates into a worsening of the trade balance.

The increased production boosts employment, generating a quarter million new jobs, to which corresponds a decrease of one hundred thousand units of part-time workers. The lower unemployment rate push wages up, and this determines a mild increase in prices. Higher production, as before, determines a rise in productivity. The effect on wages and prices is however stronger than that on productivity, so that the overall competitiveness decreases. This last effect, combined with the rising prices of exports and the higher interest paid abroad by the public sector, contributes to the worsening of the current account balance.

As we saw, the increased funds for firms do not translate into higher investments so that, contrary to Scenario 2, their Net Acquisition of Financial Assets goes positive. Banks, in turn, only see a minor increase, since the higher inflows from Government Bonds are more or less counteracted by the the higher outflows on deposits. Finally, the CAB goes negative, given the decrease in Net

Figure 6.31: Scenario 3. Real GDP and Components

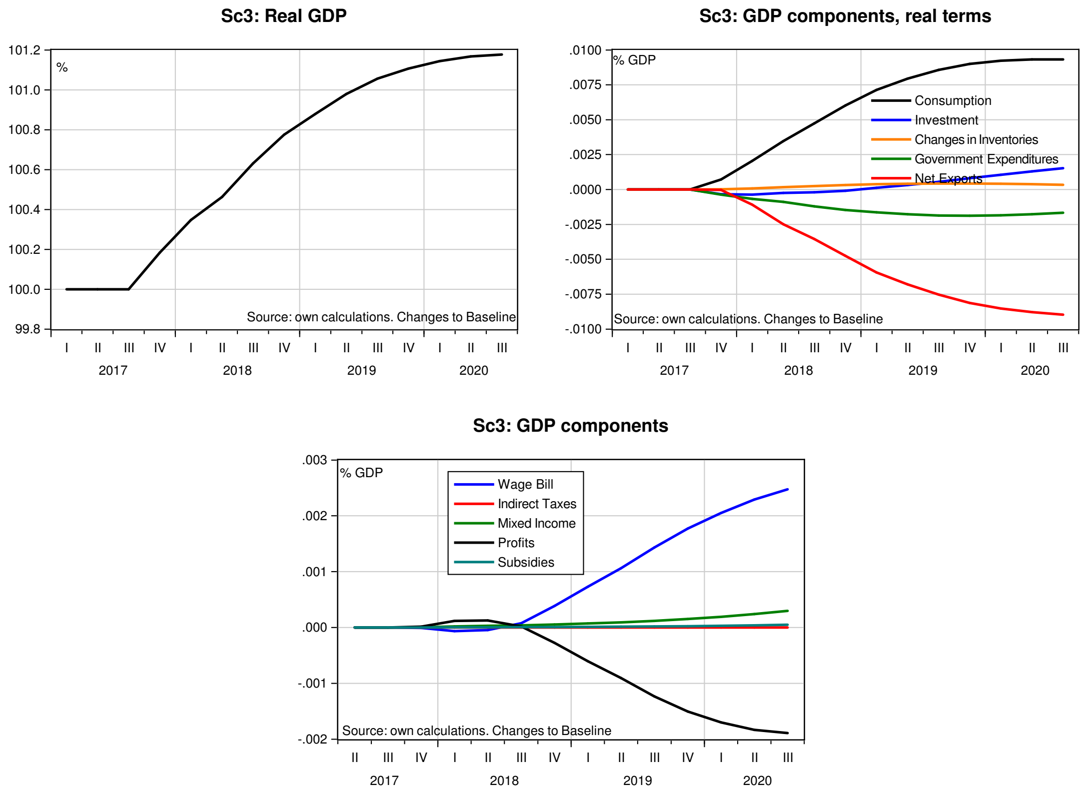


Figure 6.32: Scenario 3. Employment

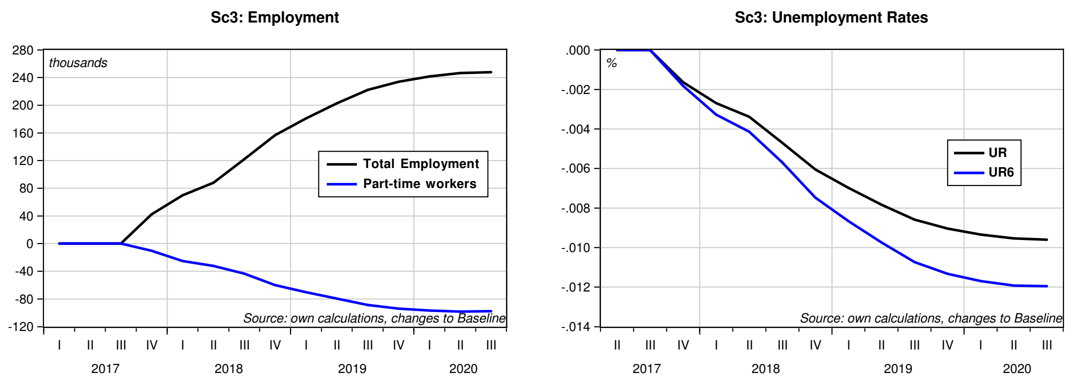
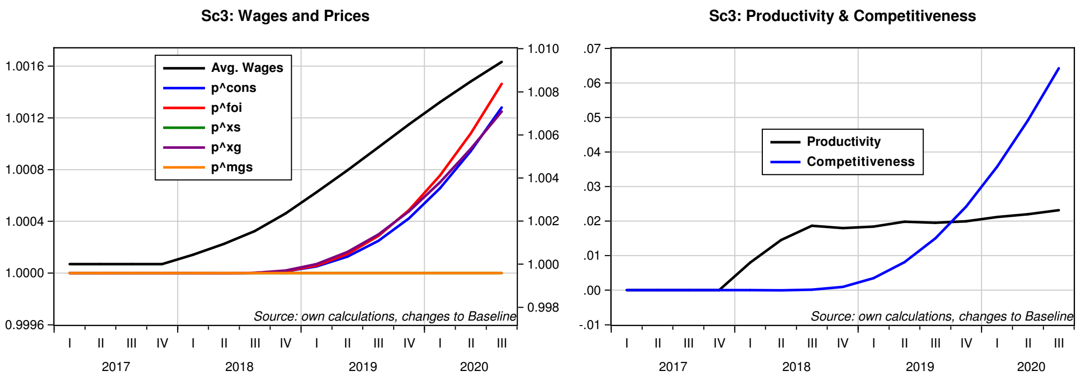
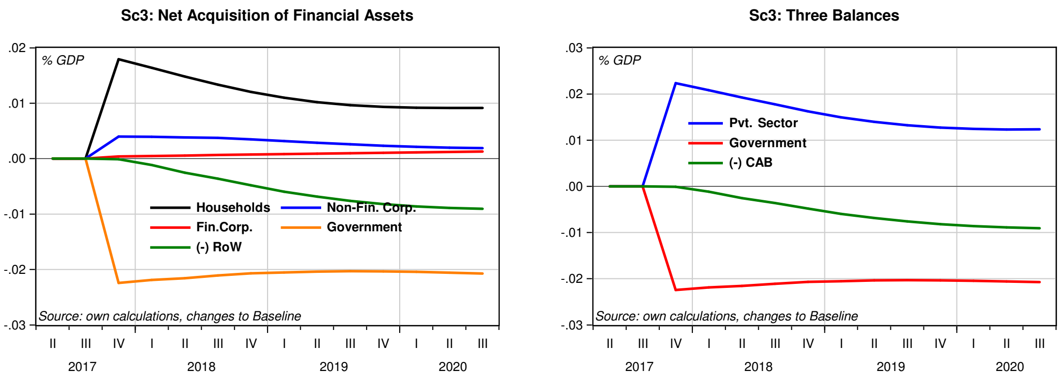


Figure 6.33: Scenario 3. Wages, Prices, Productivity and Competitiveness



Exports and the higher interest payments on government bonds. As for Scenario 2, most of the new issues of government debt are bought by banks and the foreign sector. However, it will still be the Central Bank that, given our closure, will increase substantially its holdings of Treasuries, as displayed in Figure 6.35.

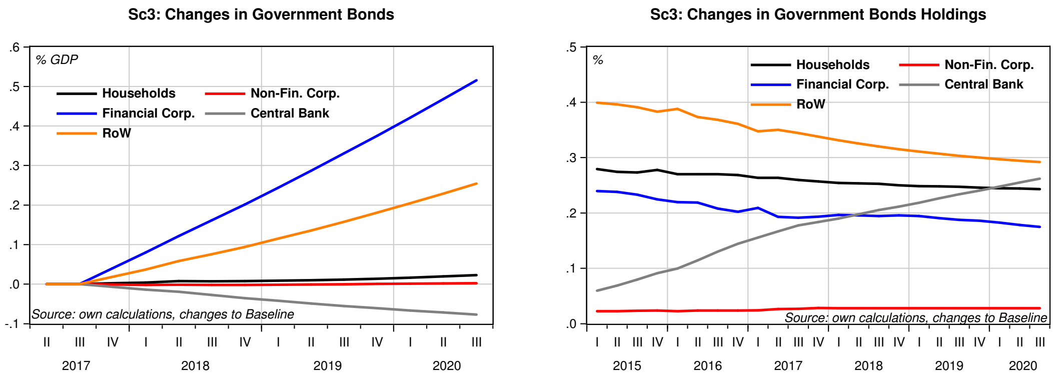
Figure 6.34: Scenario 3. NAFA and Three Balances



We may now turn to the financial sector, and look at the balance sheet adjustments for our sectors. As before, the households sector increases in mortgage credit are accompanied by the increase in liquidity held, while the rest of acquisitions splits between the other assets given the exogenous ratios, notably into foreign liabilities. Given our closure and their balance sheet composition, the increased incomes for firms immediately translates into loans reimbursement and, with one and two quarters lag, into an increase in deposits and government Treasuries, respectively. Banks, in turn, see a substantial increase in Deposits, which as we said implies higher interest payments to all other sectors, which are however more than offset by the increase in government Treasuries.

As clearer from Figure 6.37, after an initial rise, the stock of excess liquidity diminishes, so that Target2 improves.The overall banks liquidity decreases, while

Figure 6.35: Scenario 3. Government Debt



loans to the private sector only increase by 4 Billion, pumped up by the slow increase in mortgage credit.

6.4.3 Scenario 4: Increasing Government Expenditures and QE boost

In this last Scenario, as we said, we will simulate the effects a Fiscal Expansion accompanied by the full political accommodation of the ECB (i.e. we set the $SPREAD$ equal to zero, so that the interest burden decreases, implying that the ECB will do, once again (!), "*Whatever it Takes*".). This has an immediate impact on the interest rate on Government Treasuries, which decreases by 170 basis points, followed by the a drop in the RoE for banks debt and a slower decrease in the interest rates on banks loans to firms and deposits. The smaller effect is on the interest rate on Mortgages. Given our estimates, the higher interest payments on their issued debt pushes the prices of banks obligations (p^{bb}) down, while the price of Treasuries increases.

As for Scenario 2, also here the increased government expenditures, both individual and collective, boost incomes for the private sectors. In this case, differently from Scenario 2, and because of the cheaper credit available via the decreased interest rates on loans, the rise in GDP is primarily led by the higher Firms' Investments. Households Consumption, and Investment, in turn, are only mildly affected, and start to rise more steadily one year after the shock, due to the rise in incomes (and Wealth) and the higher Mortgages.

The higher production boost employment, creating half a million jobs, which implies a decrease of two hundred thousand units of part-times. By the end of the simulation period, the Unemployment Rate goes down by 2%. The increased employment pushes wages up, soon followed by (a mild increase in) the other prices. This lowers the country's international competitiveness, while the increased production also boost productivity which, by the end of the simulation period, increases by 6%.

Overall, as for the others Expansionary Scenarios, the higher Government Deficit generates a *Twin Deficit* situation, while the private sector registers a positive NAFA. The surplus of the Private sector is led by the small increase

Figure 6.36: Scenario 3. Balance sheets Adjustments

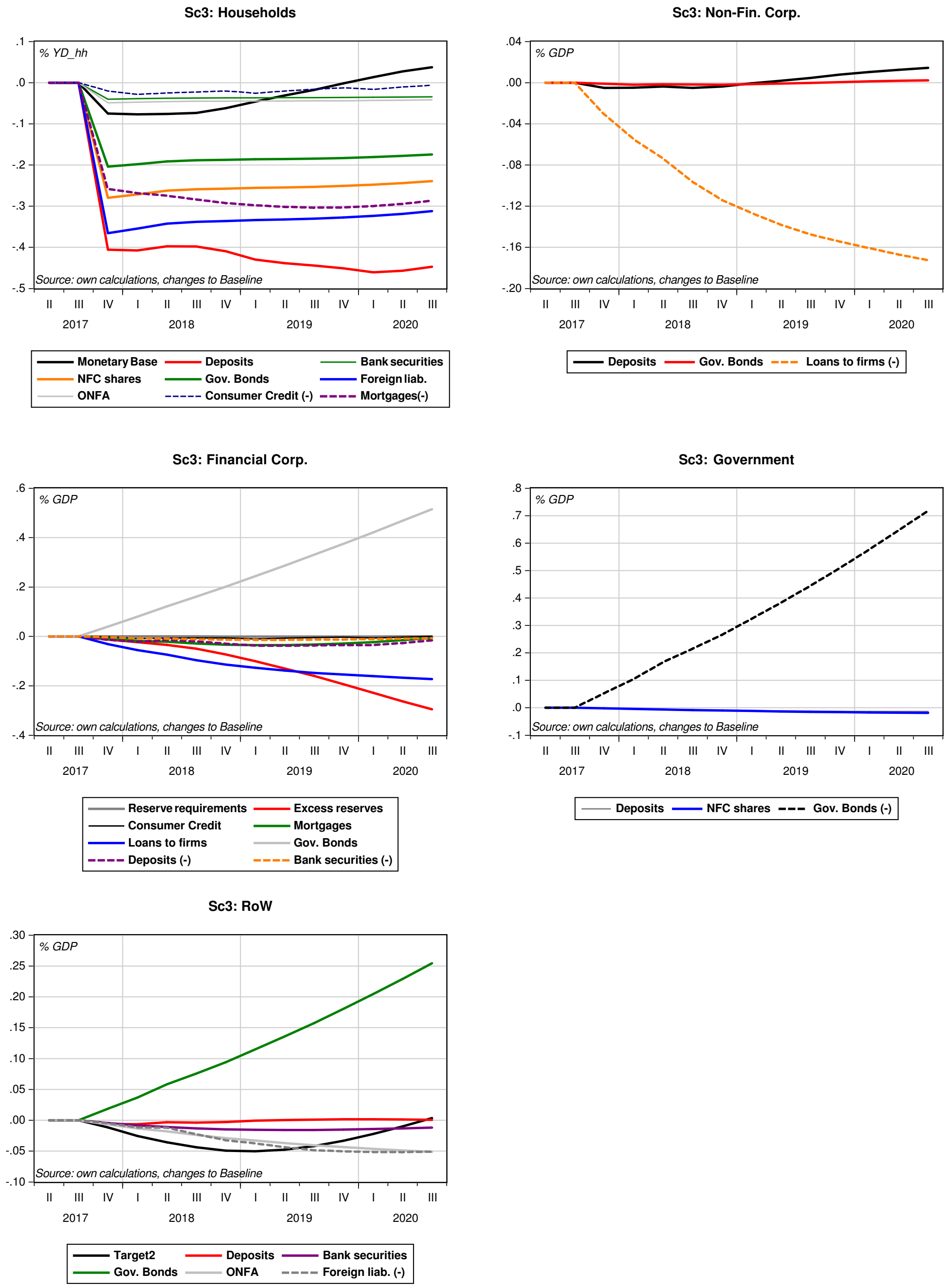


Figure 6.37: Scenario 3. Monetary Base, Fin. Corp. Liquidity and Credit

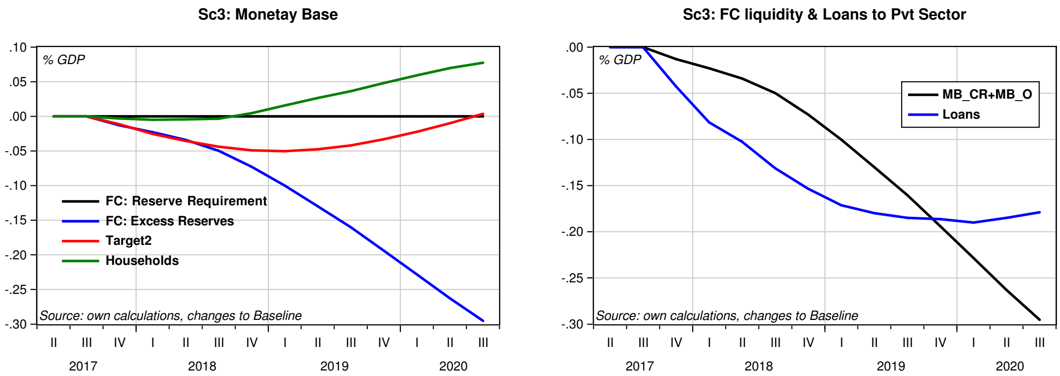


Figure 6.38: Scenario 4. Spread and Interest rates

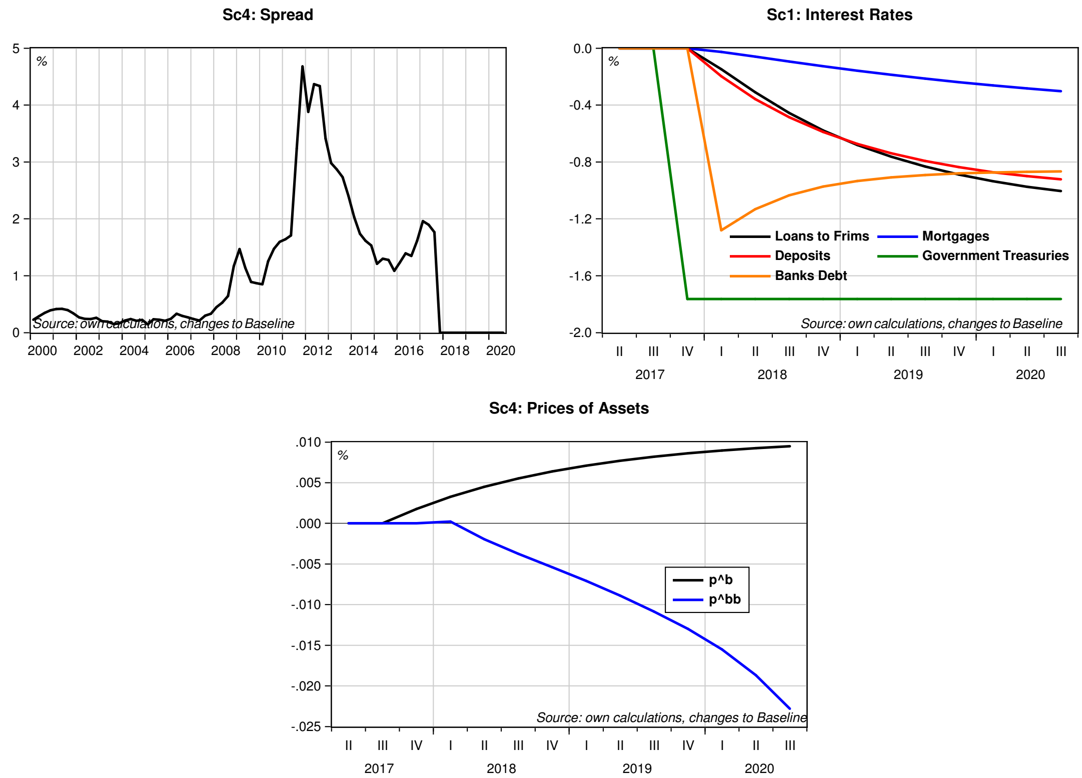


Figure 6.39: Sencario 4. Government Expenditures, Consumption and Investments

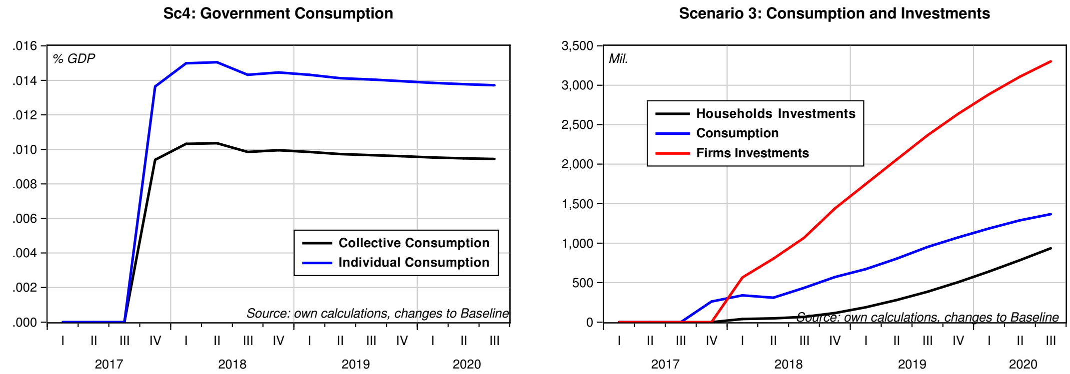


Figure 6.40: Scenario 4. Real GDP and components

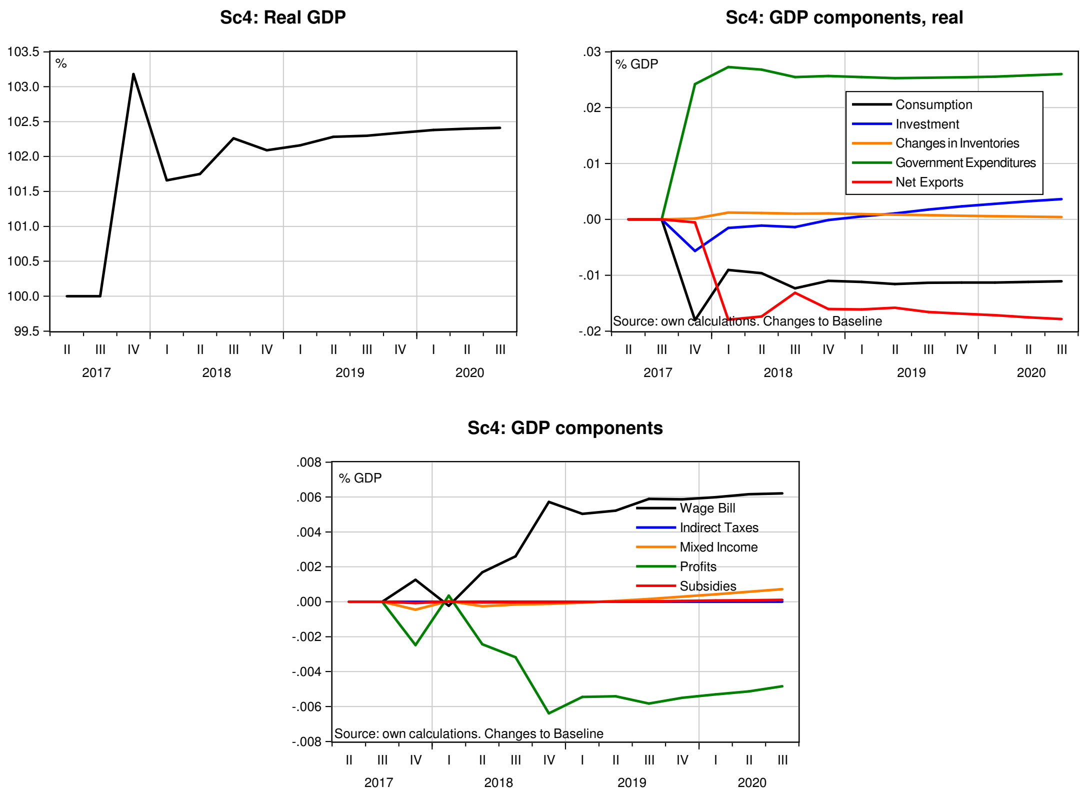


Figure 6.41: Scenario 4. Employment

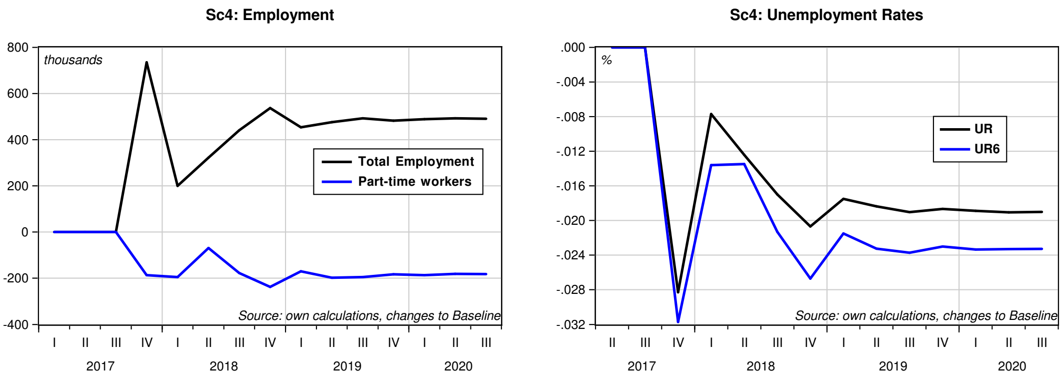
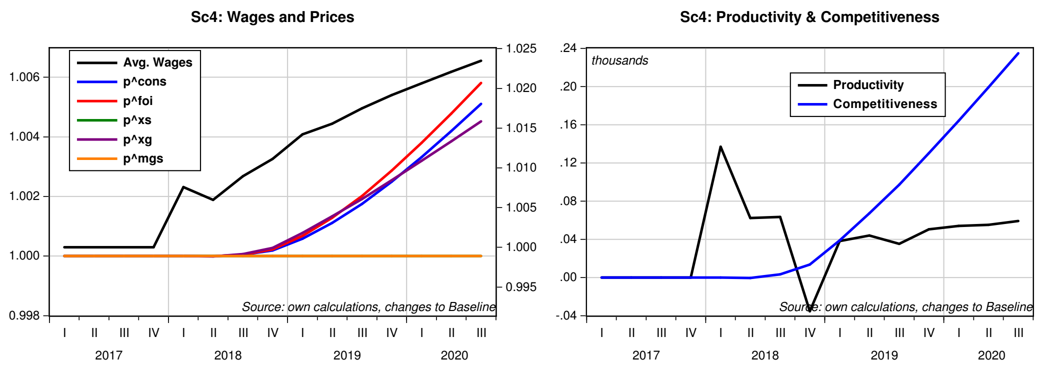
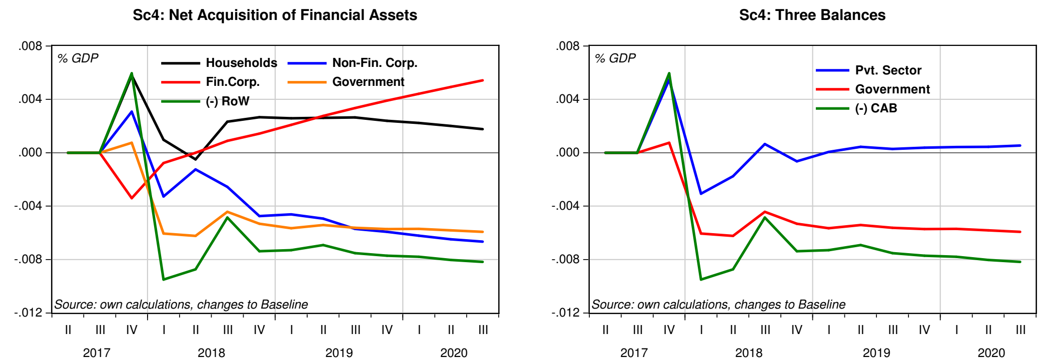


Figure 6.42: Scenario 4. Wages, Prices, Productivity and Competitiveness



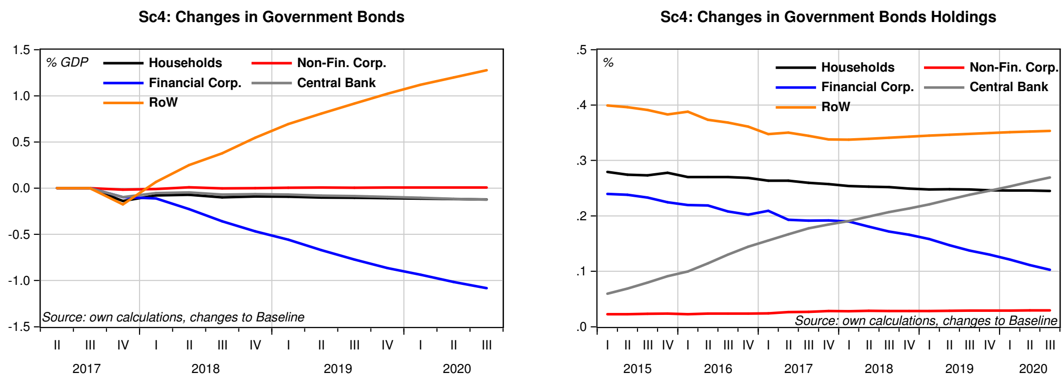
in households Financial position and in that of banks, since firms NAFA goes negative, following the steady rise in investments, financed through new credit. It is worth noting that, here, the government deficit only rises by 3 Bn, compared to the 10 Bn of Scenario 2.

Figure 6.43: Scenario 4. NAFA and Three Balances



Differently to all other cases, in Scenario 4 *all* new Government debt is bought by the foreign sector, due to the now risk-free investment opportunity. Moreover, the Foreign sector also absorbs part of Banks' holdings of Treasuries. Overall, all this will stabilize the External Debt at about 35%, while only banks will see a strong deleverage with respect to Government debt holdings. As in all other cases, finally, the CB will see its role increasing due, we repeat it once again, to our closures.

Figure 6.44: Scenario 4. Government Debt



We can finally turn to the balance sheets adjustments, displayed in Figure 6.45. As we said, households only increase, mildly, their mortgage credit, while the increased incomes gets mostly deposited or held as liquidity. Firms financial activity consists mainly in the new issues of credit for production, which raise by some 3.5 Billion. For banks, in turn, all the action is on their Asset side. They decrease their stocks of excess reserves and, most notably, of Treasuries, while increasing steadily their stocks of foreign liabilities. Finally, the foreign sector experiences higher demand for its asset, so that the stock of liabilities held by domestic agents rises steadily. As we said, it also absorbs all new government Treasuries, while the Target2 (net) balance, after a first improvement, worsens by the end of the simulation period.

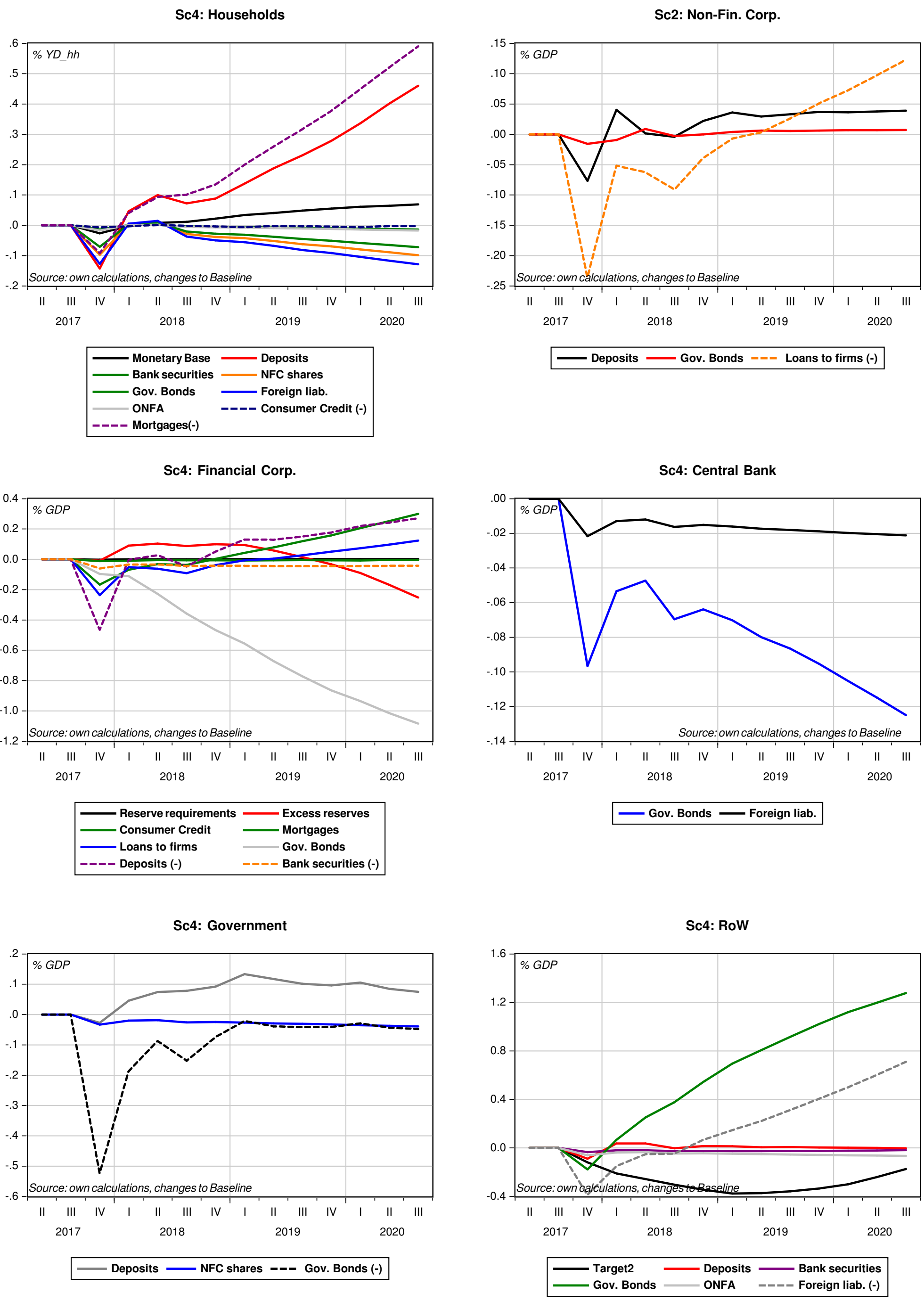
6.5 Overall Results and Model Responses

In this last section we will check the overall simulation results with respect to financial stability (i.e. debt-to-income ratios, consumption&investments to GDP), Maastricht Parameters (i.e. Debt/GDP, Deficit/GDP), Real GDP and Productivity.

Financial Stability As we said previously, we see an overall tendency toward deleveraging processes for households and banks which, given our estimates, are still going trough a restructuring of their balance sheets. Moreover, as detailed in various occasions by ISTAT and Bank of Italy (see Gola *et al.* (2017), for a recent survey and description of Italian regulations), the Italian economy is not as financialized as most other G8 countries. This may be seen by the "weight" of the financial sector on the economy as well as the (minor) role played by financial intermediaries (the so-called *Shadow Banks*). The banking sector, notwithstanding the recent turbulence on the stock market, is still more solid than that of other major partners (given its structure, centered among PMI and small Banks). It is worth saying that most of the new European banking regulations, most notably the so-called "*Bail-in*", together with Fiscal and Stability Pact, are the major culprits for the stress on Italy's banking sector. In conclusion, there are no major warnings with respect to the financial stability *coming from* Italy at sight but, we stress again, an external shock would bring rapidly back the country to recession.

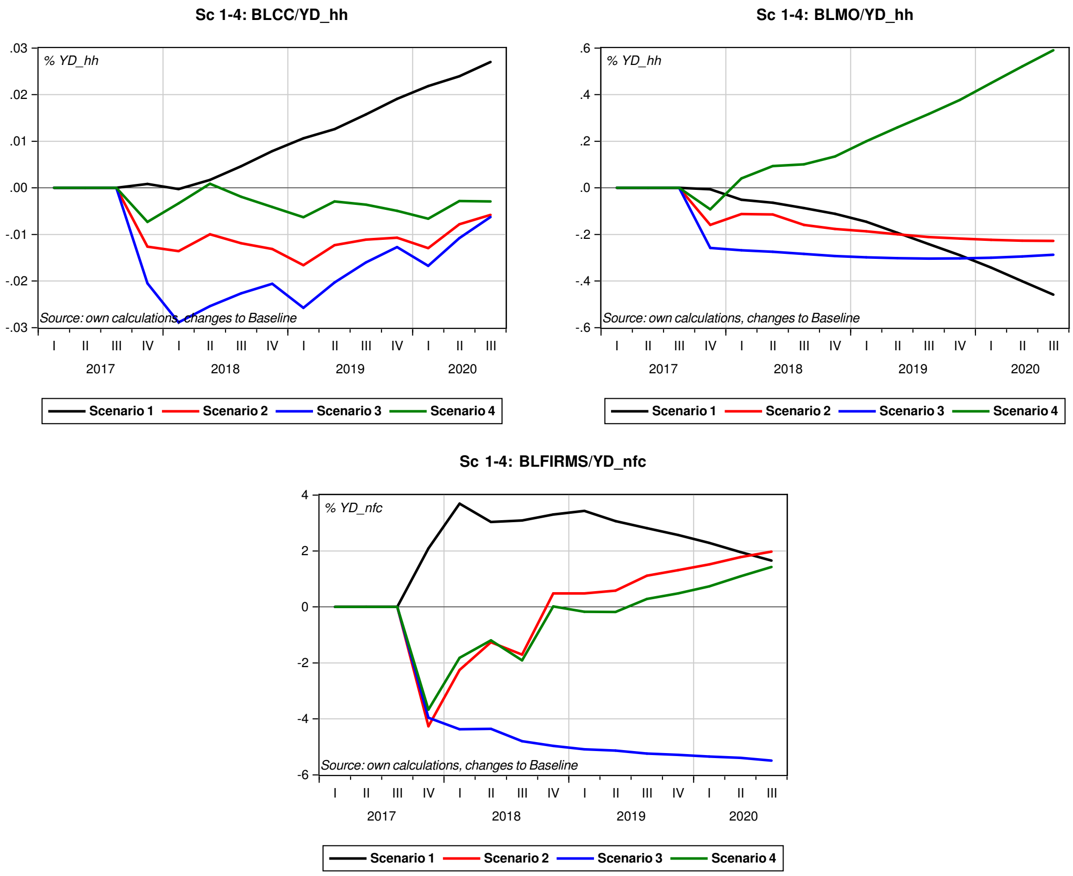
That said, we start with the effects of our shocks on the loans-to-income ratios in our different Scenarios, shown in Figure 6.46. Starting from the upper-left Figure, which displays the dynamics of consumer credit relative to households income, we see that only Scenario 1 causes a increase in the ratio, the effect being however very small. In the expansionary cases, in turn, only in Scenario 3 we see a strong initial decline, while in Scenario 4, given the lower interest rates, the effect is smaller. Anyway, the end-of-sample values for Scenarios 2-4 do not differ so much and range between -.3 and -.7 %. With respect to mortgages, the story changes a bit. As we said previously, the major moves in mortgages in Scenario 1 and 4 are connected to the strong reaction to the interest rate, while we see a general deleveraging process in Scenario 2 and 3, where the ratios falls by .3 and .35, respectively. Finally, we have the loans to firms, displayed in the lower Figure. In this case, the dynamics are primarily led by the reaction of investment (and firms income) to the various shocks. In Scenario 1, the increase in the stock of loans relative to income is due to the drop

Figure 6.45: Scenario 4. Balance sheets Adjustments



in incomes (since investments go down with the drop in GDP), while the initial drop in Scenario 2 and 4 followed by a mild increase by the end of the simulation period are due to the rise in investment, which grow more than income in the medium-run.

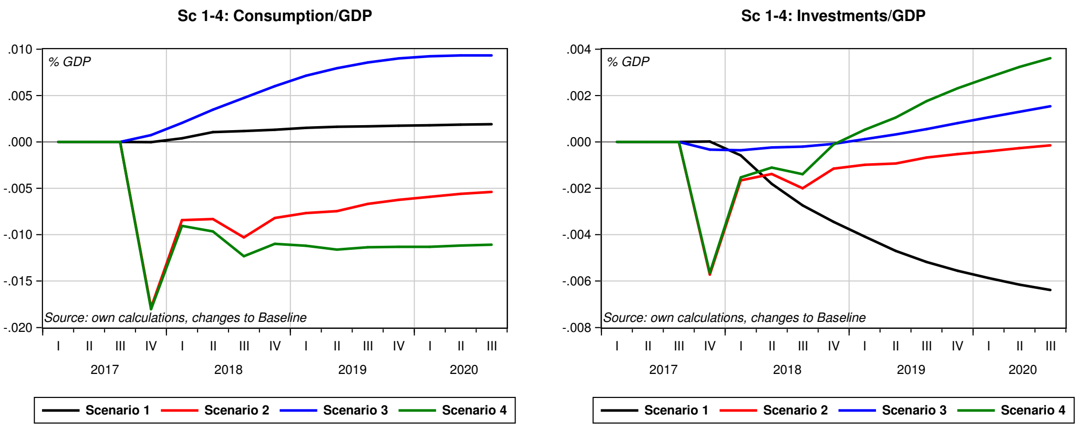
Figure 6.46: Scenario 1-4. Loans to Disposable Income



Maastricht Parameters We can now pass to the so-called "*Maastricht Parameters*", i.e. notably the government deficit, debt and CAB to GDP ratios, which are still seen, in major European circles, as "*The Major*" indicators for the performance and sustainability of economic policies.

Starting from government deficit, displayed in the upper-left corner on Figure 6.48, it is worth noting its different behavior in Scenario 4 with respect to the other two expansionary Scenarios (which, we recall, are constructed so as to equal the end-of-sample deficit.). In Scenario 4 thus, although the shock to government expenditure is exactly the same as in Scenario 2, the decreased interest burden determines only a very slight increase in the deficit to GDP ratio, even smaller than the one obtained

Figure 6.47: Scenario 1-4. Consumption and Investmpent to GDP



in the contractionary Scenario 1. With respect to the debt-to-GDP dynamics, it is again worth stressing that the major rises corresponds to the contractionary Scenario 1 and to Scenario 3, while we see that, when GDP is boosted through production rather than tax-cuts, the impact on debt is lower. Finally, in the lower Figure we see the dynamics of the current account balance. Again, when most of the increase in GDP goes to consumption, as in Scenario 2, the rising imports relative to exports determines a worsening of the trade balance as strong as the one determined by the drop in GDP of Scenario 1. Overall, as we said many times, we need to better specify the behaviors and reaction of exports to rising productivity and production and their effect on relative prices which are, at this stage, lower with respect to other estimates.

GDP and Competitiveness Finally, we may now analyze the overall effects on GDP and productivity, displayed in Figure 6.49. As we already said, it is in Scenario 2 and 4, where the boost is given to spending rather than through a tax-cut, that we have tha major expansionary effects. The annual rate of growth in Real GDP, by 2019, would be 2.5 and 2.3%, respectively.

Tables 6.2 to 6.5 display the different model responses to the shocks, as year-on-year percent change with respect to the Baseline.

Figure 6.48: Scenario 1-4. Maastricht Parameters

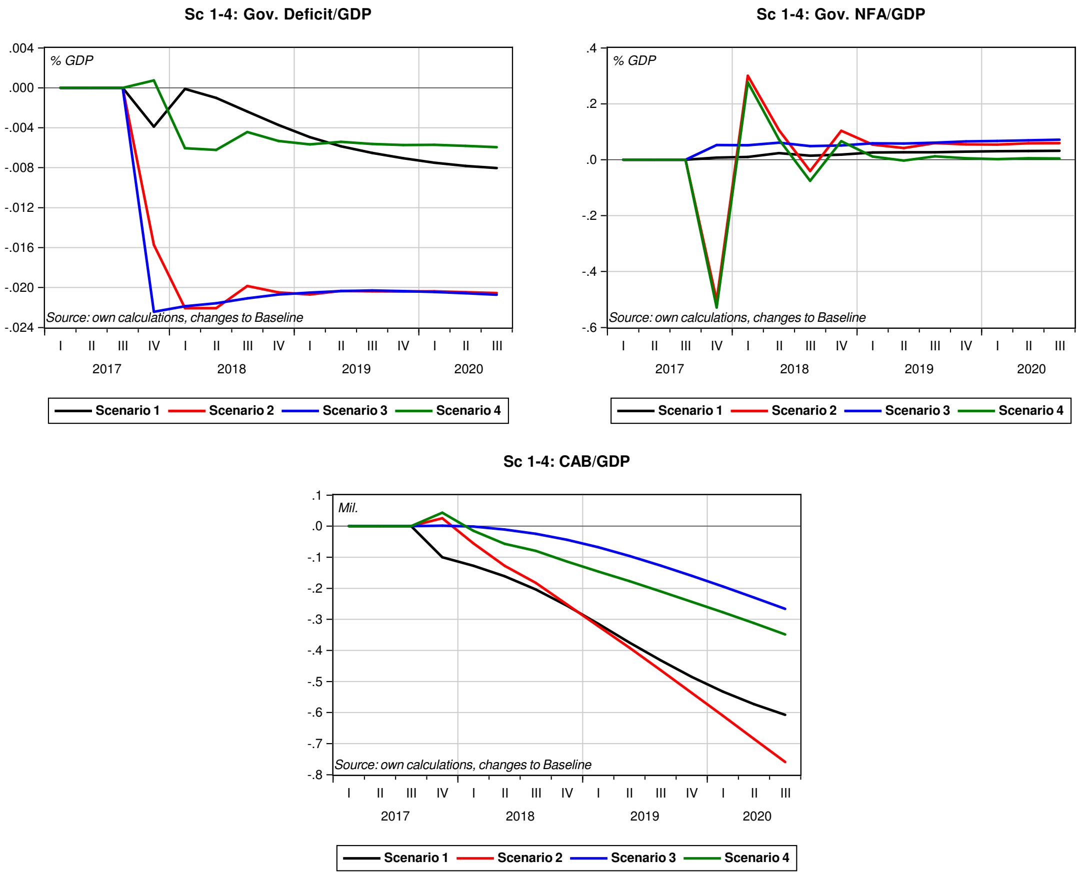


Figure 6.49: Scenario 1-4. Real GDP and Productivity

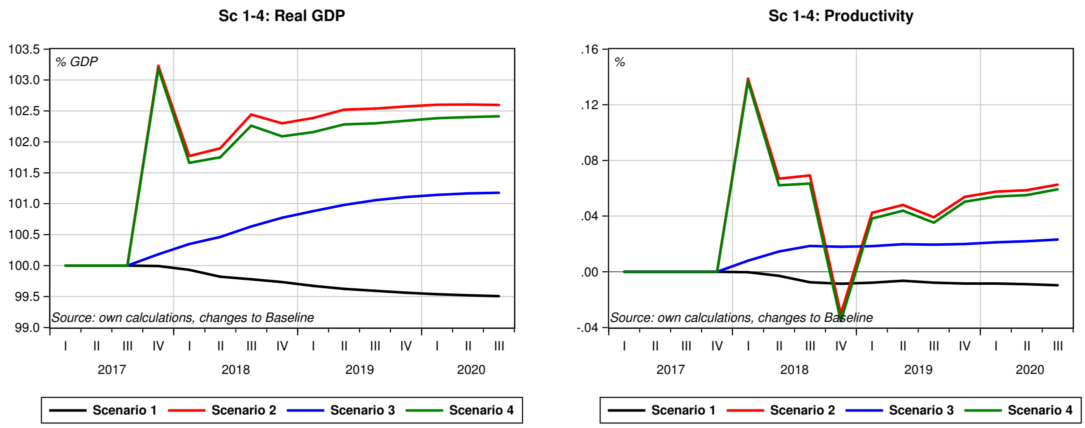


Table 6.2: Scenario 1 - Year-o-year change wrt Baseline

	2017	2018	2019
Real GDP	-0.0	-0.2	-0.4
- Imports	0.0	-0.3	-0.8
- Exports	0.0	0.0	0.0
- Consumption	-0.0	-0.0	-0.1
- Investments	0.0	-1.3	-2.9
Employment (thousands)	-2.0	-145.0	-322.6
Unemployment Rate (%)	0.0	0.0	0.0
Productivity (%)	0.0	-0.0	-0.0
Avg. Unit Monetary wages (%)	0.0	-0.0	-0.2
Consumer Credit (% YD)	0.0	0.0	0.1
Mortgages (% YD)	-0.0	-0.8	-1.8
Loans to Firms (% YD)	3.5	19.5	16.8
Current account (% of GDP)	-0.1	-0.1	0.1
Public debt (% of GDP)	0.0	0.4	1.1

Table 6.3: Scenario 2 - Year-o-year change wrt Baseline

	2017	2018	2019
Real GDP	0.8	2.1	2.5
- Imports	0.0	5.6	5.8
- Exports	0.0	-0.0	-0.0
- Consumption	0.0	0.6	1.3
- Investments	0.0	1.3	2.1
Employment (thousands)	745.2	1627.0	2101.2
Unemployment Rate (%)	-0.0	-0.1	-0.1
Productivity (%)	0.0	0.4	0.3
Avg. Unit Monetary wages (%)	0.0	0.9	1.8
Consumer Credit (% YD)	-0.0	-0.1	-0.1
Mortgages (% YD)	-0.2	-0.9	-1.2
Loans to Firms (% YD)	-7.9	-4.8	8.3
Current account (% of GDP)	-0.0	-1.6	-1.7
Public debt (% of GDP)	-0.5	0.0	1.4

Table 6.4: Scenario 3 - Year-o-year change wrt Baseline

	2017	2018	2019
Real GDP	0.0	0.6	1.0
- Imports	0.0	1.0	2.3
- Exports	0.0	-0.0	-0.0
- Consumption	0.1	1.2	2.4
- Investments	0.0	0.4	1.2
Employment (thousands)	42.4	436.5	839.5
Unemployment Rate (%)	-0.0	-0.0	-0.0
Productivity (%)	0.0	0.1	0.1
Avg. Unit Monetary wages (%)	0.0	0.1	0.5
Consumer Credit (% YD)	-0.0	-0.1	-0.1
Mortgages (% YD)	-0.4	-1.7	-1.8
Loans to Firms (% YD)	-7.0	-28.5	-31.7
Current account (% of GDP)	-0.0	-0.3	-0.7
Public debt (% of GDP)	0.5	2.0	3.4

Table 6.5: Scenario 4 - Year-o-year change wrt Baseline

	2017	2018	2019
Real GDP	0.8	1.9	2.3
- Imports	0.0	5.3	5.3
- Exports	0.0	-0.0	-0.0
- Consumption	0.0	0.2	0.4
- Investments	0.0	1.4	3.0
Employment (thousands)	743.3	1499.9	1903.8
Unemployment Rate (%)	-0.0	-0.1	-0.1
Productivity (%)	0.0	0.3	0.2
Avg. Unit Monetary wages (%)	0.0	0.8	1.7
Consumer Credit (% YD)	-0.0	-0.0	-0.0
Mortgages (% YD)	-0.1	1.0	-2.5
Loans to Firms (% YD)	-6.9	-5.2	4.0
Current account (% of GDP)	0.2	-0.7	-0.7
Public debt (% of GDP)	-0.7	-1.0	-0.8

Chapter 7

Conclusions

As far as 2008 Olivier Blanchard, chief economist at the IMF, stated that "the state of macro is good [...] Macroeconomics is going through a period of great progress and excitement" ((2008): 2-26). He was talking about the RBC revolution and the advent of DSGE models as the working horse of macroeconomists and central bankers, which were seen by many as "The Only" way to model aggregate systems and behaviors. Then the Financial Crisis hit, followed by the Great Recession from which many countries, and Italy in particular, has not yet recovered. As we said, this had much to do with the underpinnings and shortfalls of the models used. To put it shortly, on the onset of the crisis, the absence of the financial system (and money in general) in DSGE prevented them from detecting rising financial distress while, during the Recessions that followed, misguided policy prescriptions, based on the aforementioned models and theories, soundly failed. But what is, today, the state of macro?

In a recent issue of the Oxford Review of Economic Policy, conveniently titled "Rebuilding macroeconomic theory" (2018), the majority of the authors intervened in the debate were more or less split between two groups. On one side, the ones still defending DSGE, even though there is a wide agreement that these have to be implemented so as to incorporate the financial system (through more "frictions") and hysteresis effects. As Blanchard states "Macroeconomics has been under scrutiny as a field since the financial crisis, which brought an abrupt end to the optimism of the Great Moderation. There is widespread acknowledgment that the prevailing dynamic stochastic general equilibrium (DSGE) models performed poorly, but little agreement on what alternative future paradigm should be pursued [...] current DSGE models are flawed, but they contain the right foundations and must be improved rather than discarded" ((2018):1).

On the other, we find two minorities. One, which in contrast pushes for a come back of the old-fashioned structural models of Keynesian flavor, at least as policy tools in Central Banks. In the same article, Blanchard, recommends, as central bank policy tools, the co-existence of DSGE with what Wren-Lewis (same issue) terms "Structural econometric models". As Hendry and Muellbauer ((2018)) reconstruct, the Bank of England models currently in use still presents serious drawbacks compared to their pre-DSGE counterparts and call for a comeback. Finally, an even minoritarian position are the ones of the "orthodox dissenters" such as Stiglitz, Wright, Haldane and others, who ask for quite more radical changes in the new paradigms.

Along with the call for a return to structural models, there is also a renewed interest for the worthiness of some concepts, as reviewed in Lavoie ((2018)). The same Blanchard, back in 2015, made the following statement in an interview with the IMF Survey Magazine:

"As a result of the crisis, a hundred intellectual flowers are blooming. Some are very old flowers: Hyman Minsky's financial instability hypothesis. Kaldorian models of growth and inequality. Some propositions that would have been considered anathema in the past are being proposed by 'serious' economists: For example, monetary financing of the fiscal deficit. Some fundamental assumptions are being challenged, for example the clean separation between cycles and trends: Hysteresis is making a comeback. This is all for the best." (Blanchard, 2015)

However, as we detailed in Chapter 5, even the SEM models currently in use (and the same applies to other Structural models adopted by central banks, such as the FRB/US) still fail to meet most of what the debate has deemed as crucial aspect of modern capitalists systems. Albeit their increased realism and detail, especially compared to the DSGE, the core module is still represented by a Solow Growth model type, with demand only affecting the short-run behavior of the system which is again, in the long-run, completely supply-led, whereas the real-financial connections, as well as credit-debit streams and dynamics, are still absent from the analysis.

Thus, we think, not only we need to get back to the right *tools* (i.e. SEM vs DSGE), but also the the right *theories*. As we showed throughout this work, indeed, we *already* have alternatives.

The Stock-Flow Consistent approach, as we detailed in Chapter 1 and 2, provides the perfect roof to host a post-Keynesian view of how the economy works within an highly detailed financial system. In Chapter 1, we contributed to the now growing literature on Supermultiplier Growth and Distribution models, providing a closed economy SFC model to analyze debt and deficit dynamics (along with functional distribution), showing that only when simulating the model with the Godley-Lavoie method one can ascertain the system wide effects of shocks. In Chapter 2, in turn, we discussed how the SFC approach deals with Open economy issues, and reviewed Godley Three Balances model and his famous *Fundamental Identity*.

In the second Part of the Thesis, we provide an example of what could be a post-Keynesian SFC applied model. Using the appropriate data sources on Financial and Non-Financial Accounts for Italy, in Chapter 3 we set-up the accounting skeleton of the model, based on the principles discussed in previous chapters, and build the (reduced form) Transaction and Balance Sheet Matrices, and discuss how to solve all the technical and theoretical problems that will come along when using such data. In Chapter 4, in turn, we show how the two database that we have built can be merged together, reconciling Stocks

& Flows in the model. We walk the reader through all the steps needed to construct the Behavioral Transaction Matrix, which represents, together with the Balance Sheet Matrix, the core of the model. Moreover, we show how to include the Central Bank and discuss extraordinary Monetary Policy by the ECB.

Finally, in the third Part of the Thesis, we "close" the model and use it to perform some policy simulations over the medium-run. In Chapter 5 we present our SFC Quarterly Structural Model for Italy (SFC QMITA). We begin by detailing, sector by sector, all the equations related to *real* transactions and then move to the Portfolio choices, detailing the buffer stocks for each asset class and sector. Finally, we present the estimations of the structural equations of the model, underlying once again our pragmatic approach and leaving some other considerations to the Appendices. We close this work in Chapter 6, where we perform some economic policy simulations on the model developed. First, we check the main transmission channels for the base interest rate. We then check the usual *keynesian* expansionary policies, running three different exercises. We show how, given the same end-of-sample government deficit to GDP ratio, a positive shock to government spending has a higher effect on GDP, employment, productivity and distribution than a reduction in tax rates. Finally, we simulated how this expansionary policy, coupled with the full accommodation of the ECB (or what may be called a renewed *Whatever it Takes*), would generally bear better outcomes, in terms of Financial Stability, government deficit and CAB to GDP ratios while having the same effects on employment and productivity.

It comes without saying that this model still needs refinement and continuous work. As we said many times, some of the short-cuts we adopted, either for practical purposes, theoretical considerations or purely data-driven findings, will need to be addressed.

For example, while it is common in theoretical SFC models to describe portfolio choices using a Tobinesque approach, when dealing with real world data, as we detailed in Chapter 5, it is practically very difficult to find in the data (given their structure, the time-span etc) the appropriate relations, if they exist, between the rate of returns and the demand and supply of the different assets and liabilities. However, with longer series, model refinements and people working on it, we could well achieve a full description of financial interactions.

Another notable example is our treatment of the Central Bank. Given the current monetary policy of the ECB, as we detailed in Chapter 4, we found it sensible to model the Central Bank as the ultimate buyer of government Treasuries. However, this assumption, which reflects the current behavior of Bank of Italy, creates problems when conducting simulations. First, as we discuss in Chapter 6, when building the baseline for the model we *had to assume* the ECB to continue with QE operations throughout the simulation period, if we didn't want the stock of reserves to go negative. This is so because, when QE will end, banks will have to change their behaviors, and the ECB will have to detail how it would supposedly absorb all the amount of excess reserves present in the system. However, the short time span of our series, together with the uncertainty about the end of QE programs prevent us for making more realistic assumptions.

Future releases of the model will have to cope with these, as well as many others, shortfalls. However, we think we are on the right track in building a *sound* SFC macroeconomteric model which, if properly implemented (and funded!) may well stand among the most prominent example in the literature, contribute to the dissemination of the approach and, possibly, provide useful Economic Policy analysis.

Francesco Zezza

Appendices

Appendix A

Data sources

Table A.1: Data sources

Database	Source	Description	Sample period	Seasonally adjusted
ISTAT	- Quarterly National Accounts	– GDP and components	1995-2017q3	Yes
		– Income from labor	1995-2017q3	Yes
		– Occupation by branch	1995-2017q3	Yes
		– Gross Fixed Investment by type	1995-2017q3	Yes
		– Costs and margins by branch	1995-2017q3	Yes
		– Household consumption	1995-2017q3	Yes
		– Household consumption by type	1995-2017q3	Yes
		– Value added by branch	1995-2017q3	Yes
	- Quarterly non-financial accounts of the institutional sectors		1999-2017q3	No
	- Capital Stock	– Capital stock and amortization	1995-2017	Annual
		– Stock of non-financial assets	2000-2016	Annual
	- Population and labor market	– Labor force	1992q4-2017q3	Yes
		– Occupation by branch	1992q4-2017q3	Yes
		– Population by cohort	1977-2017q3	No
		– Part-time and full-time employent	1977-2017q3	No
		– Underemployment	2004-2017q3	No
		– Long-term unemployment	1992q4-2017q3	No
	- Prices	– House price index	2010-2017q3	No
		– Price index for blue-collars	1996m1-2017m10	No
Bank of Italy	- Quarterly financial accounts of the institutional sectors		1995-2017q3	No
	- Monetary statistics	– Liabilities subject to mandatory reserves	1999m1-2017m10	No
		– Reserves	1999m1-2017m10	No
		– BoI balance sheet: assets	1999m1-2017m10	No
		– BoI balance sheet: liabilities	1999m1-2017m10	No
		– Banks: deposits by sector, stocks	1999m1-2017m10	No
		– Banks: deposits by sector, flows	1999m1-2017m10	No
	- Public finance	– Financing of AAPP	1980m12-2017m10	No
		– Debt of AAPP: holding sectors	1861m12-2017m10	No
	- SSDS	– Debt securities	2010q4-2017q3	No
	- Interest rates	– Government bonds: gross yields to maturity	1988m12-2017m10	No
		– Composite indexes	2003m1-2017m10	No
		– Interest rates on loans to households	1995m1-2017m10	No
		– Interest rates on deposits	1990m1-2017m10	No
		– Other bank rates	1990m3-2017m10	No
	- Balance of Payments	– Financial accounts	1997m1-2017m10	No
		– International investment position, asset, stocks	1998q1-2017q3	No
		– International investment position, asset, flows	1998q1-2017q3	No
	- Competitivity index		1993m1-2017m10	No
Eurostat	- Interest rates	– EMU convergence criterion series	1980m1-2017m10	No
		– Money market rates	1980m1-2017m10	No
	- International trade	– Trade by country	1992-2016	Annual
		– Oil imports	2000m1-2017m10	No
OECD	- Unemployment by duration		1983-2016	Annual
	- GDP of tranding partners		1995q1-2017q3	Yes
FRED economic data	Share prices index	– Italy	1960m1-2017m10	No
		– United Kingdom	1960m1-2017m10	No
		– United States	1960m1-2017m10	No
	- Gold fixing price 3PM		2/1/1990-30/9/2017	No

Appendix B

Matrices

Table B.1: Non Financial Accounts. Italy, 2015, Mill. euro.

	Transactions	*Sectors*						
		Total Economy		NFC	FC	GVT	HH	ROW
1	*Production Account/account of the rest of the World for Goods and Services*							
2	Resources							
3	Production							
4	- Imports of Goods and Services		Total Imports					59679,64
5	- Imports of goods							46374,09
6	- Imports of services							13305,55
7	Taxes less subsidies on products	28922,35	Net Indirect Taxes on Production					
8	Uses							
9	Intermediate consumption							
10	Exports of Goods and Services		Total Exports					61944,36
11	- Exports of goods							50357,57
12	- Exports of services							11586,78
13	Gross Domestic Product/Gross Value Added	274274,85	GDP	127557,16	11298,28	35852,64	70644,41	0
14	Amortization	42124	(-) AMM	23394,93	566,03	6281,74	11881,29	0
15	Net Domestic Product/Net Value Added	232150,9	(=) GNP	104162,2	10732,3	29570,9	58763,1	0
16	Balance of trade in goods and services with the rest of the world							-2264,7
17	*Primary Income generation account*							
18	Resources							
19	Gross Domestic Product/Gross Valued Added	274274,85	GDP	127557,16	11298,28	35852,64	70644,41	0
20	Contributions	6116,25	(+) social contributions	1653,56	3,78	0	654,4	0
21	- Contributions to production	3804,51		0	0	0	0	0
22	- Other contributions to production	2311,74		1653,56	3,78	0	654,4	0
23	Uses							
24	Salaries	98914,49	(-) Wages	58979,75	6146,94	26811,39	6976,41	416
25	Taxes on Imports and production	41844,67	(-) Taxes on goods	services	4494,62	588,9	1593,72	2440,58
26	- Taxes on production	32726,87		0	0	0	0	0
27	- Other taxes on production	9117,81		4494,62	588,9	1593,72	2440,58	0
28	Gross operating surplus and (gross) Mixed income	139631,9	(=) Gross Profits	65736,4	4566,2	7447,5	61881,8	0
29	Gross Operating Surplus	93996,7		65736,4	4566,2	7447,5	16246,6	0
30	Mixed income (gross)	45635,23	(-) Mixed Income	0	0	0	45635,23	0
31	Amortization	42124		23394,93	566,03	6281,74	11881,29	0
32	Net operating surplus and (net) Mixed income	97507,9	(=) Net Profits	42341,5	4000,2	1165,8	50000,5	0
33	*Primary Income distribution account*							
34	Resources							
35	Gross operating surplus and (gross) Mixed income	139631,9	Gross Profits	65736,4	4566,2	7447,5	61881,8	0
36	Salaries	99034,49	(+) Wages	0	0	0	99034,49	296
37	Taxes on Imports and production	41535,9	(+) Indirect taxes	0	0	41535,9	0	308,77
38	- Taxes on production	32418,1		0	0	32418,1	0	308,77
39	- Other taxes on production	9117,81		0	0	9117,81	0	0
40	Capital incomes	82388,27	(+) Capital income	8343,42	23085,16	1016,5	49943,19	12235,67
41	- Interests	46300,86		6781,9	22409,04	465,33	16644,59	10542,67
42	- Dividends	29116,1		444	355	27,38	28289,73	820
43	- Reinvested FDI earnings	779		779	0	0	0	785
44	- Other investment income	5485,39		314,19	321,12	0	4850,08	88
45	- Rent from Land	706,92		24,33	0	523,8	158,8	0
46	Uses							

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Table B.1: (continued)

	Transactions	Total Economy		NFC	FC	GVT	HH	ROW
				Sectors				
47	Contributions	3190,25	(-) Subsidies	0	0	3190,25	0	2926
48	- Contributions to production	1902,51		0	0	1902,51	0	1902
49	- Other contributions to production	1287,74		0	0	1287,74	0	1024
50	Capital Incomes	83371,58	(-) Capital income	39245,4	21791,05	19591,41	2743,72	11250,08
51	- Interests	48105,55		9499,21	16689,88	19586,33	2330,13	8737,08
52	- Dividends	29062,73		28672,93	389,79	0	0	872
53	- Reinvested FDI earnings	785		785	0	0	0	779
54	- Other investment income	4711,39		0	4711,39	0	0	862
55	- Rent from Land	706,92		288,26	0	5,08	413,59	0
56	Gross National Income/balance of gross primary incomes	276028,7	(=) YP	34834,4	5860,3	27218,2	208115,8	
57	Amortization	42124		23394,93	566,03	6281,74	11881,29	
58	Net National Income/balance of net primary incomes	233904,7		11439,5	5294,3	20936,5	196234,5	
59	*Secondary Income distribution account*							
60	Resources							
61	Gross National Income/balance of gross national income	276028,7	YP	34834,4	5860,3	27218,2	208115,8	
62	Direct Taxes on incomes, wealth, etc.	27743,65	(+) Taxes	0	0	27743,65	0	90
63	Benefits and social contributions	112727,45	(+) Benefits	4282,68	1774,82	30664,81	76005,14	376
64	- Net social contributions	37029,24		4282,68	1774,82	30664,81	306,93	
65	- Social contributions "other than transfers in nature"	47686,72		0	0	0	47686,72	
66	- Transfers in nature	28011,49		0	0	0	28011,49	0
67	- Other current transfers	19173,37	(+) Other curent transfers	2007,93	5635,9	3111,73	8417,81	5114
68	Uses							
69	Direct Taxes on incomes, wealth, etc.	27721,65	(-) Taxes	465,44	176,81	404,11	26675,29	112
70	Benefits and social contributions	112424,45	(-) Benefits	3124,63	1221,05	69404,15	38674,63	679
71	- Net social contributions	37081,24		0	0	0	37081,24	
72	- Social contributions "other than transfers in nature"	47331,72		3124,63	1221,05	42738,67	247,38	
73	- Transfers in nature	28011,49		0	0	26665,48	1346,01	0
74	- Other current transfers	22420,88	(-) Other current transfers	3250,02	5747,7	4912,37	8510,78	1866
75	Gross Disposable Income	273106,2	(=) YD	34284,9	6125,5	40683,2	192012,6	0
76	Amortization	42124		23394,93	566,03	6281,74	11881,29	0
77	Net Disposable Income	230982,2		10890	5559,5	34401,5	180131,3	0
78	*Disposable Income utilization account*							
79	Resources							
80	Gross Disposable Income	273106,2	YD	34284,9	6125,5	40683,2	192012,6	0
81	Variations in pensions entitlements	1830,62	(+) Variations in pensions entitlements	0	0	0	1830,62	0
82	Uses							
83	Final consumption	219231,22	(-) Final consumption			46510,61	172720,61	
84	- Individual consumption	199386,09				26665,48	172720,61	
85	- Collective consumption	19845,13				19845,13	0	
86	Variations in pensions entitlements	1830,62		1465,2	352,53	0	12,89	0
87	Gross Saving	53875	(=) SAV	32819,7	5773	-5827,4	21109,7	0
88	Amortization	42124		23394,93	566,03	6281,74	11881,29	0
89	Net Saving	11751	(=) NSAV	9424,8	5207	-12109,1	9228,4	0

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Table B.1: (continued)

	Transactions	Total Economy		NFC	FC	GVT	HH	ROW
				Sectors				
90	Balance of current operations with the rest of the world	0		0	0	0	0	-1093,4
91	*Account of changes in equity due to savings and capital transfers*							
92	Changes in liabilities and net worth							
93	Net Saving	11751	NSAV	9424,8	5207	-12109,1	9228,4	0
94	Transfers in Capital account	6158,06	(+) Transfers in Capital account	3691,93	126	1384,4	955,13	368
95	- Taxes on Capital Account	360,4		0	0	360,4	0	0
96	- Other transfers in Capital account	5797,66		3691,93	126	1024	955,13	368
97	Changes in assets							
98	Transfers in Capital account	5659,69	(-) Transfers in Capital account	158,88	540	4319,68	640,53	867
99	- Taxes on Capital Account	361,03		26,01	0	0	334,42	0
100	- Other transfers in Capital account	5298,66		132,88	540	4319,68	306,11	867
101	Variations in Net Worth due to saving and transfers in Capital account	12249,4	(=) DNW	12957,8	4793	-15044,4	9543	-1592,4
102	*Non-financial incomes acquisition account*							
103	Variations in liabilities and net worth							
104	Variations in Net Worth due to saving and transfers in Capital account	12249,4	DNW	12957,8	4793	-15044,4	9543	-1592,4
105	Amortization	42124	(+) AMM	23394,93	566,03	6281,74	11881,29	0
106	Variations in assets							
107	Gross Fixed Capital Formation	52777,74	(-) Gross Investments	25841,07	787,27	7657,26	18492,13	0
108	- Gross Fixed Capital Formation	54760		28155,96	780,43	7657,26	18166,35	0
109	- Changes in inventories	-1982,26		-2314,89	6,84	0	325,79	0
110	- Acquisitions less disposals of non-produced non-financial assets	42	(-) Other non-financial investments	155,89	6,07	97,59	-217,54	-42
111	*Net Lending/Borrowing*	1553,6	(=) NETLEND	10355,8	4565,7	-16517,5	3149,7	-1553,6

Table B.2: Simplified Transaction Matrix. Italy.

	Transaction	*Sector* Production	Households	Non-financial business	Financial business	Government	Rest of the World	Pool	Total
1	GDP	tot_gdp							
2	Wage income: domestic	-wb	hh_wag_r				-wagesfrow		0
3	Wage income paid abroad	-wages2row					+wages2row		0
4	Mixed income	-mixy	+hh_mixy						0
5	Operating surplus	-ops	+hh_ops	+nfc_ops	+fc_ops	+gvt_ops			0
6	Indirect taxes	-indtax				+gvt_indt_r	+row_indt_r		0
7	Subsidies	+subs				-tot_subs_p	-row_subs_p		0
8	*SUM 2-7 Income from production*	0	*+HH_INCP*	+nfc_ops	+fc_ops	*+GVT_INCP*	*+ROW_INCP*		
9	Interest received		+hh_int_r	+nfc_int_r	+fc_int_r	+gvt_int_r	+row_int_r	-INTEREST	
10	Interest paid		-hh_int_p	-nfc_int_p	-fc_int_p	-gvt_int_p	-row_int_p	+INTEREST	
11	Dividends received		+hh_div_r	+nfc_div_r	+fc_div_r	+gvt_div_r	+row_div_r	-DIVIDENDS	
12	Dividends paid			-nfc_div_p	-fc_div_p		-row_div_p	+DIVIDENDS	
13	Renivested earnings from FDI - received			+nfc_reinvfdi_r	+fc_reinvfdi_r		+row_reinvfdi_r	-REINVEARN	
14	Renivested earnings from FDI - paid			-nfc_reinvfdi_p	-fc_reinvfdi_p		-row_reinvfdi_p	+REINVEARN	
15	Other capital income - received		+hh_kinco_r	+nfc_kinco_r	+fc_kinco_r		+row_kinco_r	-OTHINCFROMK	
16	Other capital income - paid				-fc_kinco_p		-row_kinco_p	+OTHINCFROMK	
17	Land rent - received		+hh_rentl_r	+nfc_rentl_r		+gvt_rentl_r		-RENTLAND	
18	Land rent - paid		-hh_rentl_p	-nfc_rentl_p		-gvt_rentl_p		+RENTLAND	
19	*SUM 8-18 Primary income*		*+HH_YP*	*+NFC_YP*	*+FC_YP*	*+GVT_YP*	*+ROW_YP*		
20	Direct tax - received					+gvt_tax_r	+row_tax_r		0
21	Direct tax - paid		-hh_tax_p	-nfc_tax_p	-fc_tax_p	-gvt_tax_p	-row_tax_p		0
22	Social benefits		+hh_ben_r	+nfc_ben_r	+fc_ben_r	+gvt_ben_r	+row_ben_r	-SOCBEN	
23	Social Benefits : Transfers in kind		+gindc			-gindc			0
24	Social contributions		-hh_ben_p	-nfc_ben_p	-fc_ben_p	-gvt_ben_p	-row_ben_p	+SOCBEN	
25	Other current transfers - received		+hh_otc_r	+nfc_otc_r	+fc_otc_r	+gvt_otc_r	+row_otc_r	-OTHCURTR	
26	Other current transfers - paid		-hh_otc_p	-nfc_otc_p	-fc_otc_p	-gvt_otc_p	-row_otc_p	+OTHCURTR	
27	*SUM 19-22 + 24-26 Disposable income*		*+HH_YD*	*+NFC_YD*	*+FC_YD*	*+GVT_YD*	*+ROW_YD*		
28	Var. pensions entitlements		+hh_pensr_r - hh_pensr_p	-nfc_pensr_p	-fc_pensr_p				0
29	- Consumption (individual)					-gvt_cons_ind			
30	- Consumption (collective)					-gvt_cons_coll			
31	Consumption		-hh_consf			-gvt_consf			0
32	*SUM 27-30 Savings (gross)*		*+HH_SAV*	*+NFC_SAV*	*+FC_SAV*	*+GVT_SAV*			
33	Ammortization		-hh_amm	-nfc_amm	-fc_amm	-gvt_amm			
34	*SUM 32-33 Savings (net)*		*+HH_NSAV*	*+NFC_NSAV*	*+FC_NSAV*	*+GVT_NSAV*			
35	Current operations balance						-row_netpos		
36	- Taxes on Capital Account		-hh_trk_tax_p	-nfc_trk_tax_p	-fc_trk_tax_p	+gvt_trk_tax_r	+row_trk_tax_r		0

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Table B.2: (continued)

	Transaction	Production	Households	Non-financial business	Financial business	Government	Rest of the World	Pool	Total
		Sector							
37	- Other transf. In Capital Account paid		$-hh\_trk\_o\_p + hh\_trk\_o\_r$	$-nfc\_trk\_o\_p + nfc\_trk\_o\_r$	$-fc\_trk\_o\_p + fc\_trk\_o\_r$	$-gvt\_trk\_o\_p + gvt\_trk\_o\_r$		$+/-TRK\_O$	
38	Trans. In Capital Account paid		-hh_trk_p	-nfc_trk_p	-fc_trk_p	-gv_trk_p	-row_trk_p	+TRK	
39	Trans. In Capital Account received		+hh_trk_r	+nfc_trk_r	+fc_trk_r	+gvt_trk_r	+row_trk_r	-TRK	
40	*SUM 34+38+39 Var. in Net Wealth*		*+HH_DNW1*	*+NFC_DNW1*	*+FC_DNW1*	*+GVT_DNW1*	*+ROW_DNW1*		
41	Gross Fixed Capital Formation		-hh_gfcf	-nfc_gfcf	-fc_gfcf	-gvt_gfcf		+GFCF	0
42	Var. in Inventories		-hh_dinv	-nfc_dinv	-fc_dinv	-gvt_dinv		+DINV	0
43	Gross Capital Formation (41+42)		-hh_gcf	-nfc_gcf	-fc_gcf	-gvt_gcf		+GCF	0
44	Acquisition less disposals of non-produced non-financial assets		-hh_othdna	-nfc_othdna	-fc_othdna	-gvt_othdna	-row_othdna	+OTHDNA	0
45	*Net Lending (43-43-44)*		*+HH_NETLEND*	*+NFC_NETLEND*	*+FC_NETLEND*	*+GVT_NETLEND*	*+ROW_NETLEND*		0

Table B.3: Behavioral Transaction Matrix. Italy.

	Transactions	*Sectors* Production	HH	NFC	FC Banks	FC Central Bank	GVT	RoW	Tot
1	GDP	$GDP = CONS + GFCF + DINV + G + XGS - MGS$							
2	Wage income: domestic	(-) $WB = wageu \cdot emp$	(+) $wages$					(-) $wagesfrow$	0
3	Wage income paid abroad	(-) $WAGES2ROW$						(+) $wages2row$	0
4	Mixed income	(-) $MIXY = ratio^{mixy} \cdot GDP$		(+) $mixy$					0
5	Operating surplus	(-) $OPS = GDP - (WB + MIXY + INDTAX - SUBS)$	(+) $ops_{hh} = \pi_{hh} \cdot OPS$	(+) $ops_{nfc} = OPS - (ops_{hh} + ops_{fc} + ops_{gvt})$	(+) $ops_{fc} = \pi_{fc} \cdot OPS$		(+) $ops_{gvt} = \pi_{gvt} \cdot OPS$		0
6	Indirect taxes	(-) $INDTAX = \theta^{i} \cdot GDP$					(+) $indt_{gvt} = indtax - indt_{row}$	(+) $indt_{row} = \theta^{iw} \cdot INDTAX$	0
7	Subsidies	(+) $SUBS = \theta^{s} \cdot GDP$					(-) $subs_{gvt} = SUBS - subs_{row}$	(-) $subs_{row} = \theta^{sw} \cdot SUBS$	0
8	Imports	(-) MGS						(+) mgs	0
9	Exports	(+) XGS						(-) xgs	
10	*Sum 2-9 Income From Production*		(+) $INCP_{hh}$	(+) ops_{nfc}	(+) ops_{fc}		(+) $INCP_{gvt}$	(+) NET_TRADE	0
11	Interest received		(+) $INTR_{hh} = (r^{deps} \cdot DEPS_{HH,t-1} + r^{b} \cdot B_{HH,t-1} + r^{bb} \cdot BB_{t-1} + r^{f} \cdot F_{HH,t-1}) + disc\_intr_{hh}$	(+) $INTR_{nfc} = (r^{deps} \cdot DEPS_{NFC,t-1} + r^{b} \cdot B_{NFC,t-1}) + disc\_intr_{nfc}$	(+) $INTR_{fc} = (r^{blcc} \cdot BLCC_{t-1} + r^{blmo} \cdot BLMO_{t-1} + r^{blfirms} \cdot BLFIRMS_{t-1} + r^{b} \cdot B_{FC,t-1} + r^{f} \cdot F_{FC,t-1}) + disc\_intr_{fc}$	(+) $INTR_{cb} = (r^{adv} \cdot ADV_{t-1} + r^{b} \cdot B_{CB,t-1} + r^{f} \cdot F_{CB,t-1})$	(+) $INTR_{gvt} = (r^{deps} \cdot DEPS_{GVT,t-1}) + disc\_intr_{gvt}$	(+) $INTR_{row} = (r^{deps} \cdot DEPS_{RoW,t-1} + r^{b} \cdot B_{RoW,t-1}) + disc\_intr_{row}$	0
12	Interest paid		(-) $INTP_{hh} = (r^{blcc} \cdot BLCC_{t-1} + r^{blmo} \cdot BLMO_{t-1}) + disc\_intp_{hh}$	(-) $INTP_{nfc} = (r^{blfirms} \cdot BLFIRMS_{t-1}) + disc\_intp_{nfc}$	(-) $INTP_{fc} = (r^{adv} \cdot ADV_{t-1} + r^{deps} \cdot DEPS_{t-1} + r^{bb} \cdot BB_{t-1}) + disc\_intp_{fc}$		(-) $INTP_{gvt} = (r^{b} \cdot B_{t-1}) + disc\_intp_{gvt}$	(-) $INTP_{row} = (r^{f} \cdot F_{t-1}) + disc\_intp_{row}$	0

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Table B.3 continued from previous page

	Transactions	Production	HH	NFC	FC: Banks	FC: Central Bank	GVT	RoW	Tot
13	Dividends + Reinvested earnings from FDI received		(+) $DIVR_{hh} = (r^{e} \cdot EN_{HH,t-1} + r^{eb} \cdot EB_{t-1}) + disc\_divr_{hh}$	(+) $FDIY_{nfc} = (r^{fdio} \cdot FDIO_{t-1}) = DIVR_{nfc} + REINVFDIP_{row}$	(+) $DIVR_{fc} = (r^{e} \cdot EN_{FC,t-1}) + disc\_divr_{fc}$		(+) $DIVR_{gvt} = (r^{e} \cdot EN_{GVT,t-1}) + disc\_divr_{gvt}$	(+) $FDIY_{row} = (r^{fdii} \cdot FDII_{t-1}) = DIVR_{row} + REINVFDIR_{row}$	0
14	Dividends + Reinvested earnings from FDI paid			(-) $(DIVP_{nfc} + FDIY_{row}) = r^{e} \cdot EN_{t-1} + r^{fdii} \cdot FDII_{t-1}$	(-) $DIVP_{fc} = r^{eb} \cdot EB_{t1} + disc\_divp_{fc}$			(-) $FDIY_{nfc} = (r^{fdio} \cdot FDIO_{t-1})$	0
15	Other net Capital Income		(+) $KYNET_{hh} = KINCOR_{hh}$	(+) $KYNET_{nfc} = KINCOR_{nfc} + (REINVFDIR_{nfc} - REINVFDIP_{row}) - (REINVFDIP_{nfc} - REINVFDIR_{row})$	(+) $KYNET_{fc} = KINCOR_{fc} - KINCOP_{fc} + REINVFDIR_{fc} - REINVFDIP_{fc}$			(+) $KYNET_{row} = KINCOR_{row} - KINCOP_{row} + DIVR_{nfc} - DIVP_{row}$	0
16	Net Rent from Land Ownership		(-) $RENTLNP_{hh}$	(-) $RENTLNP_{nfc}$			(+) $RENTLNR_{gvt}$		0
17	*Sum 10-16 Primary Income*		$YP_{hh} = INCP_{hh} + (INTR_{hh} + DIVR_{hh} + KYNET_{hh}) - (INTP_{hh} + RENTLNP_{hh})$	$YP_{nfc} = ops_{nfc} + (INTR_{nfc} + FDIY_{nfc} + KYNET_{nfc}) - (INTP_{nfc} + DIVP_{nfc} + FDIY_{row} + RENTLNP_{nfc})$	$YP_{fc} = ops_{fc} + (INTR_{fc} + DIVR_{fc} + KYNET_{fc}) - (INTP_{fc} + DIVP_{fc})$	$INTR_{cb}$	$YP_{gvt} = INCP_{gvt} + (INTR_{gvt} + DIVR_{gvt} + RENTLNR_{gvt}) - (INTP_{gvt})$	$YP_{row} = YTRADE_{row} + (INTR_{row} + FDIY_{row} + KYNET_{row}) - (INTP_{row} + FDIY_{nfc})$	0
18	Direct Tax - received						(+) $TAXR_{gvt} = (TAXP_{hh} + TAXPD_{nfc} + TAXP_{fc} + TAXP_{row}) + disc\_tax$	(+) $TAXR_{row} = TAXPW_{nfc}$	
19	Direct Tax - paid		(-) $TAXP_{hh} = \theta^{d}_{hh} \cdot (YP_{hh} + penspaym)$	(-) $TAXPD_{nfc} = TAXP_{nfc} - TAXPW_{nfc} = (\theta^{d}_{nfc} \cdot OPS_{nfc}) - (\theta^{dw} \cdot WAGES2ROW)$	(-) $TAXP_{fc} = \theta^{d}_{fc} \cdot OPS_{fc}$			(-) $TAXP_{row} = \theta^{d}_{row} \cdot WAGESFROW$	
20	Social Benefits		(+) $penspaym = BENR_{hh}$				(-) $penspaym$		0
21	Social Contributions		(-) $soccon = BENP_{hh}$				(+) $soccon$		0

Continued on next page

Table B.3 continued from previous page

	Transactions	Production	HH	NFC	FC: Banks	FC: Central Bank	GVT	RoW	Tot
					Sectors				
22	Other (net) current transfers		(+) $OTCN_{hh}$	(+) $OTCN_{nfc}$	(+) $OTCN_{fc}$	(-) $OTCP_{cb}$	(+) $OTCN_{gvt}$	(-) $OTCN_{row}$	0
23	*Sum 18-22 Disposable income*		*(+)* YD_{hh}	*(+)* YD_{nfc}	*(+)* YD_{fc}	0	*(+)* YD_{gvt}	*(+)* YD_{row}	0
24	Pensions		(+) $PENSR_{hh} = PENSP_{nfc} + PENSP_{fc}$	(-) $PENSP_{nfc} = ratio^{pensp}_{nfc} \cdot penspaym$	(-) $PENSP_{fc} = ratio^{pensp}_{fc} \cdot penspaym$				0
25	Gov. Consumption - Individual						(-) $CONSCOLL_{gvt} = par^{cc}_{gvt} \cdot G$		
26	Gov. Consumption - Collective						(-) $CONSIND_{gvt} = par^{ci}_{gvt} \cdot G$		
27	Consumption		(-) $CONSF_{hh} = cons + disc\_cons$						
28	*Sum 23-27: Savings*		(+) $SAV_{hh} = YD_{hh} + PENSR_{hh} - CONSF_{hh}$	(+) $SAV_{nfc} = YD_{nfc} - PENSP_{nfc}$	(+) $SAV_{fc} = YD_{fc} - PENSP_{fc}$		(+) $SAV_{gvt} = YD_{gvt} - (CONSCOLL_{gvt} + CONSIND_{gvt}$	(+) $SAV_{row} = YD_{row}$	0
29	Taxes on Capital Account		(-)$TRKTAX\_P_{hh}$	(-) $TRKTAX\_P_{nfc} = TRKTAX\_PD_{nfc} + TRKTAX\_PW_{nfc}$	(-) $TRKTAX\_P_{fc}$		(+) $TRKTAX\_R_{gvt} = TRKTAX\_P_{hh} + TRKTAX\_PD_{nfc} + TRKTAX\_P_{fc}$	(+) $TRKTAX\_R = TRKTAX\_PW_{nfc}$	0
30	Net Transfer in Capital Account		(-) $NTRK_{hh}$	(-) $NTRK_{nfc}$	(-) $NTRK_{fc}$		(+) $NTRK_{gvt}$		0
31	Gross Fixed Capital Formation		(-) $GFCF_{hh}$	(-) $GFCF_{nfc}$	(-) $GFCF_{fc}$		(-) $GFCF_{gvt}$		
32	Changes in Inventories		(-) $DINV_{hh}$	(-) $DINV_{nfc}$	(-) $DINV_{fc}$		(-) $DINV_{gvt}$		
33	Other Non-Produced non-Financial Assets		(-) $OTHDNA_{hh}$	(-) $OTHDNA_{nfc}$	(-) $OTHDNA_{fc}$		(-) $OTHDNA_{gvt}$		
34	*Sum 28-33: Net Lending*		$NETLEND_{hh} = SAV_{hh} + (TRKTAX\_P_{hh} - NTRK_{hh}) - GFCF_{hh} - DINV_{hh} - OTHDNA_{hh}$	$NETLEND_{nfc} = SAV_{nfc} + (TRKTAX\_P_{nfc} - NTRK_{nfc}) - GFCF_{nfc} - DINV_{nfc} - OTHDNA_{nfc}$	$NETLEND_{fc} = SAV_{fc} + (TRKTAX\_P_{fc} - NTRK_{fc}) - GFCF_{fc} - DINV_{fc} - OTHDNA_{fc}$		$NETLEND_{gvt} = SAV_{gvt} + (TRKTAX\_R_{gvt} + NTRK_{gvt}) - GFCF_{gvt} - DINV_{gvt} - OTHDNA_{gvt}$	$NETLEND_{row} = SAV_{row} + (TRKTAX\_R_{row} + NTRK_{row}) - OTHDNA_{row}$	0

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Table B.4: Italy. Financial accounts of institutional sectors, 2016q4, Millions euro.

	Sectors									
	NFC	Financial Corporations					GVT	HH	RoW	Tot.
		CB	Banks	OFI	Fin Aux	Ins.&Pens.				
Financial Assets										
Gold, Monetary Reserves		93,098							8,387	101,485
Banknotes and monetary deposits	296,449	3,953	418,422	60,478	18,520	25,503	52,221	866,555	406,178	2,148,279
Other deposits	21,950	254,604	251,014	124,774	158,318	1,507	41,395	463,309	258,890	1,575,761
Short-term assets	49	1,042	26,073	6,128	2,480	2,462	86	2,285	80,765	121,370
Medium/long-term assets	63,858	413,920	784,986	193,067	82,510	572,047	38,188	361,965	955,697	3,466,238
Derivatives	13,421	29	178,665	4,646	935	742		757	124,152	323,347
Short-term loans	45,354	42	499,094	24,365		1,509		14,072	81,325	665,761
Medium/long-term loans	25,570	2,464	1,389,682	178,431		8,497	141,329		169,451	1,915,424
Shares	592,663	9,135	188,591	118,286	8,138	101,460	135,173	984,657	482,268	2,620,371
Shares of Mutual Funds	13,448		15,383	200,208	67,748	183,318	4,229	474,413	1,084	959,831
Insurance technical reserves	17,420		6,125			2,928	1,318	940,041	16,180	984,012
Other accounts	552,417		18,756	2,388	79	3,124	133,666	126,709	90,429	927,568
Total	1,642,598	778,285	3,776,790	912,770	338,729	903,097	547,605	4,234,764	2,674,806	15,809,447
Financial Liabilities										
Gold, Monetary Reserves		8,387							93,098	101,485
Banknotes and monetary deposits	41,777	632,837	1,120,110				160,657		192,897	2,148,278
Other deposits			1,441,565				80,743		53,452	1,575,760
Short-term assets	4,982			57			107,261		9,071	121,371
Medium/long-term assets	140,095		572,692	179,053		16,067	2,023,133		535,200	3,466,240
Derivatives	12,997	3	193,479	2,877	4,377	855	30,110	68	78,580	323,346
Short-term loans	343,995			121,349	86,119	915	12,148	54,188	47,046	665,760
Medium/long-term loans	752,202	304	57,620	101,277	6,560	10,581	211,645	643,397	131,838	1,915,424
Shares	1,761,046	7,500	180,143	36,408	9,100	80,920			545,254	2,620,371
Shares of Mutual Funds			4,813	296,042					658,977	959,832
Insurance technical reserves	91,808	7,186	8,601			795,051	4,964	37,154	39,247	984,011
Other accounts	535,973		2,464	609	37	2,992	79,649	178,596	127,246	927,566
Total	3,684,874	656,217	3,581,489	737,672	106,193	907,381	2,710,310	913,403	2,511,904	15,809,444
Net Wealth	-2,042,276	122,068	195,301	175,098	232,536	-4,284	-2,162,705	3,321,361	162,902	3

Source: Bank of Italy

Table B.5: Model Balance-Sheet Matrix. Italy.

		Sector						
	Assets/liabilities	HH	NFC	FC	CB	GVT	RoW	Total
1	*Real assets*							
2	Capital (residential)	(+) K_{hh}						
3	Capital (non-residential): machinery		(+) K_M_{nfc}	(+) K_M_{fc}				
4	Capital (non-residential): warehouses		(+) K_NR_{nfc}	(+) K_NR_{nfc}				
5	Capital (infrastructures)					(+) K_{gvt}		
6	*Financial assets*							
7	Gold				(+) $GOLD$		(-) $GOLD$	0
8	Monetary base	(+) MB_{hh}		(+) MB_{fc}	(-) MB		+ MB_T2	0
9	CB refinancing			(-) ADV	(+) ADV			0
10	Bank deposits	(+) $DEPS_{hh}$	(+) $DEPS_{nfc}$	(-) $DEPS$		(+) $DEPS_{gvt}$	(+) $DEPS_{row}$	0
11	Bank loans: consumer credit	(-) $BLCC$		(+) $BLCC$				0
12	Bank loans: mortgages	(-) $BLMO$		(+) $BLMO$				0
13	Bank loans to firms		(-) $BLFIRMS$	(+) $BLFIRMS$				0
14	Banks debt	(+) BB_{hh}		(-) BB			(+) BB_{row}	0
15	Banks equities	(+) EB		(-) EB				0
16	Public debt	(+) B_{hh}	(+) B_{nfc}	(+) B_{fc}	(+) B_{cb}	(-) B	(+) B_{row}	0
17	Firms equities	(+) EN_{hh}	(-) EN	(+) EN_{fc}		(+) EN_{gvt}		0
18	Outgoing FDI		(+) $FDIO$				(-) $FDIO$	0
19	Incoming FDI		(-) $FDII$				(+) $FDII$	0
20	Foreign liabilities	(+) F_{hh}		(+) F_{fc}	(+) F_{cb}		(-) F	0
21	Other net	(+) $ONFA_{hh}$	(+) $ONFA_{nfc}$	(+) $ONFA_{fc}$	(+) $ONFA_{cb}$	(+) $ONFA_{gvt}$	(+) $ONFA_{row}$	
22	Net financial assets	NFA_{hh}	NFA_{nfc}	NFA_{fc}	NFA_{cb}	NFA_{gvt}	NFA_{row}	0

Appendix C

Econometric Appendix

After the Golden Age of Econometrics of the 1950s and 60s, a growing skepticism toward the discipline arose. As Desai said, "even within the academic profession, one in sensing a doubt as to whether the generation of more numbers for their own sake is fruitful, The ad hoc approach of many practicing econometricians to the problem of hypothesis testing and inference is illustrated by the popular image of much econometrics as a high R^2 in search of a theory." (Desai, 1967:7).

The forecasting ability of the large scale macro-econometric models built in the 1970s following what has been labelled the Cowles Commission methodology, moreover, was found to be poor (see Cooper, 1972).

In 1978, however, a major step forward in the discipline occurred with the publication of the work of Davidson, Hendry, Srba and Yeo. This work has had an important influence on the way many econometricians now use time series data to model economic relationship. These new developments include general to specific modelling and cointegration analysis, upon which our work will be built.

One of the main methodological innovations of their approach was that a "good" empirical econometric model could be developed by starting from a relatively large, general model and by gradually reducing its size and transforming the variables through the testing of various linear and non-linear restrictions.

By general to specific modelling we mean the formulation of a fairly unrestricted dynamic model which is subsequently tested, transformed and reduced in size by performing a number of tests for restrictions.

The general mode is usually described in an autoregressive distributed lag (ADL) form. This means that a dependent variable y_t is expressed as a function of its own lagged values, and the current and lagged values of all explanatory variables X, as in

$$a(L)y = B(L)X + u \tag{C.1}$$

where L is the lag operator.

An important implication, thus, is that we must have a tool which can be used for testing whether or not the restrictions of interest which lead to a specific model are valid, or equivalently, whether or not the restrictions contradict the general model. Several tests have been suggested for testing both linear and non-linear restrictions in a general econometric model. The most well-known are the Likelihood Ratio, Wald and Lagrange Multiplier (scores) tests.

The General-to-specific approach is usually adopted on stationary variables. A first step of modern econometric analysis involving time series has thus become unit root testing, to ascertain the order of integration of each series. Formally given

$$a(L)y = u \tag{C.2}$$

In order for the variable y_t to meet what are called the "stationarity conditions", it is required that the roots of the lag polynomial $a(L)$ "lie outside the unit circle", i.e. they are larger than unity in absolute value (see Granger and Newbold, 1986:6-10). To put it differently, a stochastic process[1] y is said to be stationary if the joint and conditional probability distributions of the process are unchanged if displaced in time. The means and the variance of the process, thus are constant over time, while the value of the covariance between the two periods depends only on the gap between the periods, and not the actual time at which this covariance is considered. If one or more of these conditions are not fulfilled, the process is said to be non-stationary.

If this is not the case, i.e. if y is not stationary, unit root testing is performed on the time difference of y, and the order of integration of a series is defined by the number of time differences required to obtain stationarity (Engle and Granger, 1987). Non-stationarity of time series has always been regarded as a major problem in econometric analysis. In such cases, a spurious correlation may emerge given stochastic (or deterministic) trends in both the dependent and one or more of the explanatory variables. These regressions often give apparently good results, and therefore may make it impossible to determine whether or not an economic relationship suggested by a theory has in fact any support from the data.

From the discussion above it follows that, in order to have meaningful economic results, regression analysis should be run only on data which are not subject to a trend. Since almost all economic series contain trends, a convenient way of getting rid of a trend is by using first differences rather than levels of the variables. A simple method of testing the order of integration of y_t has

[1] By "stochastic process" we mean a family of real valued random variables, indexed by t, which represents time. Simply put, each element $X_1, X_2 ... X_t$ of the stochastic process $\{X_t\}$ is a random variable.
If all the random variables X_t have means (expected values), we may describe the *mean of a stochastic process* X_t as a series of means (expected values) for particular X_t's or as a function of t. We will denote the mean of a stochastic process μ_t, while σ_t^2 will stand for its variance and the covariance between two of the variable which belong to the stochastic process, for example X_t and X_{t+j}, by $\sigma_{t,t+j}$.

been proposed by Dickey and Fuller (1979), hereafter DF test, which is a test of the null-hypothesis that the series contains a unit root, i.e. is integrated of order zero. If the test is rejected, the series could be integrated of order higher than zero, or might be not integrated at all. Consequently, one shall test whether the order of integration is one (Δy_t) or two ($\Delta\Delta y_t$) ans so on. However, is unusual for economic time series to be integrated of order higher than two.

A substantial weakness of the original DF test is that it did not take into account of auto-correlation in ϵ_t. A simple solution, proposed by the same authors (Dickey and Fuller 1981), is to use lagged left-hand-side variables as additional explanatory variables to approximate the auto-correlation. This test is called the Augmented Dickey Fuller test (ADF).

The problem of modelling first differences, however, is that we lose long-run properties. The attention, thus, concentrated on economic data series that, although non-stationary, can be combined together into a single series which is itself stationary. Such series are defined as cointegrated. The formal definition of cointegration of two variables, developed by Engle and Granger (1987) is as follows: *time series x_t and y_t are said to be cointegrated of order d,b* if: 1) both series are integrated of order d and, 2) there exist a linear combination of these variables which is integrated of order d-b. The vector $[\alpha_1, \alpha_2]$ is called a *cointegrating vector*.

For empirical econometrics, the most interesting case is where the series transformed with the use of the cointegrating vector become stationary and the cointegrating coefficients can be identified with parameters in the long run relationship between the variables.

The fact that the variables are cointegrated implies that there is some adjustment process which prevents the errors in the long-run relationship becoming larger and larger. Engle and Granger (1987) showed that any cointegrated series have an error correction representation. The converse is also true, in that cointegration is a necessary condition for error correction models to hold. This kind of models currently represent the most common approach to incorporate the theory-driven long-run relation of the variables and their short-run disequilibrium behavior.

The analysis of cointegration in time series econometrics, introduced in the mid-1980s, has indeed been regarded as one of the main methodological development in empirical modelling. Following the previous discussion, we start with appropriate tests for the stationarity of our time series[2].

[2]Tests are available on request

C.1 Estimation Outputs

In this Section, we detail the rest of the estimation outputs of Chapter 5. To ease the reader, we also report the corresponding equation.

$$1/(p^b) = \alpha_1^{pb} \cdot 1/p_{t-1}^b + \alpha_2^{pb} \cdot r^b + \alpha_0^{pb} \quad \text{(EQ. PB)}$$

Table C.1: Price of Government Bonds

Dependent Variable: $1/p^B$
Method: Least Squares
Sample (adjusted): 1995Q2 2017Q3
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(α_1^{pb})	0.842358	0.067353	12.50670	0.0000
(α_2^{pb})	0.000867	0.001867	0.464294	0.6436
(α_0^{pb})	0.148344	0.059038	2.512692	0.0138

R-squared	0.880834	Mean dependent var	0.984046
Adjusted R-squared	0.878094	S.D. dependent var	0.055196
S.E. of regression	0.019272	Akaike info criterion	−5.027613
Sum squared resid	0.032311	Schwarz criterion	−4.944286
Log likelihood	229.2426	Hannan-Quinn criter.	−4.994011
F-statistic	321.5363	Durbin-Watson stat	2.092504
Prob(F-statistic)	0.000000		

$$log(p^{bb}) = \alpha_1^{pbb} \cdot log(p_{t-1}^{bb}) + \alpha_2^{pbb} \cdot \frac{INTP_{fc,t-1} \cdot 4}{BB_{t-2}} + \alpha_3^{pbb} \cdot \frac{BB_{row,t-1}}{BB_{t-1}} + \alpha_4^{pbb} \cdot p_{t-1}^b + \alpha_5^{pbb} \cdot p_{t-1}^{en} + \alpha_0^{pbb} \quad \text{(EQ. PBB)}$$

$$log(p^{eb}) = \alpha_1^{peb} \cdot log(p_{t-1}^{eb}) + \alpha_2^{peb} \cdot log(sp^{it}) + \alpha_3^{peb} \cdot dum_{11}\text{“2008}q1\text{”} + \alpha_4^{peb} \cdot dum_{12}\text{“2011}q1_b\text{”} + \alpha_5^{peb} \cdot dum_{12}\text{“2011}q1_b\text{”} \cdot log(sp^{it}) + \alpha_6^{peb} \cdot dum_{12}\text{“2011}q1_b\text{”} \cdot log(p_{t-1}^{eb} + \alpha_0^{peb} \quad \text{(EQ. PEB)}$$

$$log(p^{en}) = \alpha_1^{pen} \cdot log(p_{t-1}^{en}) + \alpha_2^{pen} \cdot log(sp^{us}) + \alpha_3^{pen} \cdot log(\frac{sp^{us}}{sp^{it}}) + \alpha_0^{pen} \quad \text{(EQ. PEN)}$$

Table C.2: Price of Banks Equities

Dependent Variable: $log(p^{BB})$
Method: Least Squares
Sample (adjusted): 2001Q1 2017Q3
Included observations: 67 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(α_1^{pbb})	0.407008	0.117241	3.471562	0.0010
(α_2^{pbb})	0.081174	0.038525	2.107046	0.0392
(α_3^{pbb})	−0.027120	0.044429	−0.610416	0.5439
(α_4^{pbb})	0.142138	0.064634	2.199131	0.0317
(α_5^{pbb})	−0.033631	0.018995	−1.770492	0.0816
(α_0^{pbb})	−0.106211	0.061821	−1.718043	0.0909

R-squared	0.670721	Mean dependent var	0.020069
Adjusted R-squared	0.643731	S.D. dependent var	0.027738
S.E. of regression	0.016556	Akaike info criterion	−5.278813
Sum squared resid	0.016721	Schwarz criterion	−5.081378
Log likelihood	182.8402	Hannan-Quinn criter.	−5.200688
F-statistic	24.85068	Durbin-Watson stat	2.102777
Prob(F-statistic)	0.000000		

$$log(p^f) = \alpha_1^{pf} \cdot log(p^f_{t-1} + \alpha_2^{pf} \cdot log(xr^{it\_us}) + \alpha_3^{pf} \cdot RB10^{de} + \alpha_0^{pf} \quad \text{(EQ. PF)}$$

$$dlog(p^{fdio}) = \alpha_1^{pfdio} \cdot dlog(p^f) + \alpha_0^{pfdio} \quad \text{(EQ. PFDIO)}$$

$$dlog(p^{fdii}) = \alpha_1^{pfdii} \cdot dlog(p^f) + \alpha_0^{pfdii} \quad \text{(EQ. PFDII)}$$

$$\begin{aligned} dlog(MB_{hh}) = {} & \nu_1^{mbhh} \cdot dlog(MB_{hh,t-3}) + \nu_2^{mbhh} \cdot dlog(MB_{hh,t-4}) \\ & + \nu_3^{mbhh} \cdot dlog(CONS_{t-4}) + \nu_4^{mbhh} \cdot IV\text{“2002q1”} + \nu_5^{mbhh} \cdot IV\text{“2002q1”}_{t-1} \\ & + \nu_6^{mbhh} \cdot d(r^{deps}_{t-1}) + \nu_7^{mbhh} \cdot d(r^{deps}_{t-2}) + \nu_8^{mbhh} \cdot d(r^{deps}_{t-4}) \\ & + \nu_9^{mbhh} \cdot log(MB_{hh,t-1}) + \nu_1^{mbhh} 0 \cdot log(CONS_{t-1}) + \nu_0^{mbhh} \end{aligned} \quad \text{(HH.28B)}$$

$$\begin{aligned} \Delta BLCC/YD_{hh} = {} & \nu_1^{blcc} \cdot \frac{BLCC_{t-4}}{YD_{hh,t-4}} + \nu_2^{blcc} \cdot \frac{\Delta BLCC_{t-1}}{YD_{hh,t-1}} \\ & + \nu_3^{blcc} \cdot r_{blcc}) + \nu_4^{blcc} \cdot d(\frac{CONS_{t-1}}{YD_{hh,t-1}}) + \nu_0^{blcc} \end{aligned} \quad \text{(HH. 36B)}$$

Table C.3: Price of Banks Shares

Dependent Variable: $log(p^{EB})$
Method: Least Squares
Sample (adjusted): 1995Q2 2017Q3
Included observations: 90 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(α_1^{peb})	0.742122	0.095978	7.732220	0.0000
(α_2^{peb})	0.348823	0.153070	2.278839	0.0252
(α_3^{peb})	−0.630126	0.142823	−4.411926	0.0000
(α_4^{peb})	−0.415393	0.086138	−4.822394	0.0000
(α_5^{peb})	0.575181	0.292367	1.967325	0.0525
(α_6^{peb})	−0.413110	0.185846	−2.222868	0.0289
(α_0^{peb})	0.120565	0.041690	2.891920	0.0049

R-squared	0.966867	Mean dependent var	0.318981
Adjusted R-squared	0.964472	S.D. dependent var	0.717520
S.E. of regression	0.135245	Akaike info criterion	−1.088878
Sum squared resid	1.518161	Schwarz criterion	−0.894448
Log likelihood	55.99949	Hannan-Quinn criter.	−1.010472
F-statistic	403.6770	Durbin-Watson stat	1.569560
Prob(F-statistic)	0.000000		

Table C.4: Price of NFC issued Shares

Dependent Variable: $log(p^{EN})$
Method: Least Squares
Sample (adjusted): 2004Q1 2017Q3
Included observations: 55 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(α_1^{pen})	0.846322	0.042809	19.76966	0.0000
(α_2^{pen})	0.100835	0.030418	3.314937	0.0017
(α_3^{pen})	−0.065140	0.019927	−3.268896	0.0019
(α_0^{pen})	0.009256	0.006736	1.374148	0.1754

R-squared	0.932825	Mean dependent var	0.125137
Adjusted R-squared	0.928874	S.D. dependent var	0.124871
S.E. of regression	0.033303	Akaike info criterion	−3.896421
Sum squared resid	0.056562	Schwarz criterion	−3.750433
Log likelihood	111.1516	Hannan-Quinn criter.	−3.839967
F-statistic	236.0720	Durbin-Watson stat	1.324784
Prob(F-statistic)	0.000000		

Table C.5: Price of Foreign Issued Liabilities

Dependent Variable: $log(p^F)$
Method: Least Squares
Sample (adjusted): 2001Q1 2017Q3
Included observations: 67 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(α_1^{pf})	0.823714	0.029478	27.94314	0.0000
(α_2^{pf})	−0.089540	0.013785	−6.495241	0.0000
(α_3^{pf})	−0.013037	0.002467	−5.284841	0.0000
(α_0^{pf})	0.009341	0.005787	1.614149	0.1115

R-squared	0.990397	Mean dependent var	−0.073734
Adjusted R-squared	0.989940	S.D. dependent var	0.143350
S.E. of regression	0.014378	Akaike info criterion	−5.588393
Sum squared resid	0.013024	Schwarz criterion	−5.456769
Log likelihood	191.2112	Hannan-Quinn criter.	−5.536309
F-statistic	2165.875	Durbin-Watson stat	1.911789
Prob(F-statistic)	0.000000		

Table C.6: Price of Outgoing FDI's

Dependent Variable: $dlog(p^{FDIO})$
Method: Least Squares
Sample (adjusted): 1999Q3 2017Q3
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(α_1^{pfdio})	0.277773	0.103087	2.694556	0.0088
(α_0^{pfdio})	−0.002827	0.002468	−1.145585	0.2558

R-squared	0.092775	Mean dependent var	−0.002024
Adjusted R-squared	0.079997	S.D. dependent var	0.021824
S.E. of regression	0.020933	Akaike info criterion	−4.867952
Sum squared resid	0.031112	Schwarz criterion	−4.805200
Log likelihood	179.6803	Hannan-Quinn criter.	−4.842944
F-statistic	7.260634	Durbin-Watson stat	1.739058
Prob(F-statistic)	0.008791		

Table C.7: Price of Incoming FDI's

Dependent Variable: $dlog(p^{FDII})$
Method: Least Squares
Sample (adjusted): 1999Q3 2017Q3
Included observations: 73 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(α_1^{pfdii})	0.418774	0.122531	3.417702	0.0010
(α_0^{pfdii})	0.000464	0.002934	0.158228	0.8747

R-squared	0.141275	Mean dependent var	0.001676
Adjusted R-squared	0.129180	S.D. dependent var	0.026663
S.E. of regression	0.024882	Akaike info criterion	−4.522367
Sum squared resid	0.043955	Schwarz criterion	−4.459615
Log likelihood	167.0664	Hannan-Quinn criter.	−4.497359
F-statistic	11.68069	Durbin-Watson stat	1.541260
Prob(F-statistic)	0.001049		

$$\begin{aligned} VBLMO/YD_{hh} = {} & \nu_1^{blmo} \cdot \frac{VBLMO_{t-4}}{YD_{hh,t-4}} + \nu_2^{blmo} \cdot \frac{GFCF\_H_{t-1}}{YD_{hh,t-1}} \\ & + \nu_3^{blmo} \cdot r_{blmo}) + \nu_4^{blmo} \cdot \frac{BLMO_{t-1}}{YD_{hh,t-1}}) + \nu_5^{blmo} \cdot \frac{BLMOWO_{t-1}}{BLMO_{t-1}}) \\ & + \nu_6^{blmo} \cdot SPREAD_{t-1} + \nu_0^{blcc} \end{aligned} \tag{HH. 37B}$$

$$ADVNET/DEPS = \nu_1^{advn} \cdot \frac{ADVNET_{t-1}}{DEPS_{t-1}} + \nu_2^{advn} \cdot SPREAD_{t-1} + \nu_0^{advn} \tag{CB. 09B}$$

$$\begin{aligned} VB_{fc}/B_{fc,t-1} = {} & \nu_1^{bfc} \cdot \frac{VB_{fc,t-4}}{B_{fc,t-5}} + \nu_2^{bfc} \cdot SPREAD_{t-1} \\ & + \nu_3^{bfc} \cdot \frac{DADVQE2}{B_{fc,t-1}} + \nu_0^{bfc} \end{aligned} \tag{FC. 26B}$$

$$\begin{aligned} VF_{fc}/F_{fc,t-1} = {} & \nu_1^{ffc} \cdot r_{t-1}^{B} + \nu_2^{ffc} \cdot SPREAD_{t-1} + \nu_3^{ffc} \cdot \frac{xr^{it\_us}}{xr_{t-1}^{it\_us}} \\ & + \nu_4^{ffc} \cdot \frac{INTP_{row,t-1}}{F_{t-2}} + \nu_0^{ffc} \end{aligned} \tag{FC. 28B}$$

Table C.8: Households Demand for Monetary Base

Dependent Variable: $dlog(MB_{hh})$
Method: Least Squares
Sample (adjusted): 2000Q2 2017Q4
Included observations: 71 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ν_1^{mbhh}	−0.358687	0.039638	−9.048957	0.0000
ν_2^{mbhh}	0.396947	0.039740	9.988521	0.0000
ν_3^{mbhh}	1.096706	0.407499	2.691310	0.0092
ν_4^{mbhh}	−0.265654	0.017676	−15.02918	0.0000
ν_5^{mbhh}	−0.133591	0.017808	−7.501707	0.0000
ν_6^{mbhh}	−0.013788	0.007590	−1.816588	0.0743
ν_7^{mbhh}	−0.016617	0.008082	−2.055919	0.0441
ν_8^{mbhh}	−0.015794	0.007159	−2.206105	0.0312
ν_9^{mbhh}	−0.078265	0.015781	−4.959436	0.0000
ν_{10}^{mbhh}	0.240263	0.059582	4.032483	0.0002
(ν_0^{mbhh})	−2.045882	0.573699	−3.566126	0.0007

R-squared	0.914826	Mean dependent var	0.014765
Adjusted R-squared	0.900630	S.D. dependent var	0.051336
S.E. of regression	0.016183	Akaike info criterion	−5.268223
Sum squared resid	0.015713	Schwarz criterion	−4.917667
Log likelihood	198.0219	Hannan-Quinn criter.	−5.128818
F-statistic	64.44405	Durbin-Watson stat	1.775244
Prob(F-statistic)	0.000000		

Table C.9: Households Demand for Consumer Credit

Dependent Variable: $\Delta BLCC/YD_{hh}$
Method: Least Squares
Sample (adjusted): 2000Q1 2017Q3
Included observations: 71 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ν_1^{blcc}	−0.052790	0.027625	−1.910932	0.0604
ν_2^{blcc}	0.780615	0.077735	10.04195	0.0000
ν_3^{blcc}	0.001117	0.000503	2.222720	0.0297
ν_4^{blcc}	0.088845	0.044211	2.009584	0.0486
(ν_0^{blcc})	0.006199	0.005257	1.179306	0.2425

R-squared	0.705848	Mean dependent var	0.000237
Adjusted R-squared	0.688021	S.D. dependent var	0.007156
S.E. of regression	0.003997	Akaike info criterion	−8.138721
Sum squared resid	0.001054	Schwarz criterion	−7.979377
Log likelihood	293.9246	Hannan-Quinn criter.	−8.075355
F-statistic	39.59352	Durbin-Watson stat	1.884951
Prob(F-statistic)	0.000000		

$$VDEPS_{gvt}/DEPS_{gvt,t-1} = \nu_1^{dgvt} \cdot \frac{VDEPS_{gvt,t-4}}{DEPS_{gvt,t-5}} + \nu_2^{dgvt} \cdot \frac{G_{t-1}}{DEPS_{gvt,t-1}} + \nu_0^{dgvt} \tag{GVT. 29B}$$

Table C.10: Households Demand for Mortgage Credit

Dependent Variable: $VBLMO/YD_{hh}$
Method: Least Squares
Date: 04/19/18 Time: 15:47
Sample (adjusted): 2000Q1 2017Q3
Included observations: 71 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ν_1^{blmo}	0.543945	0.074975	7.254984	0.0000
ν_2^{blmo}	0.949661	0.252272	3.764426	0.0004
ν_3^{blmo}	−0.010847	0.001483	−7.314990	0.0000
ν_4^{blmo}	−0.034498	0.005167	−6.676488	0.0000
ν_5^{blmo}	−1.115476	0.358880	−3.108216	0.0028
ν_6^{blmo}	−0.006706	0.001146	−5.853270	0.0000
(ν_0^{blmo})	0.060724	0.012592	4.822577	0.0000

R-squared	0.922278	Mean dependent var	0.027032
Adjusted R-squared	0.914992	S.D. dependent var	0.024762
S.E. of regression	0.007220	Akaike info criterion	−6.930598
Sum squared resid	0.003336	Schwarz criterion	−6.707517
Log likelihood	253.0362	Hannan-Quinn criter.	−6.841886
F-statistic	126.5753	Durbin-Watson stat	1.737078
Prob(F-statistic)	0.000000		

Table C.11: Supply of Advances to Banks net of QE

Dependent Variable: $ADVNET/DEPS$
Method: Least Squares
Sample (adjusted): 2000Q1 2017Q3
Included observations: 71 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ν_1^{advn}	0.793376	0.064803	12.24297	0.0000
ν_2^{advn}	0.005126	0.001471	3.485690	0.0009
(ν_0^{advn})	0.001463	0.001087	1.345964	0.1828

R-squared	0.904548	Mean dependent var	0.032756
Adjusted R-squared	0.901741	S.D. dependent var	0.026137
S.E. of regression	0.008193	Akaike info criterion	−6.729723
Sum squared resid	0.004565	Schwarz criterion	−6.634117
Log likelihood	241.9052	Hannan-Quinn criter.	−6.691704
F-statistic	322.1998	Durbin-Watson stat	1.840377
Prob(F-statistic)	0.000000	Wald F-statistic	267.3397
Prob(Wald F-statistic)	0.000000		

Table C.12: FC Demand for Government Bonds

Dependent Variable: $VB_{fc}/B_{fc,t-1}$
Method: Least Squares
Sample (adjusted): 1996Q2 2017Q3
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ν_1^{bfc}	0.203251	0.107262	1.894906	0.0616
ν_2^{bfc}	0.012125	0.005804	2.089137	0.0398
ν_3^{bfc}	−0.637182	0.482280	−1.321187	0.1901
(ν_0^{bfc})	−0.005383	0.009492	−0.567059	0.5722

R-squared	0.128599	Mean dependent var	0.006952
Adjusted R-squared	0.096719	S.D. dependent var	0.064341
S.E. of regression	0.061151	Akaike info criterion	−2.705556
Sum squared resid	0.306631	Schwarz criterion	−2.591400
Log likelihood	120.3389	Hannan-Quinn criter.	−2.659613
F-statistic	4.033787	Durbin-Watson stat	2.075306
Prob(F-statistic)	0.009952		

Table C.13: FC Demand for Foreign Issued Liabilities

Dependent Variable: $VF_{fc}/F_{fc,t-1}$
Method: Least Squares
Sample (adjusted): 1999Q2 2017Q3
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ν_1^{ffc}	−0.022017	0.003203	−6.873321	0.0000
ν_2^{ffc}	0.011617	0.003667	3.167821	0.0023
ν_3^{ffc}	0.142148	0.063803	2.227908	0.0291
ν_4^{ffc}	2.236040	0.319009	7.009337	0.0000
(ν_0^{ffc})	−0.131352	0.065647	−2.000882	0.0493

R-squared	0.498235	Mean dependent var	0.009545
Adjusted R-squared	0.469148	S.D. dependent var	0.032711
S.E. of regression	0.023833	Akaike info criterion	−4.570281
Sum squared resid	0.039194	Schwarz criterion	−4.414601
Log likelihood	174.1004	Hannan-Quinn criter.	−4.508179
F-statistic	17.12867	Durbin-Watson stat	1.720791
Prob(F-statistic)	0.000000		

Table C.14: Government Demand for Bank Deposits

Dependent Variable: $VDEPS_{gvt}/DEPS_{gvt,t-1}$
Method: Least Squares
Sample (adjusted): 1996Q2 2017Q3
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ν_1^{dgvt}	0.461453	0.075207	6.135783	0.0000
ν_2^{dgvt}	0.564507	0.094096	5.999278	0.0000
(ν_0^{dgvt})	−0.582024	0.101889	−5.712355	0.0000

R-squared	0.615808	Mean dependent var	0.046469
Adjusted R-squared	0.606550	S.D. dependent var	0.293155
S.E. of regression	0.183883	Akaike info criterion	−0.514772
Sum squared resid	2.806478	Schwarz criterion	−0.429156
Log likelihood	25.13522	Hannan-Quinn criter.	−0.480316
F-statistic	66.51885	Durbin-Watson stat	2.146865
Prob(F-statistic)	0.000000		

C.2 Actual-Fitted Graphs

Figure C.1: Real Consumption

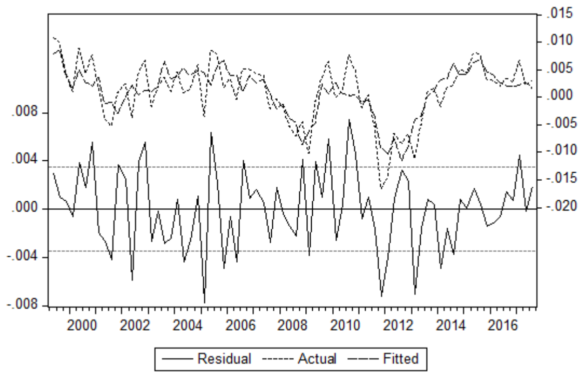


Figure C.2: Real Investments in Housing

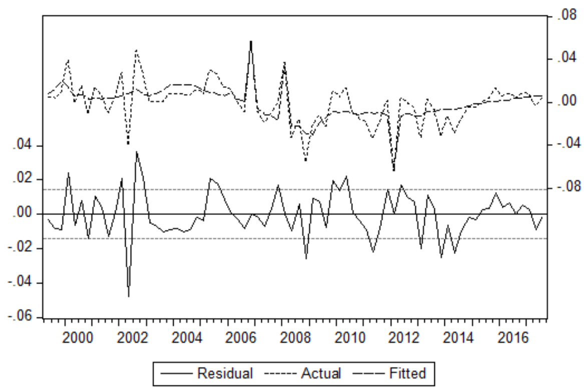


Figure C.3: Real Investments in Machineries

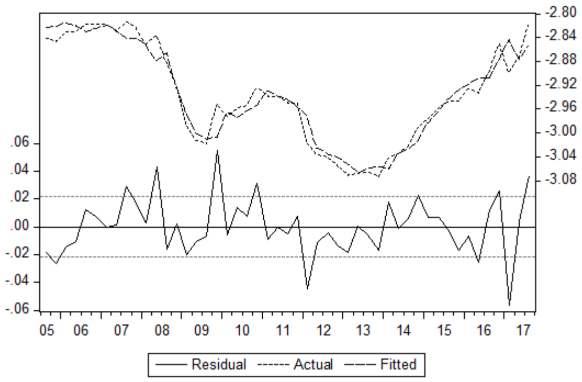


Figure C.4: Real changes in Inventories

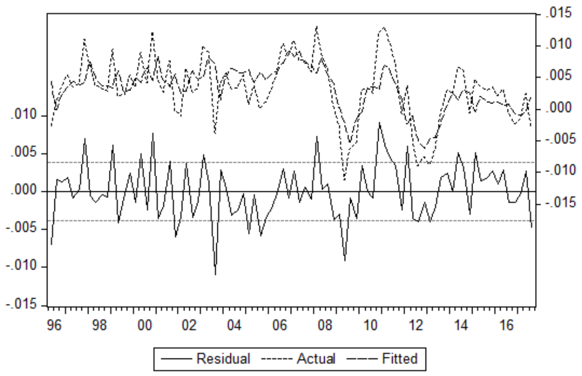


Figure C.5: Real Imports of Goods and Services

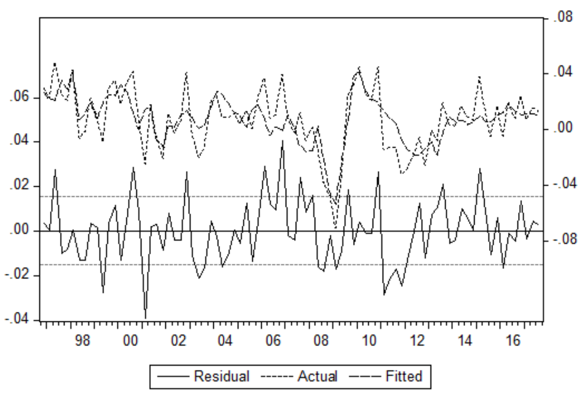


Figure C.6: Real Exports of Goods

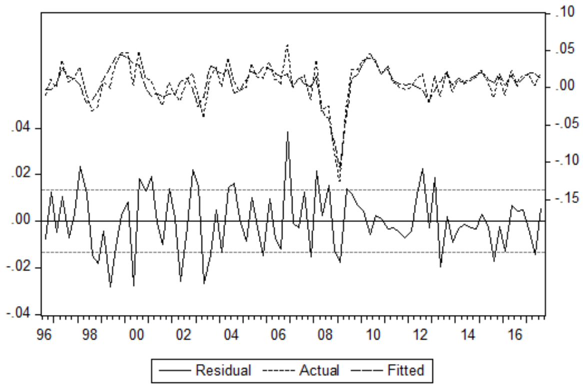


Figure C.7: Real Exports of Services

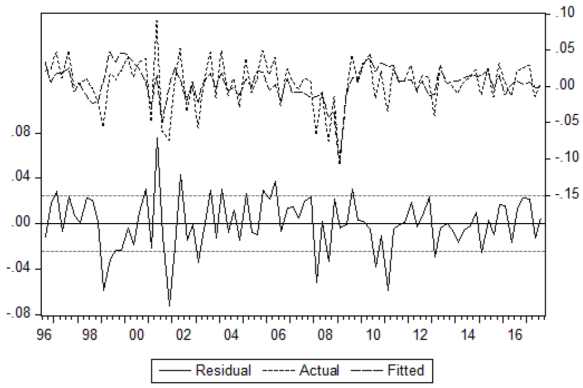


Figure C.8: Ratio of part-time workers in Total Employment

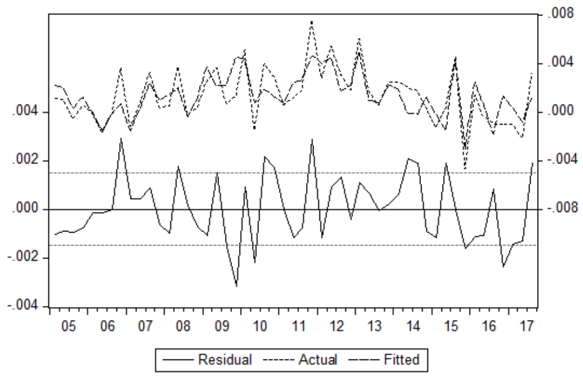


Figure C.9: Unit Nominal Wages

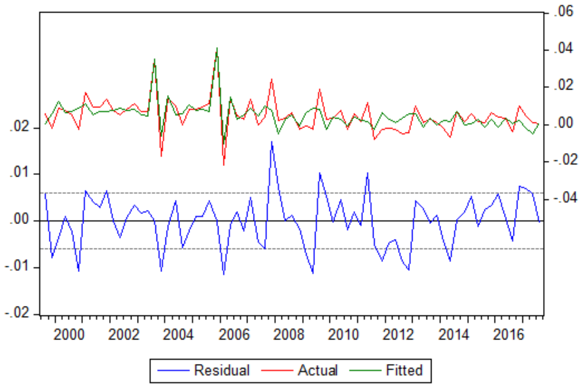


Figure C.10: Productivity

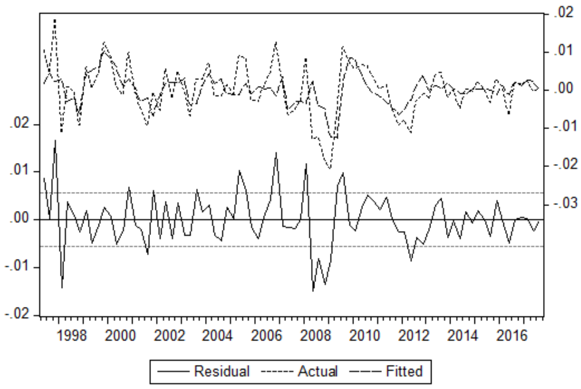


Figure C.11: Domestic Prices

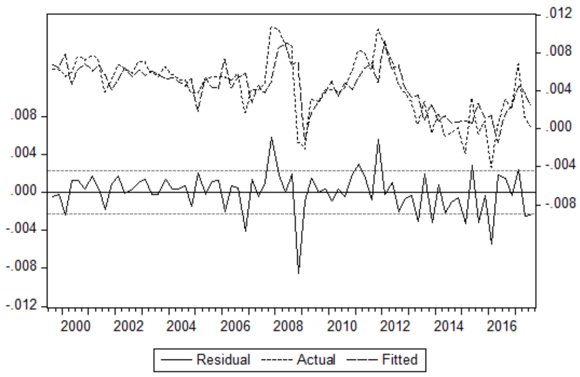


Figure C.12: Consumption Deflator

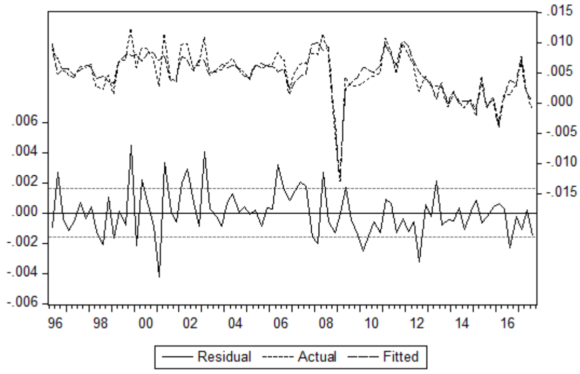


Figure C.13: Prices of Imports

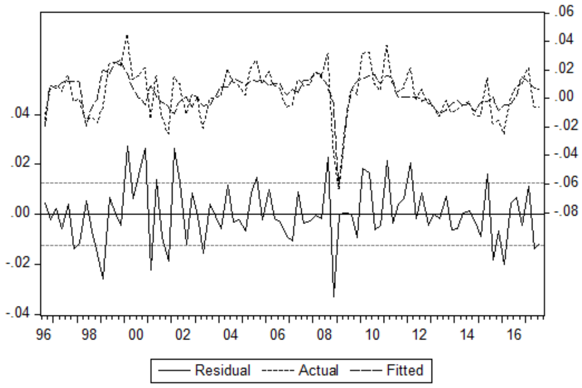


Figure C.14: Prices of Export Goods

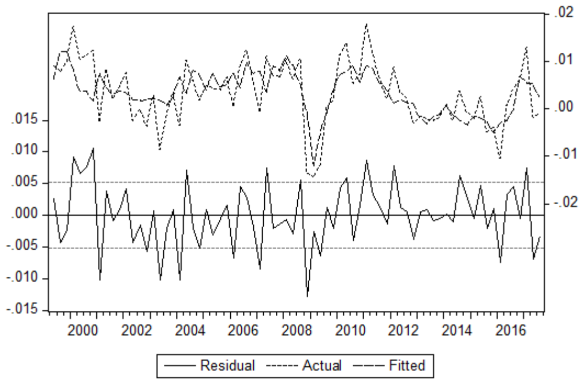


Figure C.15: Prices of Export Services

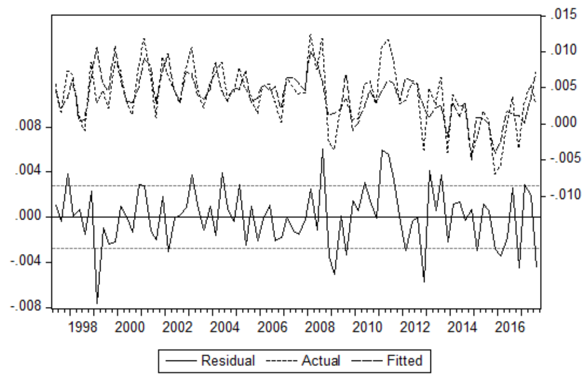


Figure C.16: Competitiveness

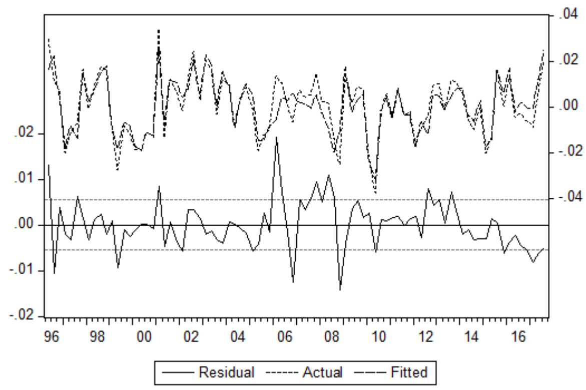


Figure C.17: Interest Rate on Deposits

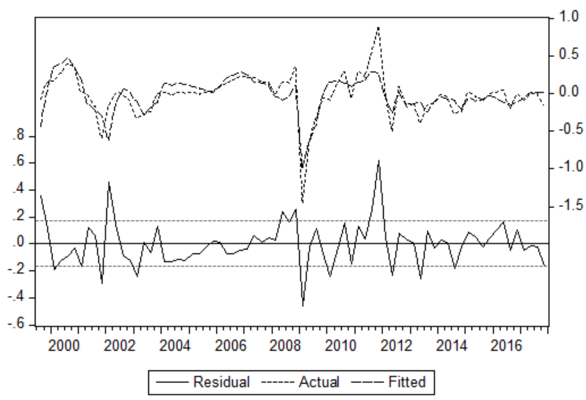


Figure C.18: Interest Rate on Mortgage Credit

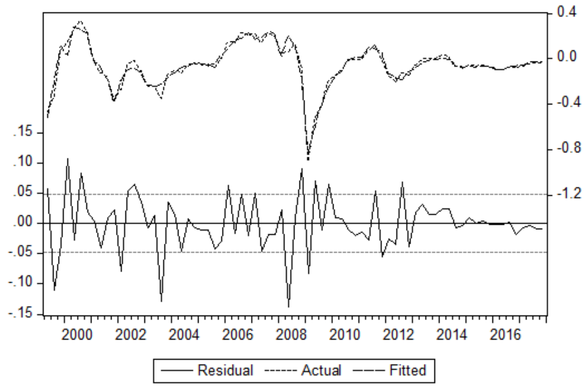


Figure C.19: Interest Rate on Consumer Credit

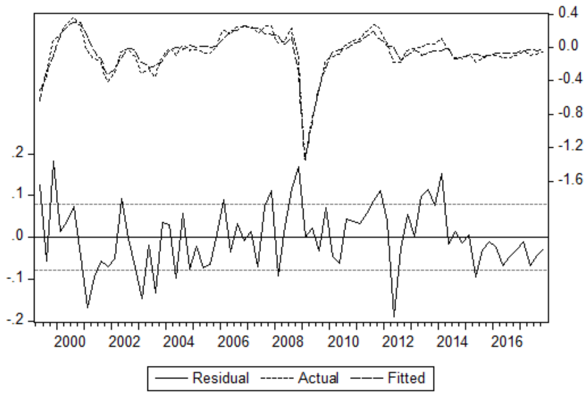


Figure C.20: Interest Rate on Credit to Non-Financial Firms

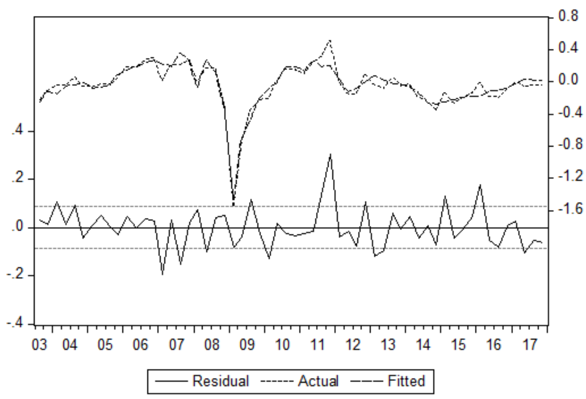


Figure C.21: (Implicit) Interest Rate on Foreign Issued Liabilities

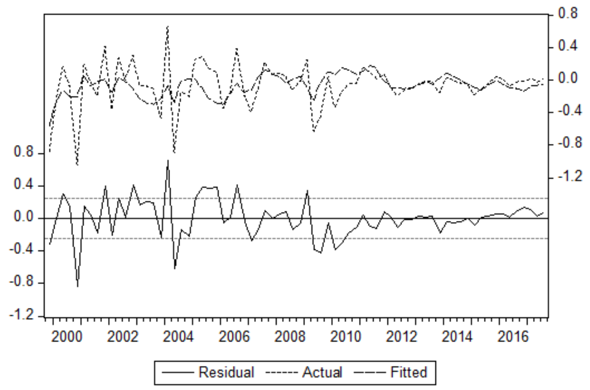


Figure C.22: (Implicit) RoE on Incoming FDI's

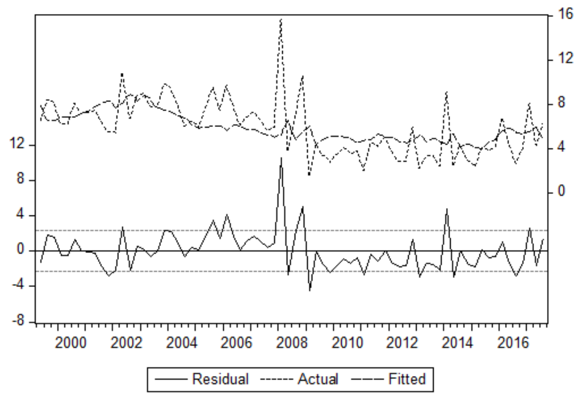


Figure C.23: (Implicit) RoE on Outgoing FDI's

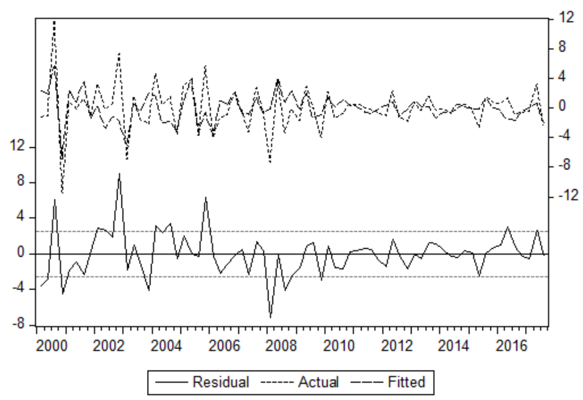


Figure C.24: Price of Government Bonds

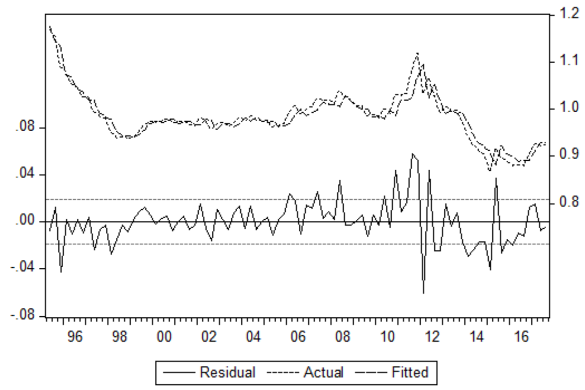


Figure C.25: Price of Banks Equities

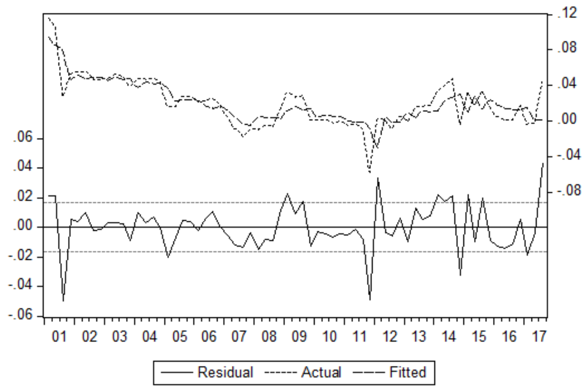


Figure C.26: Price of Banks Shares

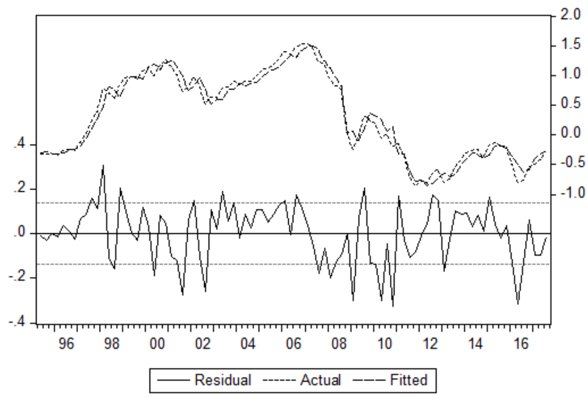


Figure C.27: Price of NFC issued Shares

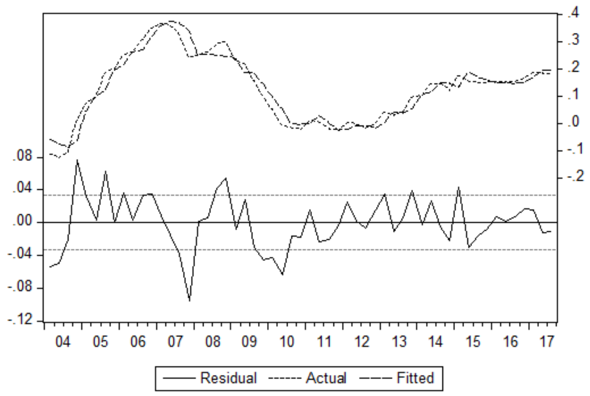


Figure C.28: Price of Foreign Issued Liabilities

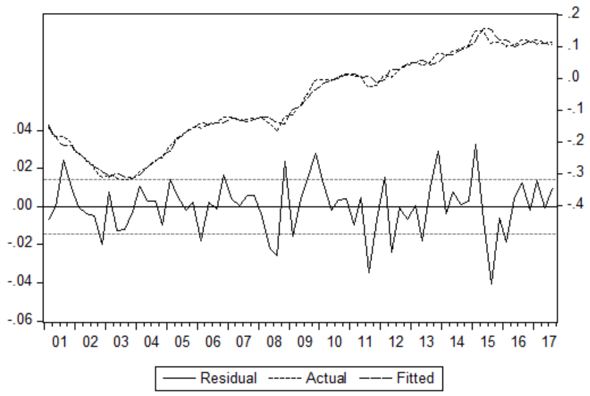


Figure C.29: Price of Outgoing FDI's

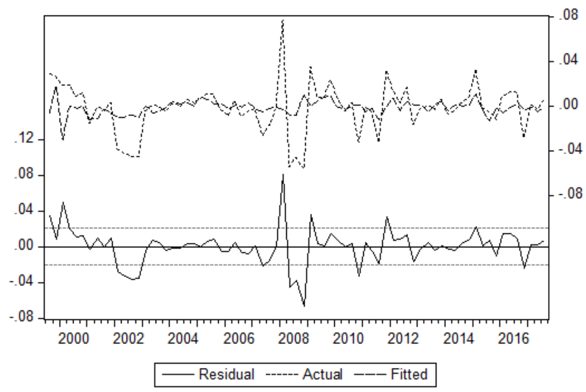


Figure C.30: Price of Incoming FDI's

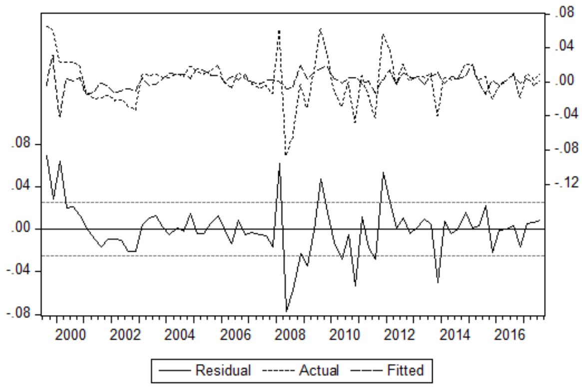


Figure C.31: Households Demand for Monetary Base

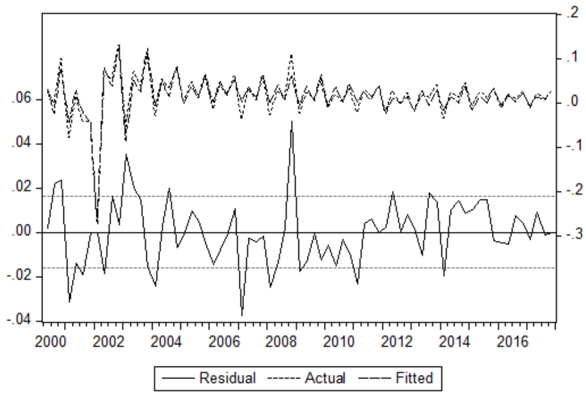


Figure C.32: Households Demand for Consumer Credit

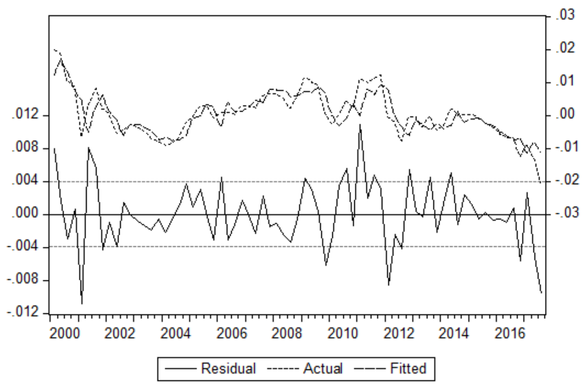


Figure C.33: Households Demand for Mortgage Credit

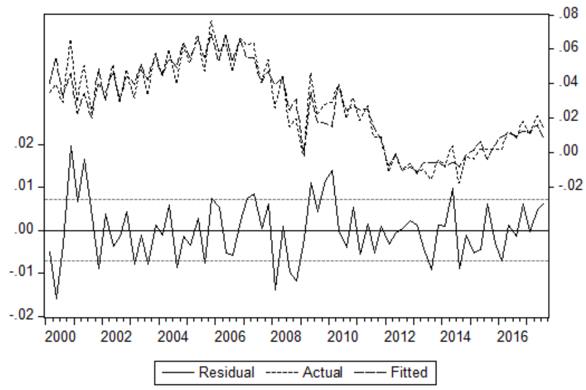


Figure C.34: CB Supply of Advances net of QE

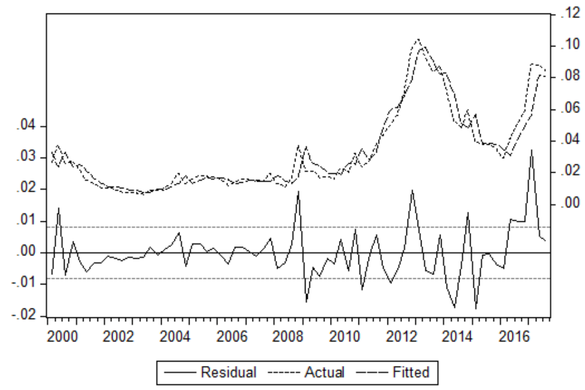


Figure C.35: FC Demand for Government Bonds

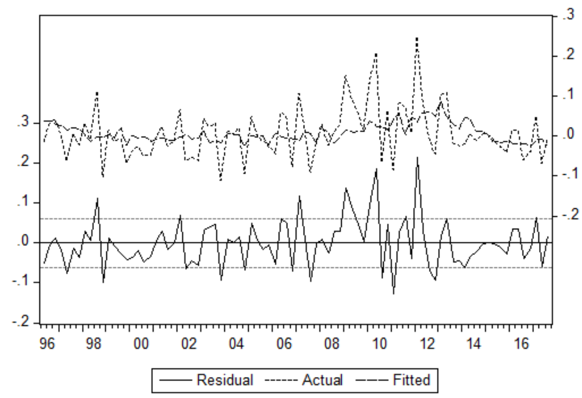


Figure C.36: FC Demand for Foreign Issued Liabilities

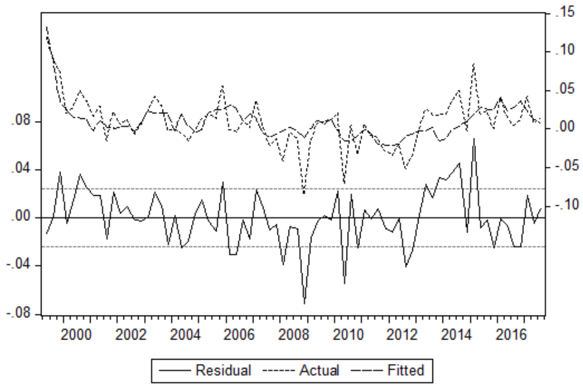
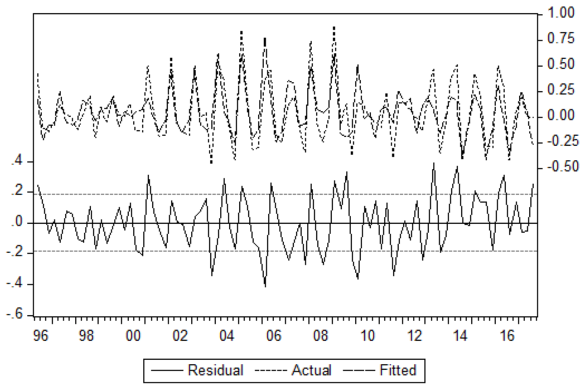


Figure C.37: Government Demand for Banks Deposits



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