Understanding and Forecasting Macroeconomic Dynamics of Argentina: An Stock-Flow Consistent Input-Output model

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May, 2017

Abstract

This paper presents a model of the Argentinean economy that can be used for both explanatory and forecasting purposes. Taking into account the availability of data in Argentina, the accounting structure of the model is defined by the integration of a 15-industry input-output matrix to social accounting and flow-of-funds matrices that describe the transactions of goods, services and financial assets between the production sector, the private sector, government and the rest of the world. In this way, the advantages of input-output analysis are successfully combined with the comprehensive and consistent description of macroeconomic systems embedded in stock-flow consistent models. The system of equations representing the dynamic behaviour of the model is put together following Post-Keynesian and Structuralist contributions to economic thought. Although it can be used for explanatory purposes, the objective of the model is fundamentally empirical, and accordingly, it is intended to be used shortly to forecast the evolution of key macroeconomic and sectorial variables of the Argentinean economy on a quarterly basis.

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1. Introduction

Input-output analysis' distinctive feature is its concern for an unavoidable trait of modern economies: the presence of strong interdependencies between industries. Input-output tables specify, in an orderly and consistent way, the transactions that take place within the firms of the production sector and between these and the rest of the sectors of the economy. By integrating industries into a complete system where their current transactions and reciprocal interdependencies are explicitly specified, input-output analysis has established itself as one of the most widely used frameworks for the analysis of industries' peculiarities and economic structures taken as a whole. In economies with diverse and unbalanced production structures, as is the case of Argentina and many Latin American countries, input-output analysis proves to have substantial advantages over frameworks which consider the productive sector as an indivisible whole.

On the other hand, stock-flow consistent models focus on the flows of money to which production and transactions give rise, providing a coherent and comprehensive description of financial economic processes and the institutional agents which are involved in them. The main advantage of the stock-flow consistent approach is that it ensures that every transaction and its financial counterpart are recorded in such a way that the model is left with no "black holes". Inasmuch as all the flows and stocks of the economy are correctly integrated, the underlying accounting structure of these models is solid and comprehensive, thus enabling the analyst to exhaustively trace the effects of changes in key macroeconomic and financial variables and analyse the multiple interactions and feedback effects between the real and the financial spheres of the economy.

To a great extent, these approaches have evolved as two separate and distinct frameworks for the analysis of economies. This paper seeks, instead, to combine input-output analysis with the comprehensive description of macroeconomic systems embedded in stock-flow consistent models. Specifically, it provides an empirical model of the Argentinean economy which implies a realistic representation of economic agents and phenomena, as opposed to the state-of-the-art macroeconometric modelling grounded on an instrumental approach that neglects the structural features of economies.

At the outset, the information provided by input-output matrix is merged with the social accounting and flow-of-funds matrices, thus obtaining the accounting identities upon which the model is built. Subsequently, a system of equations representing the dynamic behaviour of the model is put together. The theoretical foundations of the model are built upon the Post-Keynesian and Latin American Structuralist schools of thought and behavioural equations are estimated econometrically using modern techniques.

The structure of the model is such that several key macroeconomic and sectoral variables (GDP, inflation, current account, budget balance, sectoral output and employment, etc.) can be forecasted simultaneously in a general equilibrium framework that acknowledges the holistic nature of the economic system and at same time enables the identification of industry-specific results. Even though forecasts and estimations are not presented in this working paper, the accounting structure is directly related to the availability of data for the Argentinean case, and hence, the model is eminently *empirical*: its main goal is to provide a consistent framework for short and medium term forecasting, even if it can also be used for explanatory purposes. In this sense, it represents the first step towards a paper comprising estimations and forecasts for the Argentinean economy on a quarterly basis, as well as a thorough discussion on them.

The rest of the paper is structured as follows. Section 2 comprises a brief discussion on the relevance of input-output analysis and stock-flow models, as well as a description of the recent attempts to synthesise these insights. In Section 3 we present and describe the input-output, social accounting and flow-of-funds matrices, which are constructed considering the availability of data in Argentina and define the core accounting relations of the model. In Section 4 we thoroughly describe a system of dynamic equations that determines the behaviour of the model's variables, relying on the identities obtained in Section 3. Finally, Section 5 contains the preliminary conclusions of the paper.

2. Input-output, stock-flow consistency and recent developments

In this section we briefly describe the contributions that both input-output and stock-flow consistent models can make to the analysis of modern economies. Even though for quite a long time these two strands of economic analysis have been developed separately and autonomously, we claim that there is a common ground that needs to be developed. In this regard, we also present some recent attempts to make this synthesis.

By incorporating explicitly the wide and heterogeneous range of industries that constitute the production sector, as well as their reciprocal interdependencies, input-output analysis enables a thorough understanding of real economic phenomena. This is particularly important in economies with a diverse (and many times unbalanced) production structure, where activities with different levels of productivity coexist. In these cases, the analyses that neglect the complexities that the production process entails and that, instead, describe it by means of a single-good production function with high levels of input substitution, do not seem to provide an accurate tool for the understanding of the most fundamental economic problems.

By virtue of their linkages with other economic activities, some industries may constitute the main drivers of production. Other industries might not exhibit so many interindustry linkages, but their labour-intensive nature may make them decisive actors in terms of labour demand. There are also some industries with low levels of interindustry linkages and labour-intensity, but whose static comparative advantages provide the overall economy with the flows of foreign exchange required by other industries with a high propensity to import both intermediate and capital goods. Finally, there are some industries that at present may seem irrelevant (in terms of value added or employment generation) but whose dynamic competitive advantages might make them worth of investments if potential spill-over effects are taken into consideration. All these issues are widely neglected by conventional economics and embody the key questions posed by the Structuralist approach to macroeconomics. Some of the most well-known attempts to model these problems can be found in the contributions of Leontief (1986), Taylor (1983) and Pasinetti (1983).

For their part, stock-flow consistent models attempt to provide a coherent and comprehensive description of financial economic processes[1]. Without denying the key role played by production processes in economic dynamics, stock-flow consistent models focus on the flows of money to which production and other activities give rise. Based on the accounting principle of quadruple-entry, this approach states that every real transaction must have its counterpart in an financial flow of equal value: for instance, when households purchase goods produced by firms, there is a real flow of commodities going from the latter to the former and, simultaneously, there is a financial flow going from the former to the latter. The structure of the stock-flow consistent approach ensures that every transaction and its financial counterpart are recorded in such a way that the model is left with no "black holes". All current transactions that take place in a given period of time are recorded in a social accounting matrix that divides the social structure into institutional agents (households, firms, government, etc.). They way of recording these transactions follows the *who does what with whom* principle, which allows the analyst to know in detail the specific economic relations underlying aggregate variables.

As regards purely financial transactions, such as the portfolio allocation of institutional agents, stock-flow consistent models ensure that the source and the use of the corresponding funds are coherently registered following the *who owes what to whom* principle. All financial transactions are registered in the flow-of-funds matrix, where both the changes in each institutional agent's assets and liabilities are explicitly described. Moreover, the consistency of stock-flow consistent models implies that the changes in each agent's net worth, whose composition is presented in the flow-of-funds matrix, perfectly matches the flow of savings arising from the current transactions recorded in the social accounting matrix. More importantly, in a world where wealth effects arising from the changes in asset prices play a key role in the shaping of economic behaviour, stock-flow consistent models contain a revaluation account that incorporates these effects into the accounting structure. Thus, stock-flow consistent models provide us with a powerful tool for the analysis

[1] The standard book that describes not only the underlying rationale of the stock-flow consistent approach but also a wide variety of models that illustrate how these models can be applied to study different macroeconomic problems is the one written by Godley and Lavoie (2007). For a review of the different applications that have been given to these models through time we recommend the work of Caverzasi and Godin (2015).

of the complex interactions between the real and the financial spheres of the economy. Rather than one being the mirror of the other, these models consider these spheres as two relatively autonomous dimensions (meaning that each has its own specific laws) that are nevertheless strongly connected, up to the point that separating one from another would make the economic analysis meaningless.

The importance of combining purely financial flows with the real transactions of goods and services and their financial counterparts was early highlighted by Lawrence Klein, when he noted the synergies between the National Income and Product accounts, the input-output accounts and the flow-of-funds accounts (Klein, 2003). To our knowledge, however, there are have been only two attempts to integrate the input-output matrix into the structure of stock-flow consistent models. On the one hand, Berg et al (2015) present a conceptual model that describes the simultaneous monetary flows through the financial system, real flows of produced goods and services through the real economy, and flows of physical materials through the natural environment. The main goal of these authors is to build a bridge between Post-Keynesian economics (represented by stock-flow consistent models) and ecological economics.

According to Berg et al (2015), even if Keynesian macroeconomics and ecological economics share a critique of the mainstream, their theoretical developments remain largely unconnected. Keynesian macroeconomics places its emphasis on the determination of effective demand and studies how this can be compatible or not with other policy goals (such as price stability, equitable income distribution or external sustainability). The ecological implications of the combination of these policy goals, however, have been largely neglected. For its part, ecological economics (apart from a few exceptions, such as Tokic (2012), Binswanger (2013) and Wenzlaff et al (2014)) have not paid enough attention to the influences of the monetary side of the economy on the environment. Berg et al (2015) conclude that "models of this type may provide additional tools to aid macroeconomists, ecological economists, and physicists in the task of understanding the economy and the physical environment as one united and complexly interrelated system, rather than as a colloidal agglomeration of artificially separated analytical domains. These modes of analysis are required to study pressing problems such as climate change, which are neither purely economic, nor purely environmental, nor purely physical, but rather are all of the above" (p. 6).

The second attempt to integrate the input-output matrix into a stock-flow consistent model was made by Valdecantos (2016), who attempts to include some of the main features of Latin American countries into the watertight structure provided by stock-flow consistent models. Since there is a large heterogeneity within Latin American countries, he models four types of economies: agro-industrial, oil-based, mining-based and maquila-based economies. This is done by means of a 4x4 input-output matrix that is subsequently merged into a social accounting matrix that captures the main features of peripheral economies (foreign ownership of firms, large stocks of external debt denominated in foreign currency, high exposure to financial shocks, etc.). Based on the simulations produced by this model the author claims that in order to gain a better understanding of the functioning of peripheral economies, a synthesis of stock-flow and input-output models is required. Otherwise, economic phenomena with determinant impacts on the dynamics of the economy would be omitted, thereby producing biased results.

The importance of introducing the production sector explicitly into the analysis of macroeconomic dynamics is further emphasised by a recent work of Kim and Lavoie (2016). Although the analysis of the dynamics of production is not the goal of their work, they admit the need "to build a more realistic growth model that helps to explain economic phenomena and to investigate drivers of economic growth in the real world, all of this within a framework that fully integrates the production and the financial sectors" (p. 404). The specific features of their theoretical model consist of the extension of the standard Kaleckian growth model to a two-sector model (a consumption sector and an investment sector) and the adoption of a target-return pricing formula that takes into account the interdependence of costs and pricing in a multisectoral framework (as in the input-output framework and the Sraffian pricing approach). These extensions are framed in the structure of a stock-flow consistent model to explore the short run effects of increases in savings rates, in the bargaining power of workers and in interest rates, as well as the transitional dynamics towards the long run steady equilibrium.

The aforementioned attempts to combine input-output and stock-flow consistent models, important as they may be, are constrained to the field of economic theory. In contrast, the work that we are currently undertaking is concerned with empirical economics. Thus, the conceptual inspiration of the previously mentioned studies is complemented with a recent empirical work: the Levy Institute Model for Greece (Papadimitrou, Zezza and Nikiforos, 2013). This model is based on the New Cambridge approach and follows the methodology developed by Wynne Godley for the construction of empirical models. The aim of the authors is to "provide a flexible tool for the analysis of policy options for the Greek economy in the medium term, keeping in mind that the analysis of a growing economy must simultaneously take into account the determinants of income and the implications of spending and saving decisions on the stocks of assets and liabilities of each of the main sectors in the economy, and the effects that changes in such assets and liabilities will have on future decisions" (p.30). This is exactly the motivation underlying our own work, to which we add the need to explicitly model the production side of the economy, given the relevant implications it has in the macroeconomic dynamics of Argentina.

3. Economic and accounting structure

3.1. The input-output table

The input-output table describes the transactions that take place within the firms of the production sector, which are classified into industries, and between these and the rest of the sectors that constitute the economy: the private sector, the government and the rest of the world.

Table 1.1. Input-output table

	Industry 1	Industry 2	Industry j	Industry n	Private S.	Gov.	RoW	Total
Industry 1	$+z^{11}$	$+z^{12}$	$+z^{1j}$	$+z^{1n}$	$+C^1 + I^1$	$+G^1$	$+X^1$	$+x^1$
Industry 2	$+z^{21}$	$+z^{22}$	$+z^{2j}$	$+z^{2n}$	$+C^2 + I^2$	$+G^2$	$+X^2$	$+x^2$
Industry i	$+z^{i1}$	$+z^{i2}$	$+z^{ij}$	$+z^{in}$	$+C^i + I^i$	$+G^i$	$+X^i$	$+x^i$
Industry n	$+z^{n1}$	$+z^{n2}$	$+z^{nj}$	$+z^{nn}$	$+C^n + I^n$	$+G^n$	$+X^n$	$+x^n$
Private S.	$+VA^1$	$+VA^2$	$+VA^j$	$+VA^n$				
Gov.	$+NIT^1$	$+NIT^2$	$+NIT^j$	$+NIT^n$				
RoW	$+IIG^1$	$+IIG^2$	$+IIG^j$	$+IIG^n$				
Total	$+x^1$	$+x^2$	$+x^j$	$+x^n$				

In the input-output framework payments are recorded in the columns, while proceeds are recorded in the rows. Therefore, the row for each Industry i describes the distribution of its output (x^i) between intermediate sales to itself and to other industries ($z^{i1}, z^{i2}, \ldots, z^{in}$), and final sales, that is, the sum of consumption (C^i), investment (I^i)[2], sales to government (G^i) and exports (X^i). The column for each Industry j describes, in turn, the inputs it requires to produce its output (x^j): intermediate purchases from itself and other industries (z_{1j}, z_{2j}, …, z_{nj}), intermediate imported goods (IIG^j), payments to the private sector (labour compensation, WB^j, and gross operating surplus, GOS^j, which make up value added, VA^j) and net indirect business taxes on production and intermediate products (both national and imported) paid to the government, net of subsides (NIT^j). Transactions between sectors other than the production one are not recorded in the input-output matrix; instead, they will be recorded in the social accounting matrix.

As it can be seen in Table 1.1, the sum of the row elements of a given industry equals the sum of the elements in its respective column. This is because the value of output of any firm can be calculated both row-wise, as the sum of its sales to every possible destiny, and column-wise, as the sum of its inputs of every possible origin. It should also be noted that since any intermediate sale by an industry is in itself a purchase by another industry, the sum of all interindustry flows, considered as both inflows and outflows, amounts to zero. There are no net transfers between industries by the means of intermediate transactions.

The composition of each industry's output in terms of its inputs can be described making use of the *technical or input coefficients*, $a_{ij} = z^{ij}/x^j$, which represent the weight of Industry i's intermediate sales in Industry j's input structure. For instance, the technical coefficient a_{21} represents the value of sales from Industry 2 to Industry 1 in terms of Industry 1's total output. For the non-industrial inputs for production

[2] Gross investment is made up of gross fixed capital formation and inventory changes. This decomposition is made explicit in the model's equations in Section 4.

(imported intermediate goods, value added and net indirect taxes) additional coefficients can be respectively be formed as $m_j = IIG^j/x^j$, $v_j = VA^j/x^j$ and $\tau_j = NIT^j/x^j$, representing the weight of each source of input in Industry j's gross output. As a result, assuming input coefficients are fixed, the output of a given Industry j in period t can be identified as follows:

$$x_t^j = a_{1\mathrm{j}}x_t^j + a_{2\mathrm{j}}x_t^j + \cdots + a_{nj}x_t^j + m_j IIG_t^j + v_j VA_t^j + \tau_j NIT_t^j \qquad \text{(A1)}$$

In order to identify the gross output of Industry i in terms of other industries' output, these coefficients can be applied row-wise, that is, to the industry's structure of sales. For each of the four components of final demand, φ_{if} coefficients can be calculated, which denote the value of sales of Industry i to final demand component f in terms of total sales to f. Thus, $\varphi_{1C} = C^i/C$, for example, represents the share of total consumption by the private sector which is sold directly by Industry 1. Therefore, we can also decompose the output of a given Industry i in period t as follows:

$$x_t^i = a_{i1}x_t^1 + a_{i2}x_t^2 + \cdots + a_{in}x_t^n + \varphi_{iC}C_t + \varphi_{iI}I_t + \varphi_{iG}G_t + \varphi_{iX}X_t \qquad \text{(A2)}$$

In this paper firms are classified into 15 industries, as shown in Table 1.2. Hence, there are 15 equations like (A1) and other 15 equations like (A2).

Table 1.2. Industry classification

Code	Industry description	ISIC Rev.3 sectors	Share in total Argentinean gross output (2016)
1	Agriculture, hunting, forestry and fishing	01-05	8.3%
2	Mining and quarrying	10-14	2.9%
3	Food products, beverages and tobacco	15-16	10.3%
4	Textiles, textile products, leather and footwear	17-19	2.0%
5	Wood, paper, paper products, printing and publishing	20-22	1.8%
6	Chemicals and non-metallic mineral products	23-26	8.8%
7	Basic metals and fabricated metal products	27-28	2.6%
8	Machinery and equipment n.e.c.	29	1.6%
9	Motor vehicles, trailers and semi-trailers	34	2.3%
10	Manufacturing n.e.c. and recycling	30-33 + 35-37	2.5%
11	Electricity, gas and water supply	40-41	2.5%
12	Construction	45	4.5%
13	Wholesale and retail trade, and repairs	50-52	10.8%
14	Other business sector services	55-74	25.9%
15	Community, social and personal services	75-95	13.2%

3.2. The social accounting matrix

Since value added is equal to total generated income, it is necessary to define how this income is distributed among the different sectors of the economy. But not just income derived from production defines the total income of each sector. Other flows of income, such as taxes and transfers, determine each sector's budget constraint. In order to represent how these flows of income and spending bring about a complex social truss it is necessary to build a social accounting matrix.

Following Papadimitriou, Zezza and Nikiforos (2013), the model considers the private sector as a whole, combining households and firms and considering their receipts and outlays with the other two sectors: the government and the rest of the world (RoW). Even if the firms actually belong to the production sector and that not all of them are owned by the private sector, for the sake of simplicity it is assumed that the totality of value added is transferred to the private sector under the form of either wages or the gross operating surplus. The accounting for flows is summarized in Table 2, where payments are recorded in the columns and receipts are recorded in the rows, just like in the input-output matrix. All the variables in the social accounting matrix are recorded in nominal terms. Transactions that involve a capital account (*KA*), i.e. changes in the composition of the balance of each sector, are considered separately, in the flow-of-funds matrix. Since some variables will be used in both their nominal and real expressions, in order to distinguish them we add the $ symbol. For instance, whereas $C\$$ denotes nominal consumption, C denotes real consumption. In the case of other variables that will only be used in nominal terms, such as TP, we omit the $ symbol.

Table 2: Social accounting matrix

	Production	Private S.	Gov.	RoW	KA	Total
Production		$+C\$ + I\$$	$+G\$$	$+NX\$$		$+GDP\$$
Private S.	$+VA\$$		$+TR_{gp}$	$+TR_{wp}$		$+YP$
Gov.	$+NIT$	$+TP$	$+TR_{gg}$	$+TR_{wg}$		$+YG$
RoW	$+IIG\$$	$+TR_{pw}$	$+INT\_ED$			$+YW$
KA		$+S$	$-GDEF$	$-CA$		0
Total	$+GDP\$$	$+YP$	$+YG$	$+YW$	0	

The second row of the social accounting matrix defines equilibrium in the goods' market, which is expressed in equation (B). Nominal aggregate demand, in turn, must be equal to nominal GDP, which must also be equal to the sum of the different flows of income to which the productive process has given rise. Since the private sector is being taken as a whole the flows of income earned by the private sector from the production process (the wage bill, *WB*, and the gross operating surplus, *GOS*) are all gathered in the nominal value added (measured at basic prices) of the overall economy, *VA*$. The government, for its part, collects indirect taxes from production and intermediate products, *NIT*. The rest of the world earns an amount that is equal to the value of imported intermediate goods (*IIG*$). Thus, the second row and column of the matrix define the accounting identity that states that aggregate demand must always be equal to aggregate income (*Y*$). Specifically, the second column describes how this income is distributed among the three sectors of the economy.

$$GDP\$_t = C\$_t + I\$_t + G\$_t + X\$_t - M\$_t \quad \text{(B)}$$

$$Y\$_t = VA\$_t + NIT_t + IIG\$_t \quad \text{(C)}$$

$GDP\$_t = Y\$_t$ (D)

The main source of income for the private sector is given by its participation in the production process, i.e., total value added (at basic prices). There are, however, other sources of income, such as transfers from the government (TR_{gp}) and the rest of the world (TR_{wp}). The sum of all these sources of income, as shown in the third row of the matrix, give the total income of the private sector, *YP*, as reflected in equation (E). The transfers from the government to the private sector are given by the sum of social security expenditures (*SSE*) and current transfers to the private sector (*CT*). The transfers from the rest of the world to the private sector are given by the sum of incoming remittances (*REI*), profits and dividends (*PDI*) and interest earnings (*IE*).

$YP_t = VA\$_t + TR_{gp_t} + TR_{wp_t}$ (E)

$VA\$_t = WB_t + GOS_t$ (F)

$TR_{gp_t} = SSE_t + CT_t$ (G)

$TR_{wp_t} = REI_t + PDI_t + IE_t$ (H)

The private sector uses its total income, *YP*, to pay taxes to the government (direct taxes and indirect taxes on the sales of final products), *TP*, and to send transfers to the rest of the world, TR_{pw}. As shown in equation (I), these latter are defined as the sum of outgoing remittances (*REO*), the outflows of profits and dividends (*PDO*) and interest payments (*IP*). Once the private sector has deducted taxes and current transfers to the rest of the world from its total income, it is left with a so-called disposable income that ultimately will be used to finance its spending on consumption and investment goods. The difference between disposable income and total expenditures of the private sector yields the flow of savings (equation (J)). Equations (E) and (J), taken together, imply that the conditions in the third row and the third column of the matrix are being satisfied.

$TR_{pw_t} = REO_t + PDO_t + IP_t$ (I)

$S_t = YP_t - C\$_t - I\$_t - DT_t - TR_{pw_t}$ (J)

The fourth row of the matrix describes the different sources of income of the public sector. As shown in equation (K), the total income of the public sector, *YG*, is given by the sum of net indirect taxes on production and intermediate products (mainly non-deductible VAT and taxes on foreign trade), direct taxes and indirect taxes on final sales paid by the private sector (mainly income taxes and VAT), intra-public sector transfers, TR_{gg}[3], and transfers from the rest of the world to the government,

[3] In the specific case of Argentina there are two main sources of intra-public sector transfers: transfers within the different levels of the public sector (the nation state, provinces and municipalities) and property rents transferred from different public institutions (like the Central Bank)

TR_{wg}. The public sector uses its total income to finance its consumption, *G*$, to send transfers to the private sector (in the case of Argentina these are comprised by different social programs as well as subsidies to public utilities providers in order to keep prices relatively low), TR_{gp}, and to pay interests on the outstanding stock of external debt to the rest of the world, *INT_ED*. The intra-public sector transfers must also be considered as part of the outlays of the public sector. The difference between total public sector outlays and total income, *YG*, gives the government deficit, *GDEF*.

$$YG_t = NIT_t + TP_t + TR_{gg_t} + TR_{wg_t} \qquad \text{(K)}$$

$$GDEF_t = G_t + TR_{gg_t} + TR_{gp_t} + INT_{ED} - YG_t \qquad \text{(L)}$$

The rest of the world earns its income, *YW*[4], from its provision of intermediate goods to Argentina, $IIG\$$, the current transfers from the private sector, TR_{pw} (which, as already mentioned, are constituted by profits and dividends, interest payments and remittances), and the interest payments from the public sector, *INT_ED*. The fifth column of the matrix describes how the rest of the world uses its income, either to pay for the net acquisition of Argentinean goods and services, $NX\$$, or to send transfers to the private or the public sector, TR_{wp} or TR_{wg}, respectively. The difference between the total income of the rest of the world and its total outlays gives its flow of savings, which is in turn the negative of the current account of Argentina (equation (N)).

$$YW_t = IIG_t + TR_{pw_t} + INT\_ED \qquad \text{(M)}$$

$$-CA_t = YW_t - NX_t - TR_{wp_t} - TR_{wg_t} \qquad \text{(N)}$$

Once all the sources of income and expenditure of the different sectors of the economy have been defined in a consistent way (implying that the identities representing each row and column of the matrix are being satisfied) it is possible to derive the macro-financial equilibrium of the overall economy. This equilibrium states that the sum of the different flows of savings belonging to the different sectors of the economy must add up to zero (equation O). Provided that this identity holds we can be sure that the accounting of the model is consistent, i.e. that every transaction in the economy has been explicitly defined in both its origin and destiny. Nothing would have been lost on the way. No black holes act against the coherency of the model and the economic analysis derived from it.

to the Treasury. In this model intra-public sector transfers are obtained as a residual in such a way that, given the rest of the variables, the fourth column is fulfilled.

[4] Given the presentation of the social accounting matrix net exports are considered an outlay for the rest of the world (see row 2). In the case the rest of the world is running a trade surplus this would imply an additional source of income to the ones specified in the fifth row of the matrix. If this would be the case, this additional income is registered as a negative outlay in the fifth column of the matrix, thereby keeping the consistency of the model unaffected.

$$S_t - GDEF_t - CA_t = 0 \quad (O)$$

$$\Delta VP_t = S_t \quad (P)$$

$$\Delta VG_t = -GDEF_t \quad (Q)$$

$$\Delta VW_t = -CA_t \quad (R)$$

3.3. The flow-of-funds matrix

Since the flow of savings of each sector is equal to the change in its net worth (equations P-R), the results obtained in the sixth row of the social accounting matrix can be used to make the link with the flow-of-funds matrix, which describes the changes in the composition of the balance sheet of each sector. Due to the lack of a unified source of information regarding financial assets and liabilities of the Argentinean economy, we build a very simplified flow-of-funds matrix that assumes that each sector issues a single asset as its own liability, which can be purchased by the remaining two sectors. We denote *GD* the liabilities of the government, *PD* the liabilities of the private sector and *WD* the liabilities of the rest of the world.

Table 3: Flow-of-funds Matrix

	Private sector	Government	RoW	Total
Government Debt	$+\Delta GD^P$	$-\Delta GD$	$+\Delta GD^W$	0
Private sector Debt	$-\Delta PD$	$+\Delta PD^G$	$+\Delta PD^W$	0
RoW Debt	$+\Delta WD^P$	$+\Delta WD^G$	$-\Delta WD$	0
Total	$+S = \Delta VP$	$-GDEF = \Delta VG$	$-CA = \Delta VW$	0

Whereas the columns of the flow-of-funds matrix must be interpreted as dynamic expression of the balance sheet of each sector, the rows corresponding to each of the three financial assets incorporated into the model represent their respective market. The fact that the sum of the elements of every row of the flow-of-funds equals to zero implies that *ex post* every market is cleared (regardless of the process through which market clearing is attained). Moreover, if the elements of a certain row would not add up to zero it would mean that some sector has increased (decreased) its holdings of the respective asset at no-one's expense, which is not a possible outcome. The logic underlying the flow-of-funds in the framework of stock-flow consistent models is that any financial asset of a given economic sector must at the same time be a liability for another sector. Provided that financial assets and liabilities are incorporated into the model following this rule, important omissions with strong implications are avoided. The equality between the supply and demand for each financial asset can be written explicitly as in equations S-U.

$$\Delta GD_t = \Delta GD_t^P + \Delta GD_t^W \quad (S)$$

$$\Delta PD_t = \Delta PD_t^G + \Delta GD_t^W \quad (T)$$

$$\Delta WD_t = \Delta WD_t^P + \Delta WD_t^G \qquad \text{(U)}$$

The flow-of-funds matrix is also useful to ensure the coherence between the change in the net worth of each sector and the change in their respective assets and liabilities. Equations V-X state these accounting identities explicitly.

$$\Delta VG_t = \Delta PD_t^G + \Delta WD_t^G - \Delta GD_t \qquad \text{(V)}$$

$$\Delta VP_t = \Delta GD_t^P + \Delta WD_t^P - \Delta PD_t \qquad \text{(W)}$$

$$\Delta VW_t = \Delta GD_t^W + \Delta PD_t^W - \Delta WD_t \qquad \text{(X)}$$

4. The model

The matrices and accounting identities presented in the previous section define the structure of the Argentinean economy in a consistent way. However, the description made thus far is static. In this section we specify a system of dynamic equations whose simultaneous resolution allows to trace how the economy moves over time. Provided that the system of equations is written respecting the accounting relations that arise from the input-output table, the social accounting matrix and the flow-of-funds matrix, we can be sure that the results produced by the model will be consistent. The fact that we respect the accounting relations when building the model implies that some of the equations will look quite similar to the identities derived in the previous section. However, the model will also require us to specify behavioural equations, whose specification will be determinant for the dynamics of the model.

4.1. The production sector's output and input

Aggregate demand (in real terms), which is always equal to GDP, implies equilibrium in the goods' market (equation 1).

$$Y_t = C_t + I_t + G_t + X_t - M_t \qquad (1)$$

Investment, in turn, is constituted by the Gross Fixed Capital Formation (*GFCF*) and inventory changes (ΔINV).

$$I_t = GFCF_t + \Delta INV_t \qquad (2)$$

Gross fixed capital formation, private consumption, exports and final imports are estimated using standard econometric procedures. Private consumption is determined by real disposable income (*YD*) and private sector's wealth (*VP*). Investment is also determined by private sectors' wealth, as well as by the gross operating surplus (*GOS*) and an accelerator term (ΔY_{t-1}). Exports are mainly given by the real exchange rate (*RER*) and the rate of growth of the main trading partners'

GDP (Y^*). Final imports are also determined by the real exchange rate and the domestic level of activity. Inventory changes are described by a stationary autoregressive moving average process. Public spending is considered exogenous.

$$C_t = f_1(YD_t, VP_t) \quad (3)$$

$$GFCF_t = f_2(GOS_t, VP_t, Y_{t-1}) \quad (4)$$

$$X_t = f_3(RER_t, Y_t^*) \quad (5)$$

$$M_t = f_4(RER_t, Y_t) \quad (6)$$

$$\Delta INV_t = ARMA(p, q) \quad (7)$$

$$G_t = \bar{G} \quad (8)$$

The transactions described in equations (3-8) constitute flows of final demand at the aggregate level. Making use of the input-output matrix it is possible to determine how these flows of final demand are distributed among the different industries of the economy. Equations (9-98) describe the sectoral allocation of the flows of final demand. The coefficients φ_{iC}, φ_{iI}, φ_{iINV}, φ_{iG} and φ_{iX} are treated as exogenous and given by the information provided by the input-output table.

$$C_t^i = \varphi_{iC} C_t \qquad \forall\, i = 1,2, \dots, 15 \quad (9\text{-}23)$$

$$GFCF_t^i = \varphi_{iI} GFCF_t \qquad \forall\, i = 1,2, \dots, 15 \quad (24\text{-}38)$$

$$\Delta INV_t^i = \varphi_{iINV} \Delta INV_t \qquad \forall\, i = 1,2, \dots, 15 \quad (39\text{-}53)$$

$$I_t^i = GFCF_t^i + \Delta INV_t \qquad \forall\, i = 1,2, \dots, 15 \quad (54\text{-}68)$$

$$G_t^i = \varphi_{iG} G_t \qquad \forall\, i = 1,2, \dots, 15 \quad (69\text{-}83)$$

$$X_t^i = \varphi_{iX} X_t \qquad \forall\, i = 1,2, \dots, 15 \quad (84\text{-}98)$$

In addition to the final demand for each industry's output there are also flows of intermediate consumption that, taken together with the former, make up total sales. In order to compute these flows of intermediate consumption we make use of the input coefficients, a_{ij}, described in section 3.1.

$$z_t^{ij} = a_{ij} x_t^j \qquad \forall\, i, j = 1,2, \dots, 15 \quad (99\text{-}323)$$

The gross output of each industry, x^i, is given by its final and intermediate sales.

$$x_t^i = C_t^i + I_t^i + G_t^i + X_t^i + \sum_{j=1}^{15} z_t^{ij} \qquad \forall\, i = 1,2, \dots, 15 \quad (324\text{-}338)$$

Each industry's intermediate imported goods, IIG^j, is obtained by means of the coefficient of imported inputs, m^j, defined in section 3.1, which are exogenously given by the information provided by the input-output matrix.

$$IIG_t^j = m_j x_t^j \quad \forall\, j = 1,2, \dots ,15 \qquad (339\text{-}353)$$

Similarly, each industry's demand for labour, L^j, is computed by multiplying its gross output by the unit requirement of labour, l^j, which is treated as exogenous.

$$L_t^j = l_j x_t^j \quad \forall\, j = 1,2, \dots ,15 \qquad (354\text{-}368)$$

4.2. Prices of the production sector's goods and services

All the variables that have been hitherto specified are expressed in real terms. However, some of them need to be transformed into nominal terms in order to merge the information arising from the production process (embedded in the input-output matrix) with the financial flows that take place in the economy. Nominal gross output of Industry j, $x\$^j$, is thus obtained by multiplying its real gross output by its respective price index, p^j.

$$x\$_t^j = x_t^j p_t^j \quad \forall\, j = 1,2, \dots ,15 \qquad (369\text{-}383)$$

Since there are fifteen industries, there are fifteen domestic prices in the economy. Taking into account each industry's specificities it seems reasonable to take the prices of industries 1 (Agriculture, hunting, forestry and fishing), 2 (Mining and quarrying) and 11 (Electricity, gas and water supply) as exogenous (García Díaz, 2016). The domestic prices of industries making direct use of natural resources (Industries 1 and 2) are usually strongly determined by the international prices of their respective commodities, as well as by export duties fixed by government, especially on Industry 1. The prices for the provision of electricity, gas and water (11), in turn, are regulated by the State in Argentina.

On the other hand, the prices of the remaining twelve industries are endogenous and depend on unit costs of production. Given the interdependencies between industries that is embodied in the input-output matrix, prices of the goods of a given Industry j are not only defined by the prices of its own inputs (intermediate purchases plus non-industrial inputs), but also by the prices of the inputs of the other industries, insofar as these are suppliers of intermediate goods. In order to represent the fact that a change in the price of an industry's good induces changes in the prices of the goods of industries which consume it as an input, we make use of Leontief's price model; specifically, Nordhaus and Joven's (1977) specification which allows for the existence of exogenously determined prices, and García Díaz's (2016) application for the Argentinean case.

According to this cost-push specification of prices, changes in the price of Industry j are caused by changes in the exogenous variables which define the cost of inputs of itself and all other industries whose prices are endogenously determined[5]. These costs are represented, on the one hand, by the expression $(E_t m^i p_t^* + l^i w_t^i + \tau^i)$, where the cost of imported intermediate inputs is given by $E_t m^i p_t^*$ (standing E and p^* for the exchange rate and the international price of intermediate imports, respectively), the cost of labour is given by $l^i w_t^i$ (w being the unit labour cost of each industry) and unit net indirect taxes on production and intermediate (domestic and foreign) goods are specified as τ. On the other hand, $\sum_{x=1}^{3} a_{xi} p_t^x$ stands for the cost of the three intermediate goods whose prices are exogenously given, each one of them weighted by their respective input coefficients, i.e. by the importance they have on the structure of costs of each industry with endogenous prices. To quantify the extent to which these exogenously induced price movements in Industry i influence the price of Industry j, the b_{ij} coefficients, known as the Leontief coefficients, are used[6]. In the context of this price specification, b_{ij} can be understood as the percentage change expected in p^j when an observed change of 1 percent in the prices of Industry i's exogenous inputs occurs.

$$p_t^1 = \overline{p^1} \tag{384}$$

$$p_t^2 = \overline{p^2} \tag{385}$$

$$p_t^3 = \overline{p^3} \tag{386}$$

$$p_t^j = \sum_{i=3}^{15} [\, b_{ij} \left(\sum_{x=1}^{3} a_{xi} p_t^x + E_t m^i p_t^* + l^i w_t^i + \tau^i \right)] \quad \forall\, j = 4, 5, \ldots, 15 \qquad \text{(387-398)}^7$$

This kind of modeling implies that any change in exogenous input costs is passed on completely by each industry to the other (except, of course, for industries 1, 2 and 11), and in this way the original variation is transmitted throughout the economy. Hence, whereas the profit margin of industries 1, 2 and 11 are endogenous, the profit margin of the remaining industries is assumed to be exogenously given.

The main advantage of this kind of specification is the fact that it takes into account the productive structure and its interdependencies in the determination of each industry's price. As a result, besides being able to consider both direct and indirect effects of exogenous shocks on the aggregate price level, we can assess their

[5] For the sake of notational simplicity, in this subsection, p^1, p^2 and p^3 are defined as the exogenous prices of the economy and are referred to with subscript *x*, while prices p^4 to p^{15} are the endogenously determined ones and are referred to with subscript i.

[6] For a full description of standard Leontief price models, see Dietzenbacher (1997) and Miller and Blair (2009).

[7] This set of twelve equations could be described in matrix form as $P_{en} = (I - A'_{en})^{-1}(A'_{ex.en} P_{ex} + \widehat{E}\, \widehat{P^*} m + \hat{l}\, w + \tau)$, where P_{en} is the 12x1 matrix of endogenously determined prices, A_{en} is the 12x12 technical coefficients matrix involving 'endogenous' industries, $A_{ex.en}$ is the 3x12 matrix specifying technical coefficients of exogenous inputs for 'endogenous' industries, P_{ex} is the 3x1 matrix of exogenous prices, and E, P^*, m, l, w, τ stand for the 12x1 matrices of exchange rate, international prices of imported intermediates, unit labour requirements, unit labour costs and unit net indirect taxes, respectively.

differential influence on prices between industries. In other words, the repercussions of exogenous movements in crucial variables, such as exchange rate, tariffs on intermediate imports, international food prices, subsidies and wage raises in key industries, can be evaluated separately and traced industry by industry. This is a major advantage over state-of-the-art macroeconometric modelling of aggregate prices.

4.3. The private sector's income and outlays

Once the prices have been defined it is possible to obtain, for each industry, nominal intermediate consumption, $IC\$_t^j$, and nominal value added. The nominal value added at basic prices of the aggregate economy (which serves as an input for the social accounting matrix) is thus given by the sum of the value added of the fifteen industries of the economy.

$$IC\$_t^j = \sum_{i=1}^{15} z_t^{ij} p_t^j + IIG_t^j E_t p_t^* \quad \forall\, j = 1,2, \dots ,15 \tag{399-413}$$

$$VA\$_t^j = x\$_t^j - IC\$_t^j - NIT_t^j \quad \forall\, j = 1,2, \dots ,15 \tag{414-428}$$

$$VA\$_t = \sum_{j=1}^{15} VA\$_t^j \tag{429}$$

The total amount of imported intermediate goods measured in nominal terms is given by the sum of each industry's real intermediate imports transformed by the price of imports and the nominal exchange rate.

$$IIG\$_t = \sum_{j=1}^{15} IIG_t^j p_t^* E_t \tag{430}$$

The net indirect taxes on production and intermediate consumption levied on each industry are obtained through the input-output matrix, where the coefficients τ^i are exogenously given.

$$NIT_t^j = \tau^j x\$_t^j \quad \forall\, j = 1,2, \dots ,15 \tag{431-445}$$

The aggregate wage bill in nominal terms is given by the sum of the wage bill of each industry. The aggregate gross operating surplus is thus obtained as a residual.

$$WB_t = \sum_{j=1}^{15} w^j L^j \tag{446}$$

$$GOS_t = VA\$_t - WB_t \tag{447}$$

Once the transaction flows arising from production have been defined it is necessary to define the payments that determine the different components of the social accounting matrix. In line with the accounting structure displayed in section 3, the private sector (which groups households and firms) earns the sum of the wage bill and the gross operating surplus, i.e. value added at basic prices, plus the transfers received from the government and the rest of the world, TR_{gp} and TR_{wp}, respectively. TR_{gp} are assumed to be given by a proportion λ_0 of aggregate nominal income, $Y\$$, and by a fraction λ_1 of the assets issued by the government held by the private sector, GD^P. TR_{wp}, in turn, represents a proportion λ_3 of the foreign assets held by the private sector, WD^P. For all the past periods, proportions λ_0 and λ_1 vary according to the co-movement of $TR_{gp}$with GD^P_{t-1} and $Y\$$, whereas λ_2 is defined by the evolution of TR_{wp} and WD^P. For the future periods comprising the forecasting horizon, however, λ_0, λ_1 and λ_2 will be kept constant. Simulation exercises where λ_0, λ_1 and λ_2 take different values (representing policy decisions or changes in the return on foreign assets) are also possible.

$$TR_{gp_t} = \lambda_0 Y\$_t + \lambda_1 GD^P_{t-1} \quad (448)$$

$$TR_{wp_t} = \lambda_2 WD^P_{t-1} \quad (449)$$

The private sector's income is therefore given by the sum of value added and these transfers.

$$YP_t = VA\$_t + TR_{gp_t} + TR_{wp_t} \quad (450)$$

Direct taxes and indirect taxes on final demand are given as a proportion of private sector income, τ_P. For all the past periods, τ_P is implicitly obtained as the ratio of these taxes to private income, thereby being susceptible of taking different values over time. For the all the future periods τ_P can be either kept constant or changed in order to simulate different tax policies.

$$TP_t = \tau_P YP_t \quad (451)$$

The private sector must also pay interests to the rest of the world accruing from the external debt accumulated in the past, PD^W_{t-1}. The rate of interest, λ_3, is calculated implicitly as the ratio of interest payments to the stock of private external debt.

$$TR_{pw_t} = \lambda_3 PD^W_{t-1} \quad (438)$$

Nominal disposable income of the private sector can be defined in terms of the wage bill, the tax rate and the transfers of the government to the private sector. Real disposable income, the key determinant of the equation of aggregate consumption (X), is obtained by deflating nominal disposable income by the price index, P. This index is computed as the weighted average of the prices of the fifteen industries of the economy, the weight being given by the share of each industry in sales to final consumption, defined previously as φ_{iC}.

$$YD\$_t = (1 - \tau_P) WB_t + TR_{gp_t} \quad (452)$$

$$YD_t = \frac{YD\$_t}{P_t} \quad (453)$$

$$P_t = \sum_{j=1}^{15} \varphi_{jC} p^j \qquad \forall\, j = 1,2, \dots ,15 \tag{454-468}$$

Private saving is given as the difference between income from all sources and payments to every other sector made by the private sector.

$$S_t = YP_t - TP_t - TR_{pw_t} - \sum_{i=1}^{15} C_t^i p_t^i - \sum_{i=1}^{15} I_t^i p_t^i \tag{469}$$

4.4. Government and rest of the world's budget constraints

The intra-public sector transfers, TR_{gg}, are obtained as a proportion of nominal GDP. The government also pays to the rest of the world the interests accruing from the stock of public external debt, GD_{t-1}^{W}. For all the past periods the rate of interest, λ_5, is implicitly obtained as the ratio of interest payments to the stock of debt. For the future periods λ_5 can be either kept constant or modified in order to simulate a change in the country's access to foreign financing. The government not only sends transfers to the rest of the world (under the form of interest payments) but may also receive interest earnings as a result of its holding of foreign assets, WD_{t-1}^{G}. The parameter λ_6 is defined following the same criterion applied to λ_5.

$$TR_{gg_t} = \lambda_4 Y\$_t \tag{470}$$

$$INT\_ED = \lambda_5 GD_{t-1}^{W} \tag{471}$$

$$TR_{wg_t} = \lambda_6 WD_{t-1}^{G} \tag{472}$$

It is now possible to specify the income of the public sector following the structure defined in the social accounting matrix.

$$YG_t = NIT_t + TP_t + TR_{gg_t} + TR_{wg_t} \tag{473}$$

The government deficit is given by the difference between total income and outlays of the public sector.

$$GDEF_t = G\$_t + TR_{gp_t} + TR_{gg_t} + INT\_ED_t - YG_t \tag{474}$$

Since all the transaction flows have already been defined, the total income of the rest of the world and the current account balance are derived by means of the following accounting identities.

$$YW_t = IIG\$_t + TR_{pw_t} + INT\_ED_t \tag{475}$$

$$CA_t = NX\$_t + TR_{wp_t} + TR_{wg_t} - YW_t \tag{476}$$

4.5. Asset allocation by each sector

The change in the stock of wealth of each of the three sectors of the economy is defined as its respective flow of savings.

$$\Delta VP_t = S_t \tag{477}$$

$$\Delta VG_t = -GDEF_t \tag{478}$$

$$\Delta VW_t = -CA_t \tag{479}$$

The private sector is assumed to define the composition of its portfolio following a standard equation in the tradition of Tobin (1969) and Godley (1996), as is usual in stock-flow consistent models[8]. The private sector's demand for assets issued by the government and the rest of the world is given by the relative expected return of these two types of assets.

$$GD_t^P = VP_t(\mu_0 + \mu_1\lambda_1^e + \mu_2\lambda_2^e) \tag{480}$$

$$WD_t^P = VP_t((1-\mu_0) + \mu_3\lambda_1^e + \mu_4\lambda_2^e) \tag{481}$$

The change in private sector's liabilities is computed as a residual, bearing in mind that the change in its stock of wealth results from its flow of savings and that the change in its assets has just been defined.

$$\Delta PD_t = \Delta VP_t - \Delta GD_t^P - \Delta WD_t^P \tag{482}$$

The rest of the world's demand for domestic assets, i.e. capital inflows, are determined by the phase of the global financial cycle (exogenously given) and the relative return of domestic assets, adjusted by a risk premium (ρ). Once the amount of financial capital that the rest of the world is willing to invest in the economy is determined, its allocation between public and privately issued assets is represented by means of standard portfolio equations.

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[8] Tobin (1969) states that if investors want to have more of an asset they must reduce the holding of another asset. Otherwise, their balance sheet would be in disequilibrium in the sense that the change in their assets would turn out to be different from the change in the flow that determines the variation in their net worth. Similarly, following a change in the relative rates of return of the different assets, the sum over all assets of the responses of the investors must be equal to zero. Again, this implies that after a certain change in the relative price in a given period investors modify the composition of their portfolio keeping their net worth constant. Moreover, Godley (1996) establishes that it should also be ensured that the demand of an asset changes in the same way when its rate of return changes (keeping constant the remaining rates of return) than when the remaining rates of return change (keeping constant the rate of return of the incumbent asset), that is to say, the demand for each asset should behave in the same way with regard to changes in the relative rates of return, regardless of the origin of that change. This condition is the so-called horizontal condition. The combination of the vertical and horizontal conditions can be applied to the portfolio equations by setting specific values to the relevant parameters λ.

$$K_t^{inflows} = f_5(Y_t^*, i_t^*, i_t, \rho_t) \tag{483}$$

$$\Delta GD_t^W = K_t^{inflows}(\eta_0 + \eta_1 \lambda_5^e + \eta_2 \lambda_3^e) \tag{484}$$

$$\Delta PD_t^W = K_t^{inflows}((1 - \eta_0) + \eta_3 \lambda_5^e + \eta_4 \lambda_3^e) \tag{485}$$

Given the rest of the world's demand for domestic assets and the change in its stock of wealth (given by the current account balance), the change in its liabilities is computed as a residual. This implies that if the rest of the world's demand for domestic assets is larger than the flow of external savings, the gap is filled by the issuance of debt (this is normally observed as an increase in the country's stock of foreign reserves, which constitutes a liability for the rest of the world).

$$\Delta WD_t = \Delta VW_t - \Delta GD_t^W - \Delta PD_t^W \tag{486}$$

Market clearing for public securities implies that, given the demand of both the private sector and the rest of the world, the government issues as much debt as the market demands.

$$GD_t = GD_t^W + GD_t^P \tag{487}$$

As regards the clearing of the market of privately issued assets, it is assumed that the government fills any gap between the total supply and the demand by the rest of the world.

$$PD_t^G = PD_t - PD_t^W \tag{488}$$

Most of the rows and columns of the flow-of-funds matrix have already been closed (meaning that the sum of their elements is equal to zero). We are only left to define how the column corresponding to the government and the row that represents the market of assets issued by the rest of the world are closed. However, while there are two processes to be closed, there is only one endogenous variable left to be defined: the foreign assets demanded by the government, WD_t^G. This is a characteristic feature of stock-flow consistent models. Since according to the underlying rationale of these models every variable is logically implied by the remaining variables, we can choose to define WD_t^G as the closing variable of any of the two processes that have not yet been explicitly closed and use the remaining one to check the consistency of the model. In this case we choose to define WD_t^G as the variable closing the market of foreign securities and use the balance sheet equilibrium of the government as the "missing equation" of the model.

$$WD_t^G = WD_t - WD_t^P \tag{489}$$

$$\Delta VG_t + \Delta GD_t - \Delta PD_t^G - \Delta WD_t^G = 0 \tag{490}$$

5. Preliminary conclusions

In this paper we have presented a model aimed at understanding and forecasting the macroeconomic dynamics of Argentina. To that effect, taking into account availability of data in Argentina, an input-output table made up of 15 industries, and social accounting and flow-of-funds matrices for a four-sector system (production, private, government and the rest of the world), have been built. By the means of integrating the input-output table into the accounting structure defined by the social accounting and flow-of funds matrices, the model comprehensively describes all the relevant sectors of the economy, as well as the transactions of goods, services and financial assets. Upon this watertight accounting structure, a model consisting of dynamic identities and equations describing the behaviour of institutional agents was built, following Post-Keynesian and Structuralist contributions.

While previous related research has to a great extent focused on either one or the other framework, we have sought to present a synthetic approach which aims at retrieving the consistent and holistic analysis of stock-flow consistent modelling whilst integrating the interdependence approach typical of the input-output framework. Stock-flow consistent modelling's *no black holes* principle guarantees that everything comes from somewhere and everything goes somewhere and, therefore, that the model's accounting identities are consistent and complete. No accounting implications within the system defined can pass unnoticed. For its part, the integration of the input-output matrix enables us to trace the evolution of macroeconomic variables without overlooking the influence of each industry's distinctive input and output structure. This feature, usually undermined by modern macroeconometric modelling of aggregate variables, is of upmost importance in countries like Argentina. As a result, we have a solid and comprehensive structure which guarantees the coherence of any conclusion obtained, but yet flexible enough to produce industry-specific forecasts which bear in mind the tight interdependence within industries and between these and all economic agents.

The model is structured taking carefully into account the availability of data for the Argentinean case, insofar as its main concern is empirical. For that reason, this paper represents the first step towards a full estimation of the model and the forecast of the Argentinean economy's key variables on a quarterly basis. To that effect, an empirical paper describing the estimation of the input-output, social accounting and flux-of-funds matrices (which has not few difficulties in a country like Argentina where information is not abundant and complete), as well as the forecasts that emerge from the model, is the unavoidable consequence of this first document.

References

Berg, Matthew, Brian Hartley, and Oliver Richters (2015). "A stock-flow consistent input–output model with applications to energy price shocks, interest rates, and heat emissions". *New Journal of Physics*, 17.1, 015011.

Binswanger, Hans Christoph (2013). *The growth spiral: money, energy, and imagination in the dynamics of the market process*. Berlin; New York: Springer.

Caverzasi, Eugenio and Antoine Godin (2015). "Post-Keynesian stock-flow-consistent modelling: a survey". *Cambridge Journal of Economics*, *39*(1), 157-187.

Dietzenbacher, Erik (1997). "In Vindication of the Ghosh Model: A Reinterpretation as a Price Model". *Journal of Regional Science*, 37, 629–651.

García Díaz, Fernando (2016). "Un modelo de inflación por costos para la Argentina". Working paper. Available at https://www.researchgate.net/publication/309591802.

Godley, Wynne (1996) Money, Finance and National Income Determination: An Integrated Approach, Levy Economics Institute, Working paper, n. 167

Godley, Wynne and Marc Lavoie (2007). *Monetary economics: an integrated approach to credit, money, income, production and wealth*. Basingstoke; New York: Palgrave Macmillan.

Kim, Jung Hoon and Marc Lavoie. (2016). "A two-sector model with target-return pricing in a stock-flow consistent framework". *Economic Systems Research*, 28:3, 403-427, DOI: 10.1080/09535314.2016.1196166.

Leontief, Wassily W. (1986). *Input-Output Economics. Second edition*. Oxford; New York: Oxford University Press.

Miller, Ronald E., and Peter D. Blair (2009). *Input-output analysis: foundations and extensions*. New York: Cambridge University Press.

Nordhaus, William D., and John B. Shoven (1977), "A technique for analyzing and decomposing inflation". In Popkin, J. (edit), Analysis of inflation: 1965-1974. (pp. 333-360), Cambridge, Massachusetts: National Bureau of Economic Research.

Papadimitriou, Dimitri B., Gennaro Zezza, and Michalis Nikiforos (2013). "A Levy Institute Model for Greece". Technical paper, Levy Economics Institute of Bard College.

Pasinetti, Luigi L. (1981). *Structural change and economic growth*. Cambridge: Cambridge University Press.

Taylor, Lance (1983), *Structuralist macroeconomics: Applicable models for the third world*. New York: Basic Books.

Tokic, Damir (2012). “The economic and financial dimensions of degrowth”. *Ecological Economics*, 84, pp. 49–56.

Tobin, J. (1969). A general equilibrium approach to monetary theory. Journal of money, credit and banking, 1(1), 15-29.

Valdecantos, S (2016), Estructura productive y vulnerabilidad externa: un modelo estructuralista stock-flujo consistente, Serie Estudios y Perspectivas (Buenos Aires), No 46.

Wenzlaff, Ferdinand, Christian Kimmich, and Oliver Richters (2014). “Theoretische Zugänge eines Wach- stumszwangs in der Geldwirtschaft”. Discussion Papers 45. Hamburg: Zentrum für Ökonomische und Soziologische Studien.