

Stock-Flow Consistent Models for Developing Countries: The Case of Colombia

Andrés Escobar-Espinoza¹

Abstract

The present research highlights the main characteristics of an applied Stock Flow Consistent model for Colombia, estimated using annual data of the last 15 years, in the tradition of applied macroeconomic models developed by Wynne Godley and Gennaro Zezza. The focus of building the model is to explore the implications of alternative economic policies for the Colombian case.

Key Words: *Macroeconomic models, simulation, stock flow consistent models*

¹ Professor at the Economics Department - Universidad de Cartagena (Colombia). Director of the Economics and Social Science Research Department of the Faculty of Economic Sciences. PhD in Economics Università Cattolica del Sacro Cuore (Italy). The author thanks Prof. Gennaro Zezza for his mentoring and support. Also to Università del Cassino e del Lazio Meridionale for its hospitality during a visiting research period.

SFCOL: An applied Stock-Flow Consistent model for Colombia

This model developed for Colombia (SFCOL), follows the “New Cambridge” approach, which is the base of empirical models developed for US (LIMUSA²), and Greece (LIMG³). These models are widely known by their consistency and effectiveness to estimate medium term scenarios for those economies (Papadimitrou et al., 2013).

The model considers the private sector as a whole: it combines families and firms, considering their income and expenditures with the rest of the economy: Government and the Rest of the World. Particular emphasis is considered on their financial balances, which allows identifying the net wealth or net debt of each sector.

The approach employed for the data base construction follows the social accounting matrices: payments registered on columns and income on rows. This approach analyses the accounting of the circular flow of the economy.

Table 1. Social Accounting Matrix builds for the SFCOL model

	(1) Production	(2) Private Sector	(3) Government	(4) Rest of the World	(5) Capital Account	(6) Total
(1) Production		+PX	+G	+NX		+GDP
(2) Private Sector	+VA		+TRGP	+TRWP		+YP
(3) Government	+NIT	+DT		+TRWG		+YG
(4) Rest of the World	+NITw	+TRPW	+TRGW			+YW
(5) Capital Account		+S	-GDEF	-CA		0
(6) Total	+GDP	+YP	+YG	+YW	0	

² Levy Institute Model for USA - LIMUSA

³ Levy Institute Model for Greece - LIMG

Following the traditional methodology (Papadimitrou et al., 2012), the capital stock is not considered explicitly, and investment is accounted as part of the Private Sector expenditures (PX). For this reason, Private Sector savings (S) are net of investment. As usual, the social accounting matrix registers the final values of the period (year) that guaranties the accounting equilibrium. With respect to production, the differences between supply and demand are registered as changes in inventories treated as investment and incorporated in Private Sector expenditures (PX). Value Added is obtained as residual between sales and indirect taxes paid to the Government.

Savings for each sector are obtained as residual between their income and expenditures (total row) and payments. By this, total rows (2 to 5) correspond to total columns. Government savings (GDEF) is presented as negative and the External Current Account.

The accounting presented in table 1 implies the following fundamental identities:

$$\text{GDP} = \text{PX} + \text{G} + \text{NX} \quad (1)$$

$$\text{YP} = \text{VA} + \text{TRGP} + \text{TRWP} - \text{TRPW} \quad (2)$$

$$\text{S} = \text{YP} - \text{PX} - \text{DT} \quad (3)$$

$$\text{YG} = \text{NIT} + \text{GOS} + \text{DT} + \text{TRWG} \quad (4)$$

$$\text{GE} = \text{G} + \text{TRGP} + \text{TRGW} \quad (5)$$

$$\text{GDEF} = \text{GE} - \text{YG} \quad (6)$$

$$\text{CA} = \text{NX} + \text{TRWP} + \text{TRWG} - \text{TRPW} - \text{TRGW} \quad (7)$$

$$\text{S} = \text{GDEF} + \text{CA} \quad (7')$$

The last relation is verified by the construction of the matrix.

With respect to flow of funds of the economy, a simplified matrix is constructed that considers the existent financial assets which are registered in the financial accounts of the economy.

Table 2. Flow of funds Matrix

	Private Sector	Government Sector	Rest of the World	Total
Government Debt	+dGD _p	-dGD	+dGD _w	0
Net Obligations of the Private Sector	-dPD		+dPD	0
Total	+S = dFNA	-GDEF	-CA=-dFW	0

One of the standard assumptions in applied models constructed so far is to consider that the Government Sector does not hold financial assets, and treat symmetrically sector liabilities that are assets of the Rest of the World, and financial assets issued by the rest of the world and held by the private sector (Godley, 1983). By this, any increase in the net savings of the private sector can increase the amount of government bills held, and/or increase the amount of foreign liabilities held domestically by the Rest of the World (Papadimitrou et al, 2013).

Stocks are calculated by the standard Stock-Flow identity:

$$\text{Stock}(t+1) = \text{Stock}(t) + \text{Flow}(t) + \text{NCG}(t) - \text{DS}(t)$$

Where, NCG refers to net capital gains and DS refers for reductions in the stock, that could increase by no payments of debt (default on debt). According to the experience of applied models developed for US and Greece, it is convenient to estimate stocks at historical costs, without considering net capital gains (Papadimitrou et al., 2013). By this reason, stock variables can be estimated by cumulating flows starting on period zero:

$$\text{GDEBT} = \text{GDEBT}(-1) + \text{GDEF} \quad (8)$$

$$\text{FNA} = \text{FNA}(-1) + \text{S} \quad (9)$$

$$\text{FW} = \text{FW}(-1) + \text{CA} \quad (10)$$

This implies that the value of net assets of the Rest of the World (FW) represents the cumulative net financial assets of the Private Sector and Government Deficit.

The External Sector considers net exports as follows:

$$NX = XGS - MGS \quad (11)$$

$$XGS = XG + XS \quad (12)$$

$$MGS = MG + MS \quad (13)$$

The following variables are transformed into real variables: PX, XG, XS, MG, MS, G, GCC, GIC, GI, YD and GDP. Public expenditures are disaggregated as collective, individual and investment, with their respective transformation into real values. Disposable income (YD) is obtained by subtracting to the Private sector's Income, direct taxes and its transfers to the Rest of the World.

It is important to highlight that the national accounting of the model depends on the following variables:

- Aggregate demand components (Private expenditure, imports and exports)
- Prices and relative prices
- Fiscal policy variables (as example, expenditure on goods and services, investment, and transfers)
- Exogenous interest rates

Data

The data used follows the specifications for the construction of empirical SFC models for developed countries (Papadimitrou et al, 2013). Data availability and methodological changes of the Statistical Office does not allow observing the behavior of the economy during the last 30 years. In addition, data availability is only annual and not is available quarterly data as occur for other countries.

The information used in the present work corresponds to institutional accounts published by the National Statistics Office (DANE) starting on 2000 to 2013. At the same time, data from the national financial accounts (stocks and flows) published by the Central Bank (Banco de la República) is used for the period 1998 to 2011.

The data employed for the construction of variables and the data base allow having a solid consistency stock-flow in order to obtain real GDP from the sum of its components. Estimated stocks in the model: Government debt stock, External net assets, and Private sector net assets, are estimated at costs by the corresponding accumulation of flows.

Some Results

Economic growth in the last decade

After the crisis occurred at the end of the 1990s, the Colombian economy entered in a period of economic recovery as a consequence of the commodity bonanza which started around 2003. The price of different commodities increased considerably by global demand, with China as a key player. With respect to Oil, growing prices were above the rates of growth of production during the last decade. Government revenues increased substantially up to the beginning of the Global Financial Crisis (GFC).

China's economic model based on FDI, industrialization and export promotion, is changing towards domestic consumption, and social services provision. By this reason, international commodity prices will be affected. On the other hand, currency devaluation in several countries, will limit the expansion of exports and international trade. With respect to assets, their prices were stimulated by speculative bubbles, and under a less dynamic economic growth, their prices will be affected negatively as just happened recently with the local stock market.

The international environment, public and private investments, will determine the Colombia's growth in the following years. For this, it is important to identify the growth of unsustainable process that the Colombian economy faces.

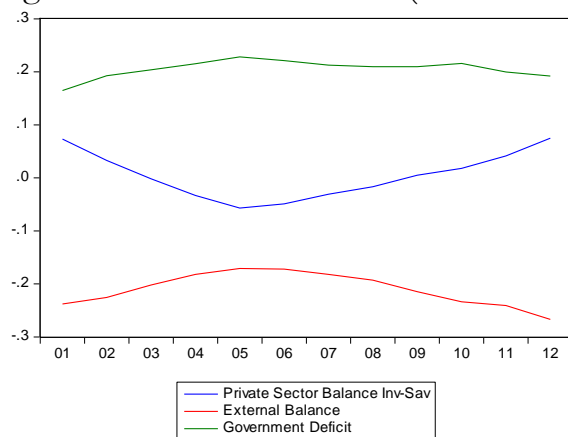
Financial Balances

The financial balances (private, public and external) of the economy, can be estimated following the “New Cambridge” hypothesis a là Godley. By this, the behavior of financial balances (with respect to income or GDP) gives a clue of which are the components that led economic growth, and the level of net assets for each sector.

For the Colombian case, financial balances show that the economy is under an unsustainable path: growing deficits of current account imply a major growth of the stock of external debt. The problem during the 1990s of highly indebted private sector, becomes relevant after 2005 turning into a deficit for the private sector as a whole.

Economic recovery of the last decade has some particularities, particularly the period of rapid growth during mid 2000s: growing private investment with respect to private savings, showing that the private sector balance became a net debtor to the Rest of the World achieving in 2012 similar levels of those of the 1999 severe crisis. The strong growth in product is associated to private sector demand fueled by debt.

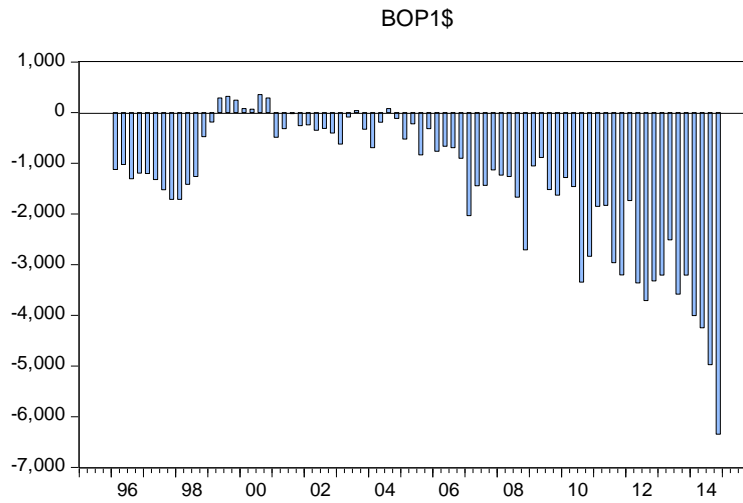
Figure 2: Financial Balances (% of GDP)



External Balance

The current account presents some problems. It was not dramatic while the structural trade deficit was balanced by capital flows and net transfers (including remittances). The deterioration of the balance of payments is evident, that became more relevant as oil prices were reduced significantly in the last period.

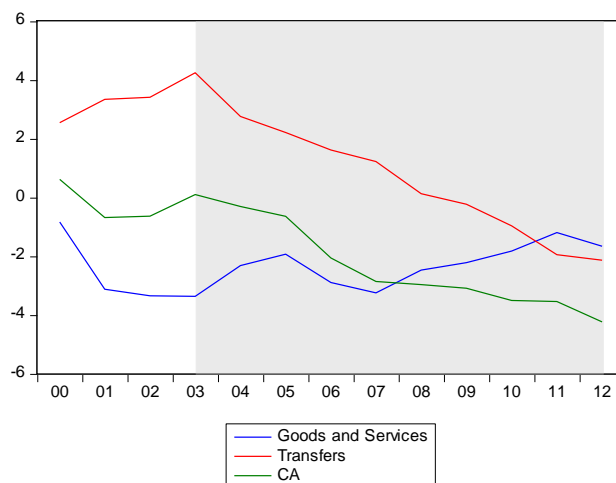
Figure 2: Balance of payments, 1996-2015* (USD)



Source: Dane and Banrep

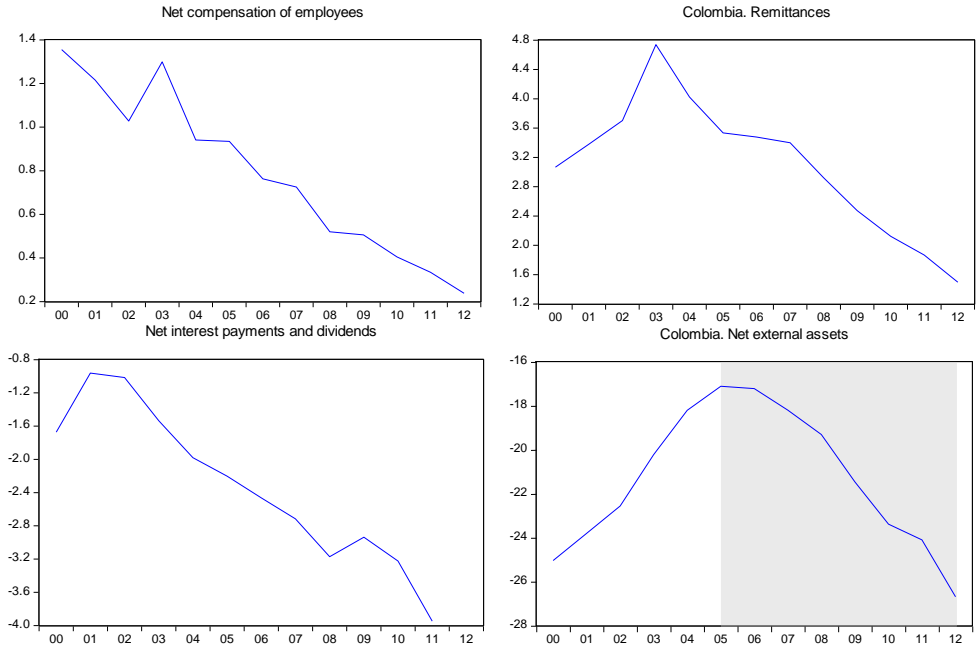
The external balance deteriorates in the recent period where transfers to the Rest of the World increased substantially having strong effects on external balance

Figure 3: Current account, trade balance and transfers (% of GDP)



Despite the boom in commodity prices, the trade deficit cannot be restored. Oil and coal are the main export products during the last decade surpassing the 50% of total Colombian exports in 2012. Remittances and net compensation of employees have decreased consistently starting from 2003. The situation is deteriorated by the increasing interest payments and dividends to the Rest of the World. Starting in 2005, and considering preliminary estimations of net external debt (at historic costs) obtained by cumulating the net external balance, show that the growing deficit of the current account implies an explosive pattern of external debt.

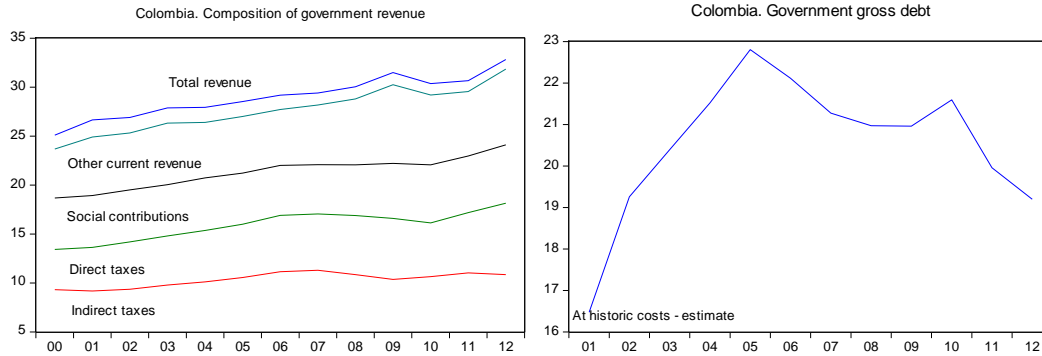
Figure 3: Net compensation of employees, remittances, interest and dividends payments (% of GDP)



Government Account

Taxes on imports (trade tariffs) and on production represent almost one third of government income and has been stable with respect to GDP. Revenues from taxes on income and wealth are far below when compared to advanced economies.

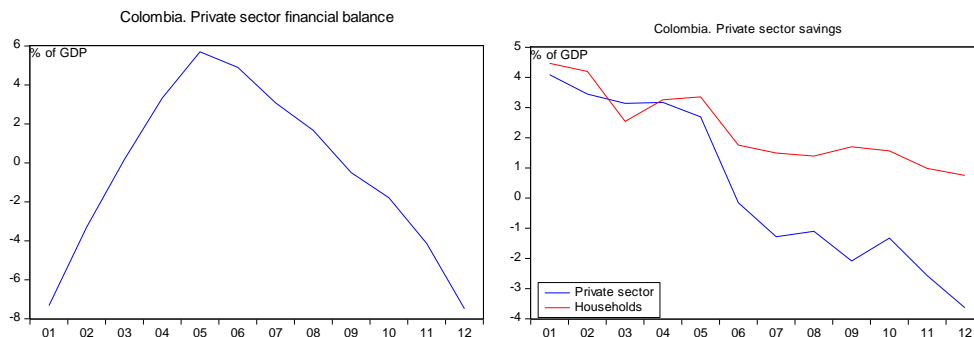
Figure 5: Composition of Government revenue (% of GDP)



Private Sector.

As consequence of the 1999 crisis, the private sector increased its financial balances until mid 2000s. Starting on 2005, the net financial assets of the private sector decreased dramatically turning out negative in 2009 and reaching during 2012 similar levels to those presented in the 1999 crisis. Despite that investment increased, private sector savings decreased systematically from a 4% of GDP in 2001 to negative values in 2006 until nowadays.

Figure 6: Private Sector financial balance, private sector savings (% of GDP)



This is the main problem that confronts Colombia. Most economies have a private sector with a net creditor position in the stock of financial assets, so that if necessary, a reduction in government net liabilities can be obtained through appropriation of private financial assets. This is ruled out in the case of Colombia, where both the private and public sector have a net debt against foreigners. By this, any attempt to reduce the stock of debt must imply a transfer of real, rather than financial, assets from Colombia to the Rest of the World.

This seems to be the main problem facing Colombia. Most economies have a private sector with a net creditor position in the stock of financial assets, so that, if necessary, a reduction in government net liabilities can be obtained through the appropriation of private financial assets. This is ruled out for Colombia, where both the private and public sectors have a net debt position against the Rest of the World. By this, any attempt to reduce the stock of debt must imply a transfer of real assets (rather than financial) to foreigners. Additionally, debt service payments represent net transfers of a fraction of national income to the Rest of the World, with important implications on aggregate demand in Colombia.

It seems to be the case that economic growth starting during the second half of the 2000s until recently –and similar to the US- has been stimulated by consumption financed by reductions in financial assets of the private sector (both families and firms) and/or by increasing debt. This process, rather than the excessive control of fiscal deficit, has put the country in an unsustainable growth path.

Preliminary Conclusions

There are strong implications. In one hand, the weak and unstable growth of the American economy does not guarantee in some way that Colombian exports will recover its structural trade deficit, which has been present since 2000s. It is not clear that other economies, at least Colombian trading partners, will be willing to increase the demand for Colombian exports. On the top of that, the new scenario that presents the TPP agreement which involves the main trading partners of the country and covers almost the 40% of global GDP. Nevertheless,

if trade deficit improves, the financial balance will remain negative due the significant net capital flows to the Rest of the World.

The negative Financial Balance of the private sector, having into account the current macroeconomic conditions, its debt level and the effect of the depreciation of the national currency against US dollar with respect of financial obligations held in foreign currency, makes it unlikely that private investment will maintain or increase significantly in the short and medium term. A scenario of austerity will maintain aggregate demand at low levels, so GDP could decline faster than the reduction of the public sector's net debt.

Maintain sustained economic growth should be a priority. The option in economic policy can be distinguished between a deflationary solution (imposition of contractive fiscal and monetary policy) that will hurt growth with increasing levels of unemployment. Alternatively, international mechanisms are an option to restore the external balance, or the international trade mechanisms that are available to protect the national economy without waiting a self-correction mechanism with important negative consequences in the future, and most important, without having to sacrifice economic growth nor employment.

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