A simple model of developing countries: financing the current account deficit

Özgür Bayram SOYLU*

Abstract

A stock flow consistent model provides a monetary and financial framework to macroeconomics. It clearly shows the sources of financing for investments and also answers the following questions: Where does the finance for investment come from? and How are budget and current account deficits financed? This paper presents a simple stock flow consistent model for the developing countries with current account deficits. Most of these countries seem to cover the current account deficit by public borrowing and private sector borrowing. For this purpose, the motivation of this paper is based on the state of these countries and the modelling of their position.

Keywords: stock flow consistent models, current account deficit, developing countries

Introduction

The current account deficit problem is one of the most important macroeconomic problems of developed and developing countries. In particular, an unsustainable current account deficit has the potential to influence the entire economy. The important issue regarding the current account deficit is the financing of the current account deficit. The problems experienced in financing the current account deficit have the potential to cause financial crises as in the past. The current account deficit and its financing are closely related to the liberalization of capital movements (Bayraktutan and Demirtaş, 2011). Therefore, the current account deficit is an important indicator for the countries' macroeconomic performance. The fact that the current account deficit is at the root of crises, especially in the economies of developing countries, shows that the current account deficit is an important indicator (Dornbusch and Fischer, 1980).

The development deficit, political and social structures and natural resources of national economies are at the root of the current account deficit problem. Revealing these dynamics of the current account deficit is an important criterion for the financing of the current account deficit. Whether the current account deficits will

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be financed by foreign capital investments and portfolio investments or by borrowing depends on these fundamental dynamics. An inadequate level of savings and an inadequate level of investment have led to the need for a high level of capital flow. The need for capital inflows in emerging economies and the problems in the financing of the current account deficit caused the current account deficit to increase significantly in the last five years. External borrowing, which is used to finance the current account deficits of developing economies, is modelled with the help of stock-flow consistency. In particular, the focus is on the borrowing of the banking sector and the public sector for the financing of current account deficits.

A stock flow consistent model is a macro dynamic model based on national income and product accounts and flow of funds accounts. Stock-flow-consistent models were pioneered by Wynne Godley in the 1970s at Cambridge and by Tobin (1982). Stock flow consistent models have become a focus of interest in the Post-Keynesian economics literature after Godley and Lavoie (2007). The main feature of the model is an integration of the real and financial sectors of the economy.

The stock flow consistent model ensures integration of all sectors of the economy with its distinctive calculation rules, ensuring the integrity of the economy by providing integration between stocks and flows. Furthermore, the stock flow consistent model indicates that the output of any sector constitutes the input of another sector, in other words, it indicates that the liability of a sector is the assets of another sector.

Tobin (1982), in his Nobel speech, presented the basic dynamics of the stock flow consistency approach by presenting a different framework than the standard macro models. The framework is based on five main characteristics that differ from the standard macro model:

- Precision regarding time: Short-term macroeconomic models indicate a time period.
- Tracking of stocks: An important part of the process is the dynamics of flows and stocks such as savings and wealth and investments and capital.
- Several assets and rate of returns: A comprehensive model should have several assets and rates of return.
- Modelling of financial and monetary policy operations:
- Sectoral budget and adding-up constraints: Economic agents must take into account their budget constraints when considering both expectations and actual results.

A stock flow consistency is an important feature of a modern capitalist economy in which the behaviour of the real sector of the economy cannot be understood by linking it with the financial sector (money, borrowing and financial assets), creating a framework for an integrative approach to the real and financial aspects of the economy (Nikiforos and Zezza, 2017). Thus, the stock flow consistency approach is an important tool that allows an analytical study of the political economy of modern capitalism.

This paper presents a simple model established for the developing countries within the context of stock flow consistency approach. The developing countries with current account deficits are analyzed within the stock flow consistency model. In Section 1, current account deficit and public borrowing positions of developing countries are evaluated. Also, the private sector balance of the developing countries is calculated by Dos Santos and Macedo e Silva (2010) and Zezza (2009). Section 2 deals with a survey on stock flow consistent approach. Section 3 includes stock flow consistent model for developing countries. Finally, the last section includes results and suggestions.

1. Current account balance, government sector balance and private sector balance of developing countries

The current account deficit is a measurement of a country's trade where the value of the goods and services it imports exceeds the value of the goods and services it exports. Current account balance is one of the most important economic indicators for developing countries. The current account of the selected developing countries can be seen in Table 1. The current account balance (% GDP) reflects the average of the years covered (2006-2018).

The fact that the current account deficit is an important matter for European countries, notably Moldova, is clearly understood from the table. Also, the fact that the current account deficit is a problem for Turkish economy becomes obvious. Many Latin American countries are still struggling with the current account deficit. If we examine the countries, Paraguay has been giving current surplus for the last three years. Bolivia had an important place in terms of the current account balance between 2006-2014, while the current account balance has deteriorated for the last three years. Although the current balance average seems to be very good, the recent imbalances bring a macroeconomic threat to the future. Hungary has also established a significant balance on the current account balance.

There are different theoretical approaches developed in the literature to eliminate the current account deficit. These approaches are mainly based on monetary policies, fiscal policies and exchange rate policies. The main problem that countries face in eliminating the current account deficit and payment imbalances is related to what policy will be implemented.

There are a number of policy instruments for financing the current account deficit: (1) foreign currency debt from the rest of world, (2) foreign capital investment, (3) portfolio investment (investment in bonds and bill or stock market), (4) foreign currency reserves (5) borrowing by public or private sector.

Most of these countries are trying to finance the current account deficit by public sector borrowing. For this reason, Table 1 shows the average values of the government sector balance (%GDP). The government sector imbalance is remarkable in many European and Latin American countries.

Table 1. Current account and government sector balance average values (2006-2018)

Countries	Government Sector Balance (% GDP)	Current Account Balance (% GDP)	Countries	Government Sector Balance (% GDP)	Current Account Balance (% GDP)
Moldova	-2.26	-8.06	Brasil	-4.99	-2.03
Belarus	-4.41	-6.93	Peru	0.03	-2.03
Romania	-3.45	-5.13	Mexico	-2.93	-1.48
Turkey	-2.24	-5.11	Czech	-1.81	-1.30
Bulgaria	-0.43	-4.77	Chile	0.31	-0.90
Ukraine	-3.32	-4.11	Argentina	-3.05	-0.73
Colombia	-1,93	-3.45	Ecuador	-2.55	0.25
Poland	-3.86	-3,23	Hungary	-3.70	0.35
Uruguay	-2.14	-2.48	Paraguay	0.03	0.98
Slovakia	-3,34	-2.10	Bolivia	-1.15	2.56

Source: IMF Outlook.

Some of the countries finance their deficits by private sector borrowing. Therefore, the private sector balance values of the countries are calculated by Dos Santos and Macedo e Silva (2010) and Zezza (2009).

The basic national accounting:

$$Y \equiv Cp + Ip + Cg + Ig + X - M \quad (1)$$

Y refers to "total expenditure in final goods and services", (Cp + Ip) refers to sum of private consumption and investment, (Cg + Ig) refers to government consumption and investment, (X) refers to exports of goods and services and (M) refers to imports of goods and services. Assuming that economic agents integrated the private, government and rest of the world sectors; net transfers (T) from sector i to sector j; considering government sector G, rest of world W, private sector P

Rewrite the basic national accounting identity above as:

$$Y - T - Tpw \equiv Cp + Ip + Cg + Ig + Tgw - T + X - M - Tpw - Tgw \quad (2)$$

Thus,

$$Y - T - Tpw - Cp - I \equiv (Cg + Ig + Tgw - T) + (X - M - Tpw - Tgw) \quad (3)$$

or,

PS (Private Sector Balance) ≡ - GS (Government Sector Balance) + CAB (Current Account Balance).

Table 2 shows the average values of the private sector balance (% GDP) which were obtained by Equation 2. Table 2 indicates that the private sector balance levels are negative especially in European countries.

Table 2. Private sector balance (% GDP). Average values (2006-2018)

Countries	Private Sector Balance	Countries	Private Sector Balance
Moldova	-5.80	Czech	0.51
Bulgaria	-4.34	Poland	0.63
Turkey	-2.86	Paraguay	0.95
Belarus	-2.51	Slovakia	1.23
Peru	-2.06	Mexico	1.44
Romania	-1.68	Argentina	2.32
Colombia	-1,51	Ecuador	2.80
Chile	-1.21	Brasil	2.95
Ukraine	-0.79	Bolivia	3.72
Uruguay	-0.33	Hungary	4.06

Source: Author's calculation.

The macroeconomic indicators of the selected countries are the source of motivation to establish stock flow consistent model for these countries. The positions of these countries will be modelled in this study by using stock flow consistency, which emphasizes the financing of investments and deficits in financial flows which are not shown in national income and allows integration of real and financial sectors. An economic decision-making units consist of households, firms, banks, government and rest of the world sectors in this paper; the stock flow consistency model was established for 2006-2018.

2. Survey

The recent macroeconomic crises in developing countries reiterated the need for a clear understanding of the underlying factors of a country's current account position (Calderon *et al*., 2002). Many of the emerging economies in Europe strive to bring the current account deficit to sustainable levels. In addition, the global economic crisis has significant implications for international capital movements, which further exacerbates the sustainability of persistent current account deficits in Southeast Europe.

There is extensive literature on the sustainability of current account deficits, determinants of current account deficit and financing of current account deficit. In this study, after emphasizing the sustainability, causes and financing of the current account deficit, the application literature of the model will be included to reveal the usage areas of the model used.

Chinn and Prasad (2003) examined the effect of net foreign asset stock on financing the current account deficit. Using panel data analysis, 18 industrialized and 71 developing countries / 1971-1995 investigated the relationship between the stock of net foreign assets and the current account balance in the medium term. The results

of the analysis indicate that the net foreign asset stock has a positive relationship with the current account deficit. Aristovnik (2007) investigated the effect of using foreign capital investments in financing current account deficit. By using the dynamic panel data method, it has been determined that foreign capital investments had a negative impact on current transactions for the 17 Middle East and North African countries in 1971-2005 period. Matsubayashi (2005) examined the sustainability of the current account deficit in the US economy by the data of the 1975-1998 period, the Johansen co-integration method, public and private savings, and examined the sustainability of the current account deficit in the United States. To sustain current deficits in the USA, it has been concluded that public deficits must be reduced and public and private savings must be increased. Fountas and Wu (1999) used the cointegration method to determine whether the current account deficit is sustainable for the USA. As a result of their study on the 1967-1994 data set, they concluded that the current account deficit in the USA was unsustainable.

The stock flow consistency approach pioneered by Wynne Godley at Cambridge in the 1970s and James Tobin at Yale in the 1980s was adopted by many Post Keynesian researchers after Godley and Lavoe (2007). Caverzasi and Godin (2014) and Nikiforos and Zezza (2017) made the most recent contribution to the stock flow consistency approach in the meaning of survey. Caverzasi and Godin (2014) divided the authors of stock flow consistency into two groups. The first of these two groups are described as the North American network, and have been gathered around the contributions of Wynne Godley, Marc Lavoie, Gennaro Zezza and Claudio Dos Santos. The second is called the European network and come from the studies of Jacques Mazier, Stephen Kinsella and Edwin Le Heron.

2.1. Modern Financial Sector Models

A key feature of model is the consistency of real and financial market integration. In addition to the modern financial sector models, the financial crisis and banking sector-based studies are also included in this heading. Le Heron and Mouakil (2008) analyzed the results of monetary policy shock on banks' financial behaviour by establishing a stock flow consistency model within the framework of a banking sector with competitive characteristics on the basis of internal monetary theory. Lavoie (2008) has established a stock flow consistency growth model. The model built in an economy with household, firm, government sectors and central bank reveals that real government expenditures have been growing at a rate consistent with a fixed unemployment rate (at the level of natural growth) for a long time. Van Treeck (2008) relied on the effects of the financial position on the stock flow consistency model. The relationship between stockholders and concepts of financialization is the core of the study. Le Heron (2009a) has established a stock flow consistency model based on the banking sector. Le Heron (2009a) defined the risks of the debtor and the lender on the basis of the Minsky approach in his model.

Le Heron (2009b) aims to show how the financial crisis that erupted in the United States has become a global crisis in a country like France. Michell and Toporowski (2012) aimed to reveal unclear points of changes in the financial structure and firms' behaviour through stock flow consistency model. Caverzasi and Godin (2015) examined the mortgage crisis in the United States in the framework of the stock flow consistency model. The model has brought a new perspective to the choice of portfolio and inter-sectoral dynamics. Sawyer and Passarella (2015) demonstrate how the monetary cycle theory relates to the financialization term and how it should be developed in order to reflect the important features of the financial system over the last thirty years.

2.2. SFC and Agent-Based Model

Caiani, Godin and Lucarelli (2014) set up a stock flow consistency model in order to analyze the development process that started with the introduction of an innovative production sector into the economic system. Michell (2014) focused on the investment cycle, non-proportional profit, leverage and financial fragility among firms, rising production and excess capacity along with rising volatility, deepening financial fragility with increasing investments, and the decline in firms deficits.

2.3. Open economy models

Godley and Lavoie (2003) have established a two-country stock flow consistency model, each country is capable of trading goods and financial assets with their local currency. Godley and Lavoie (2005) state that high levels of activity reach higher levels of activity within the limits prescribed by the inflationary consequences, with the public sector choosing an appropriate fiscal policy. The model is based on the assumption of flexible exchange rate. Semieniuk, Truger and Van Treeck (2011) examined whether the 2011 national stabilization programs of the Eurozone countries were an instrument to achieve economic stability or not in the European Monetary Union. They focused on government deficits and external economic imbalances. Kinsella and Khalil (2012) have established a stock flow consistent model to analyze macroeconomic effects in a small open economy with a debt deflation. Valdecantos and Zezza (2015) set up a stock flow consistent model to demonstrate the potential reform of the international monetary system. The link between the global imbalances, which are the determinants of financial instability and global stagnation, and the current situation of the international monetary system are discussed.

2.4. Distribution of personal ıncome models

Zezza and Dos Santos (2006) state that the increase in tax rate slows growth and the investment function varies depending on the parameter selection. Zezza (2008) discussed the developments in the distribution of income in the American economy to 5% of the population and the decrease in savings compared to disposable income in the last two decades. Zezza (2008) points out that the strong growth in the American economy is largely based on revenue growth in private spending and therefore, savings have fallen.

2.5. Empirical models for whole countries

Godley and Zezza (1992) defined a simple stock flow consistent model for the Danish economy over the period 1971-1986. Godley and Zezza (1992) stated that it is necessary to establish an effective income policy for the Danish economy. Godley and Lavoie (2006) established a three-country (United States, Germany, Italy) model that trade in goods and financial assets with each other. It is stated that if the three countries carry out different fiscal policies, the system will operate under the floating exchange rate regime. Kinsella and Aliti (2012) set up a stock flow consistent model to reveal the effects of a sudden and sharp decline in government spending in the Irish economy. As a result of simulation, it was stated that a decrease of 11.5% in government expenditures caused a decrease in the liabilities of Irish government bonds.

2.6. Ecological models

Studies have been carried out including environmental factors within the framework of stock flow consistency model in recent years. Naqvi (2014), Berg, Hartley and Richters (2015) integrated econometric calibration by integrating environmental factors into stock flow consistent model.

3. Basic principle and SFC model

A stock flow consistent model is a macroeconomic model that allows the integration of real and financial sides of the economy. The stock flow consistent model consists of two components: accounting framework and behavioural equations. The accounting framework is based on balance sheet matrix, transaction flow matrix and capital gains of the economic sectors. As a result of this accounting framework, the resulting equations are expressed as behavioural equations.

An important feature of the stock flow consistent approach is the “quadruple entry principle” attributed to Copeland (1949). According to this principle, any change in the sources of a sector must be compensated by at least one change in the

use of the funds of the same sector. For example, when the household buys a product from the firm sector, an increase in firms income and household expenditures will occur. In this case, there is an increase in the assets of the firms sector despite the increase in the liability of the household.

Another feature of the stock flow consistency approach is "everything comes from somewhere and everything goes somewehere"; there is *no black hole* in the economy, that is, the assets of a sector generates the liabilities of another sector. For example, household consumption expenditure refers to the production earnings of the firm sector. This guarantees the coherence of the model.

One of the last and most important features of the stock flow consistency approach is the emphasis on financial flows, which are not shown in national income, finance investments or deficits. The other basic principles of stock consistency will be given when introducing the model's balance sheet matrix and transaction flow matrices.

3.1. SFC model for developing countries

Stock flow consistency clearly shows the financial flows that are not shown in national income finance, investments or deficits. The stock flow consistent model, which allows the integration of the financial sector and the real sector, is built for selected developing countries over the period of 2006-2018.

The model is based on financing the current account deficit through government debt and private sector debt. In the stock flow consistency models, the borrowing of the government sector is generally carried out by issuing treasury bills to some sectors. Godley and Lavoie (2007, part 3), who pioneered the establishment of stock flow consistency models, financed government sector deficits by distributing high powered money to the household in the model SIM (simplified model). In Godley and Lavoie (2007, Chapter 4), the government sector issues treasury bonds to households and central banks in order to finance the deficits. Dos Santos and Zezza (2008) assumed that the government sector issues treasury bills to the banking sector in order to finance its deficits.

The government sector issues treasury bills to households, the banking sector and the rest of world sector to finance its deficits in my model. The other borrowing channels are clearly expressed in the transaction flow matrix in the model.

Open economy stock flow consistency models have been developed as multi-country as in the studies of Lavoie and Daigle (2011), Godley and Lavoie (2003,2006), Godley (1999) and Lavoie and Zhao (2010); these models are designed to have the same sectoral structure in each country. The external sector is considered as a whole and is named rest of the world sector; it is also defined as a sector in this model as in the case of Godley and Lavoie (2005) and Detzer (2016).

The model built for developing countries consists of five sectors: household, firms (private sector), banking sector, government sector and rest of the world sector.

Each sector has assets and liabilities. The model is abbreviated as DC in the following sections.

3.2. Model developing countries (DC) Balance Sheet Matrix

Table 3 shows the balance sheet matrix of Model DC**.** The balance sheet matrix includes five sectors in total. The assets (+) and liabilities (-) of these sectors are clearly shown in the balance sheet matrix. The "h" refers to households, "f" refers to firms, "b" refers to banks, "g" refers to government, "row" refers to rest of world, "1" refers to domestic loans, "2" refers to foreign loans in the balance sheet matrix. The loans provided by the banking sector to the firms sector are represented by L_1, while the loans provided by the banking sector from the rest of world are represented by L_2. „S" and "d" refer to supply and demand in the government sector column. All row and column totals must be equal to zero according to the stock flow consistent model principle. Each column in the balance sheet matrix reflects the budget constraint for that sector.

It is assumed that the household holds bank deposits (+ M_h) and treasury bills (+ B_h). In other words, the wealth of households (-V_h) consists of bank deposits and treasury bills. The balance sheet matrix also promises to an important rule. This rule is that all rows and column sum to zero, that is, all assets and liability sum to zero, thus ensuring that 'everything comes from somewhere and everything goes somewhere'. The sum of the components in the columns constitutes the net wealth. The inclusion of net wealth in the system with a negative sign (-) will result in the sum of the other elements in the columns to be zero, thus providing consistency and coherence in stock accounting (Godley and Lavoie, 2007).

The firms sector is included in the second column. It is assumed that the firms sector needs loans to finance its investments. This loan requirement is covered by the banking sector. The assets and liabilities of the firms sector reveal the net wealth of this sector (-V_f). The firms sector is assumed to have fixed capital, it does not have a liability for other sectors. Fixed capital is only the assets of the firm sector.

The assets of the banking sector, included in the column of the balance sheet matrix, consist of the loans (+ L_1) provided to the firms sector and the treasury bills issued by the public sector (+ B_b). Its liabilities consist of the deposits given to households (-M) and the loans (-L_{2b}) obtained from the rest of the world. The net wealth of the banking sector is assumed to be equal to zero. The sum of assets and liabilities of the banking sector are equal.

The government sector is included in the fourth column of the balance sheet matrix. It is assumed that the government sector supplies treasury bills to households and banks (-B_s) and rest of world. The government debt is equal to the amount of outstanding bills issued by the government sector to households, banking sector and rest of the world. Therefore, the treasury bills constitute the net wealth of the government sector (-V_g).

The rest of the world sector provides loans to the domestic banking sector in the last column of the balance sheet matrix (+ L_2). It is assumed that the rest of the world sector holds treasury bills (+ B_{row}). (-V_{row}) represents the net wealth of the rest of the world sector.

Table 3. Balance Sheet Matrix

	Households	**Firms**	**Banks**	**Govern.**	**ROW**	∑
Fixed Capital		+K				+K
Domestic Loans		$-L_f$	$+L_1$			0
Foreign Loans			$-L_2$		$+L_2$	0
Deposits	$+M_h$		-M			0
Treasury Bills	$+B_h$		$+B_b$	$-B_s$	$+B_{row}$	0
Balance (net worth)	$-V_h$	$-V_f$	$-V_b$	V_g	-Vrow	-K
∑	0	0	0	0	0	0

Source: Author's calculation.

3.3. MODEL DC Transaction Flow Matrix

The transaction flow matrix defines the transaction and flows between the economic sectors. The transaction flow matrix is based on the rule that all row and column totals are zero. The „everything comes from somewhere and goes somewhere" principle is clearly revealed in the transaction flow matrix. Each column in the transaction flow matrix actually refers to the sector's budget constraint. Positive signs (+) represent the source of funds, while negative signs (-) represent the use of funds.

Table 4 describes the transactions and flows between the sectors in the national economy and the external (rest of the world) sector. All rows and columns must be equal to zero in the transaction flow matrix, as expressed in the balance sheet matrix. The household earning wages (+ WB_s) and earnings profits (+ FD_f and FD_b) from firms and banking sector were considered. The households also receive interest income (+$rm_{(-1)}.M_{h(-1)}$ and +$rb_{(-1)}.B_{h(-1)}$) on deposits and treasury bills. The households use these flows to cover their consumption expenditures and taxes that the government is obliged to pay. The households use the remaining amount (-V_h) that we can qualify as savings to obtain more financial assets.

The firms sector have two sub-components: current and capital account. While the current account shows the earnings and expenditures of the firms sector, the capital account shows how the firms sector finances its expenditures.

The returns in the current account of the firm sector are used to finance wages, taxes, imports, loan rates and profits. The firms sector distributes a portion of their profits to households (+ FD_f) while the remaining part (+ FU_f) is in the capital

account. The firms sector finances its investments with domestic loans and retained earnings.

The banking sector is divided into two sub-components: current and capital account. The current account refers to the difference between the profit earned by banks and their expenditures. While the banking sector obtains interest income on loans and bills, they pay interest on deposits to household and on foreign loans to the rest of the world. The difference between the interest income of the banking sector and the interest expenses paid by the banking sector constitutes the profit of this sector ($-F_b$)

The government sector column refers to the budget constraint of this sector. The government sector collects taxes from households and firms to finance government expenditures and expenses. The difference between input and output determines the public sector borrowing requirement. The government sector issues new treasury bills to cover this public sector borrowing requirement.

The exports of firms constitute the imports of the rest of the world sector, while imports of firms constitute the export of the rest of the world sector. The rest of the world sector receives interest on the loans provided to the banking sector.

Table 4. Transaction Flow Matrix

	Household	Firms		Banks		Government	Rest of World	∑
		Current	Capital	Current	Capital			
Consumption	$-C_d$	$+C_s$						0
Investment		+I	-I					0
Gov. Expenditur		+G				-G		0
Exports		+Ex					-Ex	0
Imports		-Im					+Im	0
Taxes	$-T_h$	$-T_f$				+T		0
Wages	$+WB_s$	$-WB_d$						0
Firms Profits.	$+FD_f$	$-F_f$	$+FU_f$					0
Bank Profits.	$+FD_b$			$-F_b$	$+FU_b$			0
Interest on domestic loans		$-r_{l(-1)}.L_{f(-1)}$		$+ r_{l(-1)}.L_{1(-1)}$				0
Interest on foreign loans				$-r_{l2(-1)}.L_{2b(-1)}$			$+r_{l2(-1)}.L_{2(-1)}$	0
Interest on deposits	$+r_{m(-1)}.M_{h(-1)}$			$- r_{m(-1)}.M_{(-1)}$				0
Interest on treasury bills	$+r_{b(-1)}.B_{h(-1)}$			$+r_{b(-1)}.B_{b(-1)}$		$-r_{b(-1)}.B_{s(-1)}$	$+r_{b(-1)}.B_{row(-1)}$	0
Change in the stocks of								

Δ **Domestic loans**			$+\Delta L_f$		$-\Delta L$			0
Δ **Foreign loans**					$+\Delta L_{b2}$		$-\Delta L_2$	0
Δ **Deposits**	$-\Delta M_h$				$+\Delta M$			0
Δ **Treasury Bills**	$-\Delta B_h$				$-\Delta B_b$	$+\Delta B$	$-\Delta B_{row}$	0
∑	0	0	0	0	0	0	0	0

Source: Author's calculation.

4. Model DC Behavioural Equations

The equations and definitions reflect the behaviour of the sectors and their decisions while defining the balance sheet matrix and transaction flow matrix. The output level of the firms sector is defined by the values of variables such as gross domestic product in expenditures (Y), consumption expenditures (C), investment expenditures (I_s), government consumption expenditures (G), export (Ex) and import (Im). The level of output in terms of income is defined on wages, profits and taxes.

$$Y = C + I_s + G + Ex - Im = WB_d + F_f + T_f \quad (4)$$

Fixed capital (K) is defined as the level of fixed capital in the previous period and investment supply (I_s). In other words, fixed capital stock is equal to investment supply.

$$K = K_{(-1)} + I_s \quad (5)$$

An important point for the firms sector is the relation between real investment (I_s) and investment demand (I_d). The level of investment demand and the level of investment supply are assumed to be equal.

$$I_s = I_d \quad (6)$$

Post Keynesian investment function or, more clearly, the capital accumulation rate is a function of capacity utilization rate and domestic loan rates. Ndikumana (1999) defined the investment function based on the cash flow rate, interest expense, percentage development in capital cost, output growth and Tobin's q ratio. Ndikumana's study is not associated with stock flow consistent model, but Lavoie and Godley (2001) benefited from this study. According to Lavoie and Godley (2001), the investment function is defined based on cash flow rate, domestic loan interest rate, Tobin q ratio and capacity utilization rate within the framework of the stock flow consistency model. Godley and Lavoie (2007) defined the investment function based on capacity utilization rate and loan interest rates. Dos Santos and Zezza (2008) defined the investment function in relation to capacity utilization rate and loan interest rates. Finally, Le Heron (2011) defined the investment function based on capacity utilization rate, cash flow rate and financial condition index. The investment function - capital accumulation rate - for developing countries is based on capacity utilization rate and domestic loan rates. It is defined as in equation (7).

The investment demand (I_d) is associated with the capital accumulation rate (grkd) and the prior period fixed capital ($K_{(-1)}$)

$$I_d = grkd \,.\, K_{(-1)} \quad (7)$$

$$grkd = \gamma_0 + (\gamma_1 \cdot u) - (\gamma_2 . rl) \quad (8)$$

The capacity utilization rate (u) is defined as the ratio between the output level (Y) and the previous period's fixed capital as in most stock flow consistency models.

$$u = Y / K_{(-1)} \quad (9)$$

It is assumed that the profits of the firm sector are distributed to households "s", while the ratio of (1-s) is not distributed for financing their expenditures.

$$FD_f = s * F_f \quad (10)$$

$$FU_f = (1 - s) * F_f \quad (11)$$

The profitability level of the firms sector is determined by the difference between income and expenses in the current account which is included in the transaction flow matrix. The real sales of the firms constitute the income of firms sector, but then, the wages paid to the household, the taxes that the government sector is obliged to pay and the interest payments of the loans obtained from the banking sector constitute the expense of this sector. Ff refers to the profits of the firm sector, Y - output level, Tf - taxes paid to the government sector, WBd - fees paid to the household sector, rl(-1) Lf(-1) - refers to the interest expense paid to the domestic loans obtained from the banking sector.

$$F_f = Y - T_f - WB_d - rl_{(-1)} . L_{f(-1)} \quad (12)$$

The wage paid by the firms sector to households (WB_d) is expressed as a ratio of the output level. The wage supply level (WB_s) and the wage demand level (WB_d) are equal.

$$WB_d = Y/(1 + w) \quad (13)$$

$$WB_s = WB_d \quad (14)$$

It is assumed that the taxes paid by the firm sector to the government sector are realized as a ratio (δ) of the output level as in OECD data.

$$T_f = \delta . Y \quad (15)$$

The firms sector goes to borrowing loans to finance their investments which cannot be financed by undistributed profits. The loan demand of the firms depends on the previous period's debt stock, the repayment of the loan and the new borrowing of the firm sector. In fact, as stated in (17), the difference between the previous period and the current period debt stock is realized by the repayment of the debt and the new borrowing.

$$L_f = L_{f(-1)} - dr - NL \quad (16)$$

$$\Delta L_f = -dr - NL \quad (17)$$

The new borrowing of the firms sector (NL) is defined as firm profits (F_f) minus distributed firm profits (FD_f) and minus investment demand as follows:

$$NL = F_f - FD_f - I_d \quad (18)$$

The difference between the firms sector profits (F_f) and the profits distributed to the households (FD_f) is equal to the undistributed profits. Considering this definition, the equation (14) is rewritten as follows:

$$NL = FU_f - I_d \quad (19)$$

The firm's loan demand is defined as follows in the capital account of the firm sector. The ΔL_d represents the loan demand. To summarize, the equation (20) represents the firm's loan demand. It is assumed that the loans stock (ΔL_d) demanded by the firms sector and the loans stock (ΔL_s) supplied by the banking sector are equal. The firms are financing their investments by loans obtained from the domestic banking sector or loans obtained from the external sector, or financing by undistributed profits, or issue bills as in stock flow consistency models. The firm finances its investments by undistributed profits, domestic loans and issue bills (see Caverzasi and Godin (2015)). The firms also finance their investments by the undistributed profits, issue of bills, and issue of corporate bonds (Le Heron and Mouakil, 2008). The firms finance their investment by undisturbed profits and domestic loans in this model.

$$\Delta L_d = I_d - FU_f \quad (20)$$

$$\Delta L_d = \Delta L_s \quad (21)$$

Household's disposable income is equal to what they earn in terms of wages, profits, and interests, minus what they pay as tax to the government sector.

$$YD = WB_s + FD_f + FD_b + rm_{(-1)}.M_{h(-1)} + rb_{(-1)}.B_{h(-1)} - T_h \quad (22)$$

In the model, it is assumed that the taxes that households have paid to the government were collected on the disposable income of households.

$$T_h = \theta(WB_s + FD_f + FD_b + rm_{(-1)}.M_{h(-1)} + rb_{(-1)}.B_{h(-1)}) \quad (23)$$

As stated in the balance sheet matrix, the household's net wealth (V) consists of deposits (M_h) and treasury bills (B_h).

$$V = M_h + B_h \quad (24)$$

Household savings or changes in wealth are equal to the difference between disposable income and consumption expenditures. This equality is important in terms of demonstrating the consistency and relationship between stocks and flows.

$$\Delta V = (YD - C) \quad (25)$$

The consumption function of households is defined as a function of disposable income and real wealth level. α_1 refers to households' marginal propensity of consumption related to income, α_2 refers to propensity to consume related to networth.

$$C = \alpha_1 YD + \alpha_2 V_{(-1)} \quad (26)$$

It is assumed that households hold deposits and treasury bills as stated above. Households' demand for these financial assets is based on the interest yields of these assets, as in Tobin (1969) and Godley and Lavoie (2007).

V_{fma} represents the wealth of financial market assets; m_h refers to deposits held by households, B_h refers to the treasury bills held by the household, rm refers to the deposit interest rate, rb refers to the treasury bills interest rate. Asset demand functions subject to portfolio preferences of households are as follows:

$$\frac{M_h}{V_{fma}} = \lambda 10 + \lambda 11\, rm + \lambda 12\, rb + \lambda 13(\frac{YD}{V_{fma}}) \quad (27)$$

$$\frac{B_h}{V_{fma}} = \lambda 20 + \lambda 21\, rm + \lambda 22\, rb + \lambda 23\,(\frac{YD}{V_{fma}}) \quad (28)$$

It states that households hold a deposit at the rate of λ_{10} and they hold treasury bills at the rate of λ_{10} in their wealth. The sum of λ_{10} and λ_{20} is equal to one. Because households decide to hold deposits at a certain rate of net wealth, they will hold bonds by the remaining wealth.

$$\lambda 10 + \lambda 20 = 1 \quad (29)$$

If there is an increase in deposit rates, this will result in a large proportion of households' deposits, which will have to reduce the amount of bonds held by the household at the same rate. The same applies to the response to an increase in bond interest rates. Therefore, the sum of the coefficients subject to portfolio equality is equal to zero. It is called "adding up constraint" by Tobin (1969). (for detailed information, see Tobin 1969, Godley ve Lavoie (2007), ch:5)

$$\lambda 11 + \lambda 21 = 0 \quad (30)$$

$$\lambda 12 + \lambda 22 = 0 \quad (31)$$

Deposit supply to household by banking sector is equal to deposit demand by household within stock flow consistency framework. In other words, the amount of banking sector deposits (M) is equal to the amount of deposits held by households (M_h).

$$M_s = M_d \quad (33)$$

$$M = M_h \quad (34)$$

Similarly, domestic loans supply to firms sector is equal to domestic loans demand by firms sector. Foreign loans demand by banking sector is equal to foreign loan supply from rest of the world.

$$L_1 = L_f \quad (35)$$

$$L_{2s} = L_{2bd} \quad (36)$$

The profitability level of banking sector is equal to what they receive in terms of the interest income from loans and bills minus what they pay in terms of deposit interest expense to household and interest on foreign loans to the rest of the world.

$$F_b = rl_{(-1)}.L_{1(-1)} + rb_{(-1)}.B_{b(-1)} - rm_{(-1)}.M_{(-1)} - rl2_{(-1)}.L_{2bd(-1)} \quad (37)$$

It is clearly seen from transaction flow matrix that the banking sector distributes some of its profits to households while the remaining part is in the capital account. There are different assumptions regarding the evaluation of the undistributed banks profits in stock flow consistent models. Benzemer (2010), Pedrosa and Silva (2016) did not give banking sector profit in any of their models, Van Treeck (2008) and Lainà (2015) assumed that the banking sector distributed

their profits completely to the households, Kinsella, Greiff and Nell (2011) assumed that the banking sector distributed their profits completely to the firms sector. Godley and Lavoie (2007, p. 402) and Papadimitrou and Zezza (2012) stated that banks should set aside their undistributed profits to increase their own funds as expressed in equation (38).

$$FU_b = F_b - FD_b \quad (38)$$

The demand of the treasury bills of the banking sector is determined from the balance sheet matrix as in (39). In addition, while the banking sector collects funds with deposits and foreign debt, some of them receive bills and the rest is given as domestic loans to the domestic market.

$$B_b = M_s + L_{2bd} - L_1 \quad (39)$$

The government sector collects taxes from households and firms as expressed in the transaction flow matrix. The government sector borrowing is realized by issuing treasury bills to the domestic market. The difference between government sector expenditures (G) and earnings ($rb_{(-1)}.B_{s(-1)}$) constitutes the public sector borrowing requirement (psbr). The government sector deficits (def_{gov}) are modelled as a negative sign of public sector borrowing requirement.

$$PSBR = (G + rb_{(-1)}.B_{s(-1)}) - (T) \quad (40)$$

$$def_{gov} = -(PSBR) \quad (41)$$

It is assumed that the government covers its borrowing requirements by issuing new treasury bills.

$$\Delta B_s = PSBR \quad (42)$$

The government sector issues bills to cover domestic demand as stated above. It is assumed that the government sector supplies treasury bills to the household (B_h), to the banking sector (B_b) and to the rest of the world (B_{row})

$$B_s = B_h + B_b \quad (43)$$

Tax revenues of governmet sector (T) consists of tax totals paid by household (T_h) and firm (T_f) sectors.

$$T = T_h + T_f \quad (44)$$

The government sector's wealth (V_{gov}) is associated with government deficits and defined as follows:

$$V_{gov} = V_{gov} - def_{gov} \quad (45)$$

The equations related to the rest of the world sector are based on Godley and Lavoie (2007, chapter 6) and Detzer (2016). The two important factors affecting the import demand are the income level and propensity to import in domestic markets. The import demand function depends on the income level and propensity to import as follows:

$$Im = \mu.Y \quad (46)$$

$$Im_{row} = \mu_{row}.Y_{row} \quad (47)$$

$$\mu = \mu_{row} \quad (48)$$

Im refers to imports from rest of the world, μ refers to propensity to import. Im_{row} refers to imports from domestic market to rest of the world, μrow propensity to import of rest of the world sector. Domestic propensity to import is assumed to be equal to foreign propensity to import. Export is considered as exogen as in most Keynesian macroeconomic models.

The volume of imports into the external sector by the national economy determines the export volume (Ex_{row}) of the external sector. The volume of exports to the external sector determines the import volume of the foreign sector.

$$EX_{row} = Im \quad (49)$$

$$IM_{row} = Ex \quad (50)$$

The balance of payments (BOP) is equal to current account balance (CAB) plus capital account balance (KAB) under the assumption that there are no net errors and omissions and reserve accounts. The current account balance is equal to the difference between the trade balance and the net current transfers. It is assumed that the banking sector loans demand from the rest of the world sector for financing the current account deficit at this stage. The net wealth of the rest of world sector is associated with the current account balance.

$$CAB = Ex - Im - rl2_{(-1)} . L_{2(-1)} - rb_{(-1)} . B_{row(-1)} \quad (51)$$

$$CAB + KAB = 0 \quad (52)$$

$$V_{row} = V_{row(-1)} - CAB \quad (53)$$

The foreign loans stock (ΔL_2) and treasury bills stock (ΔB_{row}), as easily understood from the transaction flow matrix, is defined as follows:

$$\Delta L_2 + \Delta B_{row} = -(CAB) = KAB \quad (54)$$

(54) is written in a clear expression (55);

$$L_2 - L_{2(-1)} + B_{row} - B_{row(-1)} = Im + rl2_{(-1)} . L_{2(-1)} + rb_{(-1)} . B_{row(-1)} - Ex$$

The new loan borrowing demanded by the banking sector from rest of the world (ΔL_2) and treasury bills issued by government sector to rest of the world (ΔB_{row}) is edited and finalized as follows:

$$\Delta L_2 + \Delta B_{row} = Im + rl2_{(-1)} . L_{2(-1)} + rb_{(-1)} . B_{row(-1)} - Ex \quad (56)$$

Lastly, domestic loan rate (rl) is defined as function of foreign loan rates (rl_2) and risk premium (rp), which is the starting point of the model simulation, and it is assumed that a change in the foreign loans rate also affects domestic loan rates:

$$rl = rl2 + rb + rp \quad (57)$$

Discussion and conclusions

A stock flow consistency model has been established for developing countries with a new approach based on stocks and flows over the period 2006-2018. The change and transformation experienced in the financing policy of the current account deficit of developing countries are analyzed with the help of stock flow consistency

model. The model reveals the effects of changes in interest rate and exogenous variables on selected macroeconomic variables.

The model consists of 54 equations. The national income, fixed capital, investment demand, domestic credit stock demand, capital accumulation rate, capacity utilization rate, domestic credit interest rate, firm profits, wage supply and demand, household and firms tax payments, disposable income, household net wealth stock, consumption portfolio decisions of households, deposit supply, banking sector profits, treasury bills held by the banking sector, public sector borrowing requirement, treasury bills supply, government tax revenues, government sector wealth, imports, imports of foreign sector, foreign debt stock, current account balance and foreign sector wealth are endogenous variables in model DC. The volume of export, government expenditures, deposit interest rate, treasury bills interest rate, foreign loan interest rate and risk premium are assumed to be exogenous. The endogeneity of most variables is another contribution to the stock flow consistency approach. This model is expandable by adding exchange rate and running simulation.

The assets and liabilities of the real and financial sectors are defined by exogenous variables in order to consistently analyze the adjustment mechanism and financial integration. Having a comprehensive accounting framework of stock flow consistency, revealing the decision-making process of households, firms, banking sector, public sector and outer sector by behavioural equations and revealing the effects of the changes in the real and financial structures of these sectors on the economic system through simulations makes stock flow consistency models interesting.

Foreign borrowing and foreign direct investment have an important role in financing the current account deficit. Bayar and Sasmaz (2019) show that external borrowing has a negative impact on economic growth in Croatia, Czech Republic, Estonia and Latvia, but has a positive impact on the Lithuanian economy. The low cost of borrowing of the private sector, in other words, the low cost of access to loans for financing investments leads to an economic expansion by increasing the investment expenditures of the firm sector. In addition, low-cost access to external loans and foreign capital inflow to finance the current account deficit are the main factors leading to economic recovery within the framework of the stock flow consistency model.

The fact that high interest rate borrowing leads to economic contraction is one of the prominent elements in terms of burdening both the private and public sectors. The common point of the simulation results of this model is that one of the basic dynamics of growth is low cost borrowing for developing countries.

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