Laura Barbosa de Carvalho

Current Account Imbalances and Economic Growth: A Two-Country Model with Real-Financial Linkages

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Current Account Imbalances and Economic Growth: a two-country model with real-financial linkages*

Laura Barbosa de Carvalho†

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Abstract

This paper builds a two-country stock-flow consistent model by combining a debt-led economy that emits the international reserve currency with an export-led economy. The model has two major implications. First, an initial trade deficit in the debt-led country leads to a permanent imbalance in the current account, even when the exchange rate is at parity. Second, different re-balancing mechanisms, namely a currency depreciation or the reduction of the propensity to import in the debt-led country, and the increase in the propensity to consume in the export-led country, are shown to reduce both countries' rate of economic growth in the medium-run. The conclusion is that in order to combine higher global economic growth with the long-run stability of the system, deeper changes must take place.

Keywords: Stock-flow consistency, two-country model, debt-led consumption, global imbalances, international reserves.

JEL Classification: E12, E17, F32, F43.

1 Introduction

In the aftermath of the 2008-09 crisis, renewed attention has been directed to the accumulation and persistence of current account imbalances between countries and to the large role played by the US trade deficit in such processes since the 1980s. Although several economists had been concerned about the long-run sustainability of this trend before 2008 (Godley, 1999; Davidson, 2006), the

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†Assistant Professor at the São Paulo School of Economics (EESP) at Fundação Getúlio Vargas (FGV). E-mail address for correspondence: decarvalho.laura@gmail.com

large focus in the current international debate on the need for "re-balancing" trade (or current accounts) can be associated with the crisis, in two ways.

First, different approaches include the increasing current account deficit among the factors leading to the breakdown of the US economy (directly or indirectly), so that re-balancing could be seen as a requirement to achieve long-run stability in the system. Second, as described by Joan Robinson (1966), in a context of a fall in world employment and world international trade, each country is tempted to try to save for itself a larger share in the shrunken total of world activity by means of one another, so that surplus countries are blamed for exporting their own unemployment to the rest of the world. Given its immediate character, one could easily argue that it is for the latter reason that countries are currently engaging not only in unilateral attempts to avoid the appreciation of their currency (via loose monetary policy, capital controls or direct interventions in the market), but also in coordinated efforts - mostly led by countries running a deficit - to enforce an international mechanism for re-balancing. The US proposition of a cap on current account surpluses and deficits of 4% of GDP made at the 2010 G20 meeting is the most prominent example of the latter.

Even if it is recognized that the increase in current account deficits may be unsustainable in the long-run, this paper aims to shed more light on the other motivations for re-balancing, meaning, its potential benefit for deficit countries (and eventually for world effective demand) in the short and medium-run. The concept of re-balancing used hereafter is the same as in Joan Robinson (1966)[1], namely that of bringing the current account deficit to zero without a fall in economic activity. The main motivation for this study is the observation that while accumulating substantial current account deficits in the 1980s and 1990s, the US economy has managed to achieve relatively high growth rates fostered by low interest rates and debt-led consumption. It will be argued that the conditions for combining high economic growth with high current account deficits are created when a debt-led economy that emits an international reserve currency runs a trade deficit with an export-led economy that accumulates international reserves (in what has been called the "revived Bretton Woods system" by authors such as Dooley et al. (2002)). The possibility that, in this particular context, re-balancing the current account may not benefit any of the two countries or the world effective demand needs further investigation. It will be argued that it is not enough to consider the direct positive effect of an increase in net exports on a country's national income and on its level of employment. The possible dynamic interaction between changes in the current account, international cap-

[1] As the phrase 'fundamental disequilibrium' figured in the Bretton Woods final act, Joan Robinson (1966) searched for which concept of equilibrium was actually being sought by the system. Equilibrium in the balance of payments (between current account and capital movements), she argues, would be of importance only in connection with the monetary position of the countries (their international reserves), but could not be the criterion of interest. When it comes to the trade balance or the current account, there would not be a unique position of equilibrium, for the amount of imports depend upon the level of activity in each country. With that in mind, she concludes that the fundamental equilibrium aimed by the Bretton Woods system is a position in which the balance in the current account is established without a fall in employment.

ital movements and the domestic components of effective demand, as well as repercussions between the two countries via trade, must be taken into account if one wants to assess the impact of re-balancing.

Many theoretical and empirical studies focus on the factors leading to the emergence and persistence of current account imbalances in the United States and other countries, each of them implying different solutions and mechanisms for re-balancing. In the recent debate, more conventional explanations highlight current account factors. These arguments are primarily distinguished between those that give weight to demand effects, and those that attribute to prices (usually to its rigidity) the major role of preventing imbalances from being corrected over time. The economic policy debate seems to favor the second view when it blames the overvaluation of the exchange rate and the lack of business competitiveness for the accumulation of current account deficits.

An alternative view, argued at length by Ben Bernanke (2005), considers the capital account as the primary driver of imbalances between US and China. According to Bernanke, a global savings glut caused by savers in China exceeds available investment opportunities and are injected into the US, resulting in a fall in US long-term interest rates (as determined in the market for loanable funds), asset price inflation and excess consumption, thus perpetuating current account imbalances. The solution to the problem would involve an increase in consumption in China. Another set of arguments, also based on the financial dimension of global imbalances, focus on the role of the US dollar as reserve currency and suggest solutions based on a new global reserve currency or asset (see for instance Bibow (2008) or the original work of Triffin (1960)). Palley (2011) critiques the two views by providing empirical evidence in support of the role of corporate globalization, as well as that of interests behind a strong dollar policy to sustain living standards in the US, as the major drivers of imbalances. When it comes to the savings glut hypothesis in particular, he argues that the attempt to explain the US trade deficit as the product of distorted interest rates makes no sense, in particular, for its inconsistency with the fact that the trade deficit had been increasing for twenty years.

This paper builds on the idea that the separation between current and capital account factors may be useful for accounting purposes, but does not help understand the underpinnings of the accumulation of global imbalances over time and its linkages with the real economy. Such distinction has been criticized by Blecker (2003) in connection with the divide between international trade and international finance, which itself gained force based on the idea of money neutrality. Moreover, the paper takes the structuralist view that the way current account imbalances are accumulated, as well as the impact of the adoption of different re-balancing mechanisms, depends on the particular structure of the economy, as represented by different closures imposed to an accounting system.

The stock-flow consistent (SFC) model in Section 3 is inspired by empirical evidence on both the domestic and the balance of payments dimension of the US current account deficit with China, as presented in Section 2. It does so by attributing a crucial role to real-financial linkages in the process of accumulation of current account imbalances between a debt-led country issuing

	USA	Rest of the World
1. Goods and Services	+A	-A
2. Interest and Dividends	0	0
3. Unilateral Transfers	-C	+C
Current account (1+2+3)	+D	-D
4. Long-term investments	-E	+E
5. Short-term capital and changes in reserves	+F	-F
Capital account and changes in reserves (4+5)	-D	+D
1+2+3+4+5	0	0

Table 1: Schematic of the balance of payments of the US around 1950's

the international reserve currency and an export-led economy that accumulates international reserves in the form of government bonds. The model is based on generally Keynesian closures, namely the principle of effective demand and a mechanism for interest rate determination in the market for stocks of bonds, rather than in a market for loanable funds (which is the basis of the global savings glut hypothesis).

Different re-balancing mechanisms are then introduced in the simulations in Section 4, so as to assess their effectiveness in both correcting the imbalance, and in generating higher levels of economic activity in both countries. The results suggest that a debt-led economy, such as the one analyzed in the model, may be able to grow more with a current account imbalance than otherwise, thus bringing the current account balance to zero may harm economic growth in both countries.

2 Empirical motivation

The charts in Figures 1 and 2 present the different components and accounting counterparts of the accumulation of a current account deficit in the United States since 1980. In short, the two figures present the evolution of (aggregate and bilateral) international capital flows to the US and other balance of payments items, as well as net borrowing flows of the US private sector and its different components. Data on National Income and Product Accounts (NIPA) and on US International Transactions from the Bureau of Economic Analysis (BEA) were combined to produce the different charts.[2]

[2]The different items of the balance of payments were added and brought to domestic currency to obtain net flows in trade and services, unilateral transfers and income payments (the sum of which gives the current account balance), in addition to foreign direct investment (NLI), short-term capital (NSC) and changes in reserves, all as a percentage of GDP. The series of private net borrowing as a % of GDP was obtained as a residual from foreign net borrowing (current account balance) and government net borrowing flows (1990-2008). Finally, the share of private income in GDP was obtained by subtracting from the share of private net borrowing, the flows of private investment and consumption as a share of GDP. One could further decompose private income in profits and wages (or business and household's income), but the effects of distribution within the private sector are beyond the scope of this paper.

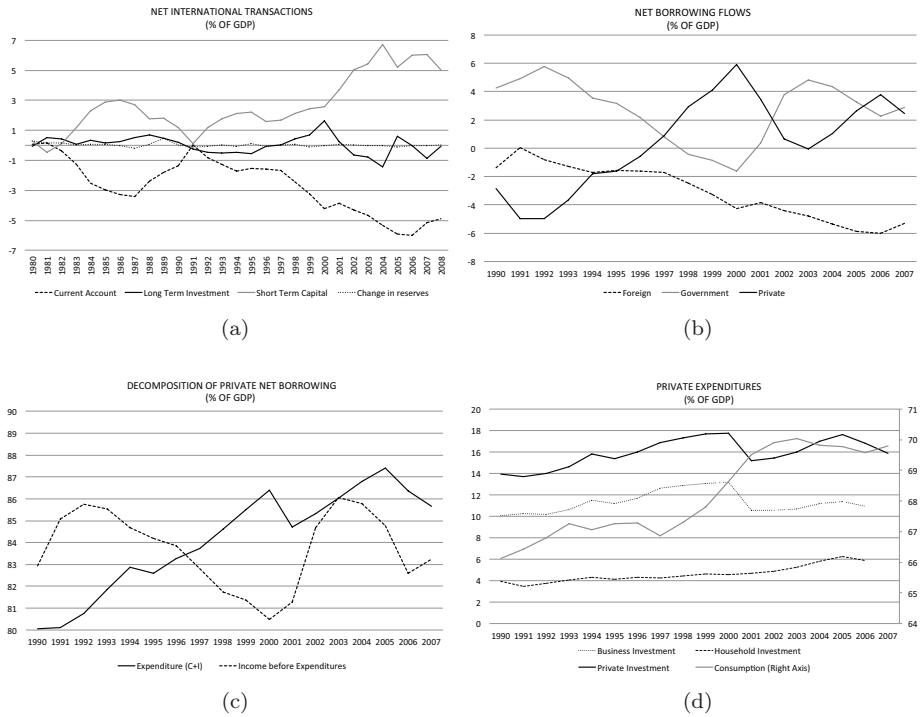


Figure 1: Net international transactions and net borrowing flows in the United States (1980-2008)

In a simple and clear exposition of the changes in the structure of the balance of payments in the US after World War II, Minsky (1983) aggregates the items in the current and capital accounts and shows how the United States' position in the global economy has shifted from one based on surplus in trade and services and deficit in long-term investment (Foreign Direct Investment) to one in which the increasing current account deficit is basically offset by positive net flows of short-term capital (in portfolio investment). A positive sign in Table 1 denotes that inflows are larger than outflows for that particular transaction. In an expression of the so-called Triffin dilemma (named after Triffin (1960)), the position of the US as a long-term investor abroad in the post-war period has generated an increase in net factor income (interest and dividends) from the rest of the world over time, so that only the switch from a trade surplus into a trade deficit has prevented the US current account from increasing exponentially its balance of payments (see Taylor (2010) for a historical description of these changes).

Figure 1 (a) shows the evolution of net international flows in the US economy from 1980 to 2008 as a share of world GDP. It is clear how the US position has changed as compared to the schematic presented in Table 1. The increase in the

US trade deficit reduced the current account balance from zero in 1990 to minus 6% in 2006, with net capital flows into the US increasing substantially, mainly in the form of short-term capital (defined here as portfolio investment). D' Arista and Ertuk (2010) argue that the increase in capital inflows to the US and the reduction of US long-term investment abroad after financial liberalization helped generate a credit boom in the US economy, which converted into higher net borrowing from the private sector and a higher trade deficit.

Figure 1 (b) presents the evolution of net borrowing flows of the private sector, the government and the rest of the world in the US as a share of GDP. As highlighted in Barbosa-Filho et al. (2008), since the early 1980s there was a strong correlation in the trends of household and foreign net borrowing (the current account deficit).[3] Moreover, the decomposition of private net borrowing in expenditures (consumption and investment) and disposable income (or income before expenditures) shown in Figure 1 (c) shows that the increase in net borrowing is mainly due to an increase in expenditure relative to disposable income in the private sector, and more precisely to the increase in consumption (see the further decomposition in 1 (d)).

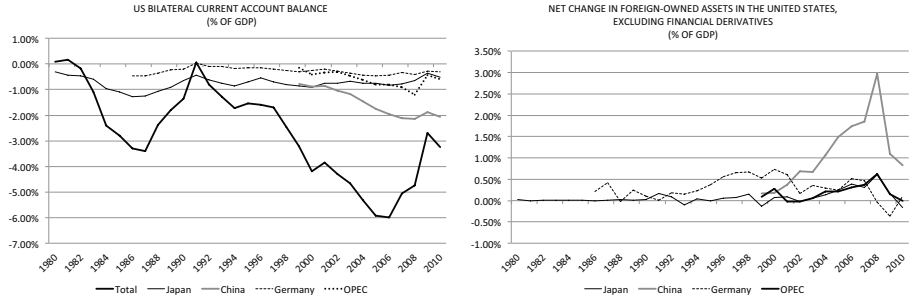
In short, the four charts in Figure 1 suggest that the accumulation of current account deficits in the US came with both an increase in short-term capital flows from abroad and in debt-led consumption by the domestic private sector. In this context, the two charts in Figure 2 show the importance of China in explaining the current account deficit in the US as an additional motivation for the model built in this section.

Figure 2 (a) shows the US current account balance with its major trade partners for available data from 1980 to 2010. OPEC oil exporting countries and China have been the major source of the increase in the US trade deficit with the rest of the world since 2000. The other side of the coin can be observed in Figure 2 (b). China's net increase in the holding of US assets reached 3% of US GDP in 2008, and fell after the crisis. The quantity of these holdings in the form of US Treasury securities is unknown due to the lack of data availability, but it is widely agreed that most of the US current account deficit has been financed by official, as opposed to private, capital inflows. According to Ferguson and Schularick (2007), China's international reserves increased by almost $200 billion a year in the past five years, of which around 70-80% is in dollar-denominated government debt. Given these estimations, China would be holding more than 10% of the total stock of US Treasury debt in 2007.

The relationship between the accumulation of current account imbalances and economic growth has been the subject to theoretical and empirical debate[4].

[3] These results contradict the "twin deficits" hypothesis, according to which the fiscal deficit largely explains the current account deficit.

[4] By applying different econometric techniques, Prasad et al. (2007) find a positive correlation between current account balance (as a share of GDP) and growth for a sample of nonindustrial countries, especially at negative values of the current account. This finding goes in contrast with orthodox theories that predict a positive effect of foreign capital on growth in developing countries. Interestingly, the authors find the opposite results for industrial countries: those who rely more on foreign capital (lower current account balance) are likely to grow faster. One of the explanations supported by their econometric study is that in underdevel-



(a) (b)

Figure 2: US bilateral net international flows (1980-2010)

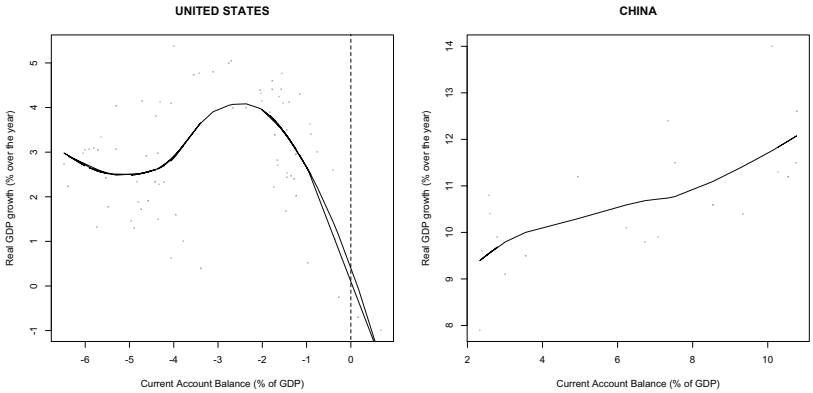
Non-parametric estimations [5] of the relationship between real GDP growth (over a year) and current account balance as a share of GDP in US and China are presented in the scatter plots on Figure 3, with points representing actual observations and the two lines given by the lowess estimations. While an increase in the current account balance seems to have been beneficial overall for economic growth in China, the relationship between the two variables appears to be non-linear in the US. An increase in the current account balance has been associated with lower GDP growth in a wide region of the graph (when the current account deficit is smaller than 2% of GDP). This observation seems to imply that the reaction of economic growth to an attempt to re-balance the current account is asymmetric between countries and may also depend on initial values.

3 The model

As in Godley and Lavoie (2007) and Taylor (2004), each country will be composed of three sectors: a private sector including both households and production firms, a banking sector consolidating commercial banks and the Central Bank, and a government sector. This baseline model does not include the shadow banking system, which had a crucial role in securitization of mortgages in the lead up to the 2008 crisis (see Mehrling (2010)). The generation of a housing bubble holds particular relevance for the phenomenon in question,

oped countries, foreign capital inflows cause overvaluation of the real exchange rate, reducing manufacturing exports and the profitability of investment and therefore slowing down growth.

[5] The estimations were based on quarterly data available for the period between the first quarter of 1990 and the second quarter of 2008 for the United States. Due to constraints in the availability of quarterly data, the estimations for China used a smaller time frame (2003-2008). The non-parametric estimations (local weighted regressions using Real GDP growth as dependent, and the share of the current account balance in GDP as the independent variable) were ran in R based on the *loess* function with a smoothing parameter of 0.5 (as described in http://stat.ethz.ch/R-manual/R-patched/library/stats/html/loess.html). The data were extracted from each country's national statistical office via Bloomberg®.



(a) (b)

Figure 3: Non-parametric estimations of the relationship between current account balance and economic growth (1990-2008)

since housing prices are the major source of capital gains in households' balance sheets and seem to have had a large impact on debt-led consumption in the US (see Taylor (2010)). However, the focus of the model is constrained to the potentially unstable feedback between reserve accumulation in the export-led country in the form of safe assets, and private expenditure in the debt-led country in the context of trade and financial liberalization.

The two-country model is detailed in the following sub-sections. Prices of goods in both countries are assumed not to change and are therefore normalized to one.

3.1 Home: a debt-led economy

3.1.1 Private Sector

The balance sheet of the Home private sector is presented in Table 2 below. For simplification, the private sector does not hold any tangible capital, so that capital accumulation is excluded from the model. Total assets are therefore given by the stocks of money M, bills B and long-term government bonds BL which are priced by the financial market at P_{BL}. The difference between the total value of assets and the stock of debt D gives the private sector's net wealth (or net worth) Ω.

The following equations define the private sector's disposable income, gross and net wealth, and consumption decision:

$$YD_t = Y_t + r_{t-1}B_{p\{t-1\}} + BL_{p\{t-1\}} - [T_t + (r_{t-1} + \delta)D_{t-1}] \qquad (1)$$

Assets	Liabilities
M	D
B_p	
$P_{BL}BL_p$	Ω_p

Table 2: Home Private Sector's balance sheet

$$W_p = \Omega_p + D = M + B_p + P_{BL}BL_p \tag{2}$$

$$\Omega_{p\{t\}} = \Omega_{p\{t-1\}} + YD_t + \dot{P}_{BL}BL_{p\{t-1\}} - C_t - \dot{D} \tag{3}$$

$$C_t = c_0 YD_t + c_1 W_{p\{t-1\}} \tag{4}$$

Equation (1) defines the private sector's disposable income, as GDP, less income tax T_t, plus interest income derived from previously held bills $B_{p\{t-1\}}$ and long-term bonds $BL_{p\{t-1\}}$, minus the amount of interest payments $r_{t-1}D_{t-1}$ and principal repayment δD_{t-1} of debt. Note that the absence of a rate of interest multiplying $BL_{p\{t-1\}}$ in (1) is due to the reciprocal relationship between the interest rate on long-term bonds r_{BL} and its price:

$$r_{BL} = \frac{1}{P_{BL}} \tag{5}$$

The gross wealth W_p of the private sector (or its total value of assets) is defined in (2), with the net worth Ω_p obtained by excluding the stock of debt D from W_p. The net worth of the private sector as expressed in equation (3) increases when disposable income and capital gains[6] arising from changes in prices of long-term bonds held in the end of the previous period ($\dot{P}_{BL}BL_{t-1}$), exceed consumption C_t, and the change in debt. The expected net worth Ω_p^e will be defined the same way, with expected changes in the price of long-term bonds replacing actual capital gains.

As expressed in equation (4), the private sector at Home is assumed to consume based on its disposable income and its gross wealth, with c_0 and c_1 denoting the corresponding marginal propensities to consume. The inclusion of gross wealth instead of the private sector's net worth in the consumption function is motivated by the idea that consumption at Home has a debt-led component.

The leverage ratio of the private sector is then defined by:

$$L_p = \frac{M + B_p + P_{BL}BL_p}{\Omega_p} = \frac{1}{1 - \frac{D}{M+B_p+P_{BL}BL_p}}$$

[6]The sum of disposable income as defined in equation(1) and capital gains gives the so-called Haig-Simons definition of disposable income (Haig (1921); Simons (1938)).

Assets	Liabilities
	B
	$P_{BL}BL$
	Ω_G

Table 3: Home Government Sector's balance sheet

The private sector chooses how to allocate its wealth between money, bills and long-term bonds according to a portfolio balance equation as laid out in Tobin (1969). The idea is that the only way to increase the proportion of the expected net worth held in one particular asset is by reducing the share in one or more of the other assets. It is further assumed that the private sector does not know the future change in the price of long-term bonds, which is determined in the financial market, at the moment it makes its allocation decisions. The way expectations on the prices of bonds and wealth are formed will be described further below. Equations (6), (7) and (8) represent the private sector's demand (superscript d) for bills, long-term bonds and high powered money, respectively, based on its expected wealth and on the rates of return on each asset.

$$B_p^d = \Omega_p^e \left[\lambda_{10} + \lambda_{11} r + \lambda_{12}(r_{BL} + \dot{P}_{BL}^e)\right] \tag{6}$$

$$P_{BL}.BL_p^d = \Omega_p^e \left[\lambda_{20} + \lambda_{21} r + \lambda_{22}(r_{BL} + \dot{P}_{BL}^e)\right] \tag{7}$$

$$M_d = \Omega_p^e \left[\lambda_{30} + \lambda_{31} r + \lambda_{32}(r_{BL} + \dot{P}_{BL}^e)\right] \tag{8}$$

The three equations above can be written in matrix form as:

$$\begin{bmatrix} B_p^d \\ P_{BL}BL_p^d \\ M^d \end{bmatrix} = \begin{bmatrix} \lambda_{10} \\ \lambda_{20} \\ \lambda_{30} \end{bmatrix} \Omega_p^e + \begin{bmatrix} \lambda_{11} & \lambda_{12} & \lambda_{13} \\ \lambda_{21} & \lambda_{22} & \lambda_{23} \\ \lambda_{31} & \lambda_{32} & \lambda_{33} \end{bmatrix} \begin{bmatrix} r \\ r_{BL} + \dot{P}_{BL}^e \\ 0 \end{bmatrix} \Omega_p^e$$

As described in Godley and Lavoie (2007, p. 143-47), the vertical Brainard-Tobin adding-up constraints imply that $\sum_m \lambda_{m0} = 1$ and $\sum_m \lambda_{mn} = 0$ for $m, n = 1, 2, 3$. Moreover, the symmetry constraints associated with Friedman (1978) imply that $\lambda_{12} = \lambda_{21}$, $\lambda_{13} = \lambda_{31}$ and $\lambda_{23} = \lambda_{32}$, so that assets are treated as gross substitutes. Only the coefficients on the own rates of return in each equation (diagonal values in the 3x3 matrix) are positive.

It will be further assumed that money holdings perform the role of the buffer asset, so that $M^d = V_p - B_p^d - P_{BL}BL_p^d$.

3.1.2 Government

The government sector's balance sheet as given in Table 3, shows that it issues bills and long-term bonds.

The following equations define the role of the government sector at Home.

$$T_t = \theta Y D_t \tag{9}$$

$$G_t = \bar{G} \tag{10}$$

$$NB_{G\{t\}} = G_t + r_{t-1} B^s_{t-1} + BL^s_{t-1} - T_t \tag{11}$$

Equation (9) defines tax revenues as a proportion θ of private sector's disposable income. Government spending is assumed to be exogenous by simplification on equation (10). Equation (11) defines the net borrowing of the government sector as the difference between its total spending, as composed of both the discretionary part $\bar{G}$ and the interest payments on previously issued bills and long-term bonds, and its tax revenue.

The change in the supply of bills in each period will be given by the net borrowing of the government, excluding the value of the new issuance of bonds, as expressed in (12).

$$B^s = B^s_{t-1} + NB_G - P_{BL}\dot{BL}^s \tag{12}$$

Finally, the supply of bonds will be given by the reaction function expressed in (13). The government will reduce or increase the quantity of bonds supplied depending on the spread between the short-run and long-run interest rates (see Godley and Lavoie, 2007, p.169). If the spread is higher than the top of the range targeted by the government, meaning that the interest rate on bonds is much higher than the interest rate on bills, the amount of new bonds supplied by the government will be reduced. Conversely, if the spread reaches the bottom of the range, the issuance of bonds will increase, so as to push its price downwards (and interest rate upwards). This assumption has a stabilizing role, even if a change in the issuance of new bonds has a limited and delayed impact on the price of bonds, which as already highlighted, is determined in the market for total stocks (including old and new bonds).

$$BL^s = (1 - z_1\beta + z_2\beta)\, BL^s_{t-1} \tag{13}$$

$$z_1 = 1 \; iif \; spread > top$$

$$z_2 = 1 \; iif \; spread < bot$$

$$spread = r_{BL\{t-1\}} - r_{t-1}$$

Assets	Liabilities
D	M
B_b	Ω_b

Table 4: Home Banking Sector's balance sheet

3.1.3 Banking system

The balance sheet of the banking system in the US, which as already mentioned consolidates commercial banks and the Central Bank, is given in Table 4.

The money supply will be considered endogenous, so it accommodates the money demand of the private sector.

$$M^s = M^d \tag{14}$$

Change in debt is equal to the new supply of loans, excluding the amount of debt repaid by the private sector.

$$\dot{D} = L^s - \delta D_{t-1}$$

The supply of loans will be given by expression (15). Along the lines of Adrian and Shin (2010), banks will be assumed to give loans based on a set target for their leverage ratio and on the observed change in private sector's leverage (see Khalil and Kinsella (2011) for a similar specification). Hence, the higher is bank's leverage L_b relative to the target $\bar{L}$, the more loans will be supplied, whereas an increase in private sector's leverage reduces the amount of loans supplied.

$$L^s = \eta_1(L_{b\{t-1\}} - \bar{L}) - \eta_2 \dot{L}_{p\{t-1\}} \tag{15}$$

where

$$L_b = \frac{D + B_b}{\Omega_b} = \frac{1}{1 - \frac{M}{D+B_b}}$$

The amount of bills demanded by the US banking system will be given by the amount supplied (the difference between total supply of bills and the demand from the private sector).

$$B_b = B^s - B_p^d \tag{16}$$

Wealth accumulation by the banking system results from changes in its assets and liabilities, and from interest payments received from the stock of loans supplied.

$$\Omega_{b\{t\}} = \Omega_{b\{t-1\}} + \dot{D} + \dot{B}_b - \dot{M} + r_{t-1} D_{t-1}$$

Assets	Liabilities
M^*	
B_p^*	Ω_p^*

Table 5: Foreign Private Sector's balance sheet

3.2 Foreign: an export-led economy

3.2.1 Private Sector

The private sector in the Foreign country has a less complex balance sheet, as can be observed in Table 5. It holds assets in the form of high powered money M^* and bills B_p^*.

Since the Private Sector in Foreign does not accumulate any debt, its gross wealth W_p^* (or total value of assets) is equal to its net worth Ω_p^*, so that the two variables can be used interchangeably. The following equations describe the behavior of the private sector. Equation (17) gives its disposable income as the sum of GDP and the income from bills, minus the amount of income taxes paid. The change in private wealth as represented in (18) is only given by the difference between disposable income and consumption (no capital gains). Equation (19) shows the consumption function for Foreign, with c_0^* and c_1^* the propensity to consume out of disposable income and past wealth (or net worth), respectively[7].

$$YD_t^* = Y_t^* + r_{t-1}^* B_{p\{t-1\}}^* - T_t^* \tag{17}$$

$$\Omega_{p\{t\}}^* = \Omega_{p\{t-1\}}^* + YD_t^* - C_t^* \tag{18}$$

$$C_t^* = c_0^* YD_t^* + c_1^* \Omega_{p\{t-1\}}^* \tag{19}$$

As in Home case, the allocation of wealth by the private sector in Foreign will be given by the following portfolio balance equations (in matrix form), where the demand for money is taken as the residual and analogous vertical and symmetric constraints apply.

$$\begin{bmatrix} B_p^{*d} \\ M^* \end{bmatrix} = \begin{bmatrix} \lambda_{40} \\ \lambda_{50} \end{bmatrix} \Omega_p^* + \begin{bmatrix} \lambda_{41} & \lambda_{42} \\ \lambda_{51} & \lambda_{52} \end{bmatrix} \begin{bmatrix} r^* \\ 0 \end{bmatrix} \Omega_p^*$$

3.2.2 Government

The government sector's balance sheet is represented in Table 6.

While equations (20) and (21) are identical to equations (9) and (10) for Home, equation (22) is slightly different. Net borrowing from the government sector in Foreign is again the difference between total spending and revenue,

[7]Since the Foreign Private sector does not accumulate any debt, the wealth effect in equation (19) does not allow for debt-led consumption.

Assets	Liabilities
	B^*
	Ω^*_G

Table 6: Foreign Government Sector's balance sheet

Assets	Liabilities
B^*_b	M^*
$(1/e)P_{BL}BL^s_{ch}$	Ω^*_b

Table 7: Foreign Banking Sector's balance sheet

but the latter has two components: tax revenues and the profits transferred from the banking system (interest paid in domestic bills and on Home bonds, converted to domestic prices by the exchange rate $1/e$). The idea is that the banking system in Foreign is mostly state-owned and transfers its profits to the government.

$$T^*_t = \theta^*.YD^*_t \tag{20}$$

$$G^*_t = \bar{G^*} \tag{21}$$

$$NB^*_{G\{t\}} = G^*_t + r^*_{t-1}B^{*s}_{t-1} - \left[T^*_t + r^*_{t-1}B^*_{b\{t-1\}} + (1/e)PB^s_{ch\{t-1\}}\right] \tag{22}$$

The change in the supply of bills is equal to the net borrowing of the government, as expressed in (23):

$$\dot{B}^{*s} = B^{*s}_t - B^{*s}_{t-1} = NB^*_{G\{t\}} \tag{23}$$

3.2.3 Banking system

As represented in Table 7, the banking system in Foreign holds Foreign bills and Home bonds (converted to domestic prices) and issues money M^*, with the net worth being given by Ω^*_b.

Again, the money supply will be assumed endogenous, and will always accommodate money demand by the private sector:

$$M^{*s} = M^{*d} \tag{24}$$

The amount of Foreign bills demanded by the banking system will be given by the difference between the supply of bills, which is determined by the government net borrowing, and the demand for bills from the private sector:

$$B^{*d}_b = B^{*s} - B^*_p \tag{25}$$

3.3 National Accounting, Trade and Balance of Payments

National income in the Home and Foreign will be given, respectively, by equations (26) and (27).

$$Y = C + G + X - eIM \tag{26}$$

$$Y^* = C^* + G^* + X^* - (1/e)IM^* \tag{27}$$

where X denotes exports and IM is the level of imports expressed in foreign currency.

Additionally, as the two countries form a closed system, the two constraints below will hold:

$$IM = X^* \tag{28}$$

$$IM^* = X \tag{29}$$

The level of exports and imports will be determined as it is standard in the literature by relative prices and income. As prices are assumed constant in both countries, imports and exports will depend directly on the exchange rate (with the Marshall-Lerner conditions assumed to hold), as expressed in equations (30) and (31), which are log-linearized for convenience.

$$\ln(X) = \ln(IM^*) = \epsilon_0 + \epsilon_1 \ln(e) + \epsilon_2 \ln(Y^*) \tag{30}$$

$$\ln(IM) = \ln(X^*) = \epsilon_0^* - \epsilon_1^* \ln(e) + \epsilon_2^* \ln(Y) \tag{31}$$

The items in the balance of payments for the two countries are summarized by the equations below. Equations (32) and (33) give the current account balance in Home and Foreign, respectively, which are given by the sum of the trade deficit and net interest payments from the holding of net foreign assets. In this case, the value of Home interest payments to Foreign will be simply given by the stock of bonds held by the Chinese in the previous period, as the interest rate on bonds is the inverse of its price (see equation (5)).

$$CA = X - eIM - BL_{f\{t-1\}} \tag{32}$$

$$CA^* = X^* - (1/e)IM^* + (1/e)BL_{f\{t-1\}} \tag{33}$$

The capital account balance (including changes in reserves), which by balance of payments accounting in this setup must be equal to the current account deficit, is given by:

$$KA = P_{BL}\dot{BL}_f \tag{34}$$

$$KA^* = -(1/e)P_{BL}\dot{BL}_f \tag{35}$$

Using (32) and (34), we get the change in the value of long-term bonds purchased by the Foreign Central Bank as given by:

$$P_{BL}\dot{BL}_{ch} = eIM - X + BL_{f\{t-1\}} \tag{36}$$

or equivalently:

$$BL_{f\{t\}} = BL_{f\{t-1\}} - \frac{CA}{P_{BL}} \tag{37}$$

3.4 Closing the model

First, in order to avoid an amplification of the unstable features of the model, expectations of capital gains by the Home private sector, which determine the portfolio balance decisions, will be assumed to be zero:

$$\dot{P}^e_{BL} = 0 \tag{38}$$

Short-run interest rates are exogenously determined by the Central Banks in both countries.

$$r = \bar{r} \tag{39}$$

$$r^* = \bar{r}^* \tag{40}$$

These rates will be assumed to be equal in the model, so that capital flows do not arise due to interest rate differentials.

Finally, changes in the price of long-term bonds are determined in the market for stocks of these bonds, so as to equilibrate total demand and supply for bonds.

$$BL^d = BL^s \tag{41}$$

This equilibrium condition is equivalent to solve equation (7) for P_{BL}, with the private demand for bonds given as the residual between the total supply and the demand for bonds in Foreign.

$$P_{BL} = \frac{\Omega^e_p \left[\lambda_{20} + \lambda_{21}r + \lambda_{22}(r_{BL} + \dot{P}^e_{BL})\right] + \lambda_{24}YD^e_t}{BL^s - BL_f} \tag{42}$$

Aside from the purchase of long-term bonds, no other capital flow happens between the countries, so that demand for bonds in Foreign is given by accounting from expression (37). Even if the model does not presume a Mundell-Flemming type of determination of interest rates and exchange rates, as described in the first section, the two-country set up leaves few degrees of freedom. This implies that international reserves are fully adjusting to the current account imbalance.

In this context, as no interest rate differentials exist in the model, Foreign is assumed to succeed in pegging the exchange rate to the Home currency, so that the exchange rate regime will be fixed to $\bar{e}$.[8]

$$e = \bar{e} \tag{43}$$

4 Simulation results

The starting values for parameters and exogenous variables[9] were set as identical for the two countries whenever the behavioral equations were also analogous (see Appendix), so as to prevent an accumulation of imbalances to be generated by a difference in parameters in the model (e.g. propensity to import or to consume). Moreover, the initial value of the exchange rate in the baseline model was set to be equal to one, so that the exchange rate level cannot be an independent source of accumulation of current account imbalances. Thus, its effect on exports in both countries, as given in equations (30) and (31), is equal to zero. The two countries start with a current account imbalance corresponding to around 3.8% of each country's GDP. The amount of the initial imbalance is given in the simulation by the stock of Home bonds initially held by the Foreign Central Bank, which as expressed in (32), leads to the same value in interest payments from Home to Foreign, therefore representing a current account deficit.

Figure 4 shows the simulation results for the fictitious period from 2000 to 2020 with quarterly frequency. As observed in Figure 4 (a), the baseline current account deficit as a share of GDP decreases initially from its starting value, but only to reach 1.7% of GDP, thereby confirming the lack of a complete adjustment mechanism in the model to the current account imbalance in the medium-run. Charts (b)-(f) in Figure 4 help understand what is behind such an unstable feature, as Home bond prices and the supply of loans are increasing over the entire simulation period. An intuitive explanation goes as follows. Even though the exchange rate is set to be equal to one and the levels of income in both countries are assumed to be the same, which in a more standard setup would be enough to bring the current account deficit to zero (see for instance Godley and Lavoie, (2007, p.473)), the initial current account deficit in this case generates reserve accumulation in Foreign, which in turn contributes to raising bond prices, as shown in chart (b). Such capital gains on bonds lead both to a direct increase in the Home private sector's gross wealth, and to a reduction of its leverage ratio, causing the banks to raise the supply of loans (see chart (c)). The two channels just mentioned end up generating positive wealth effects on consumption (chart (d)), therefore acting as a force of deterioration of the current account (even if the propensity to consume out of wealth is only set to be 0.04, which is compatible with the usual empirical estimations).

[8] Foreign may for instance impose capital controls which help prevent attacks to the fixed regime by participants in the market for forward and spot rates.

[9] The E-views program is available upon request.

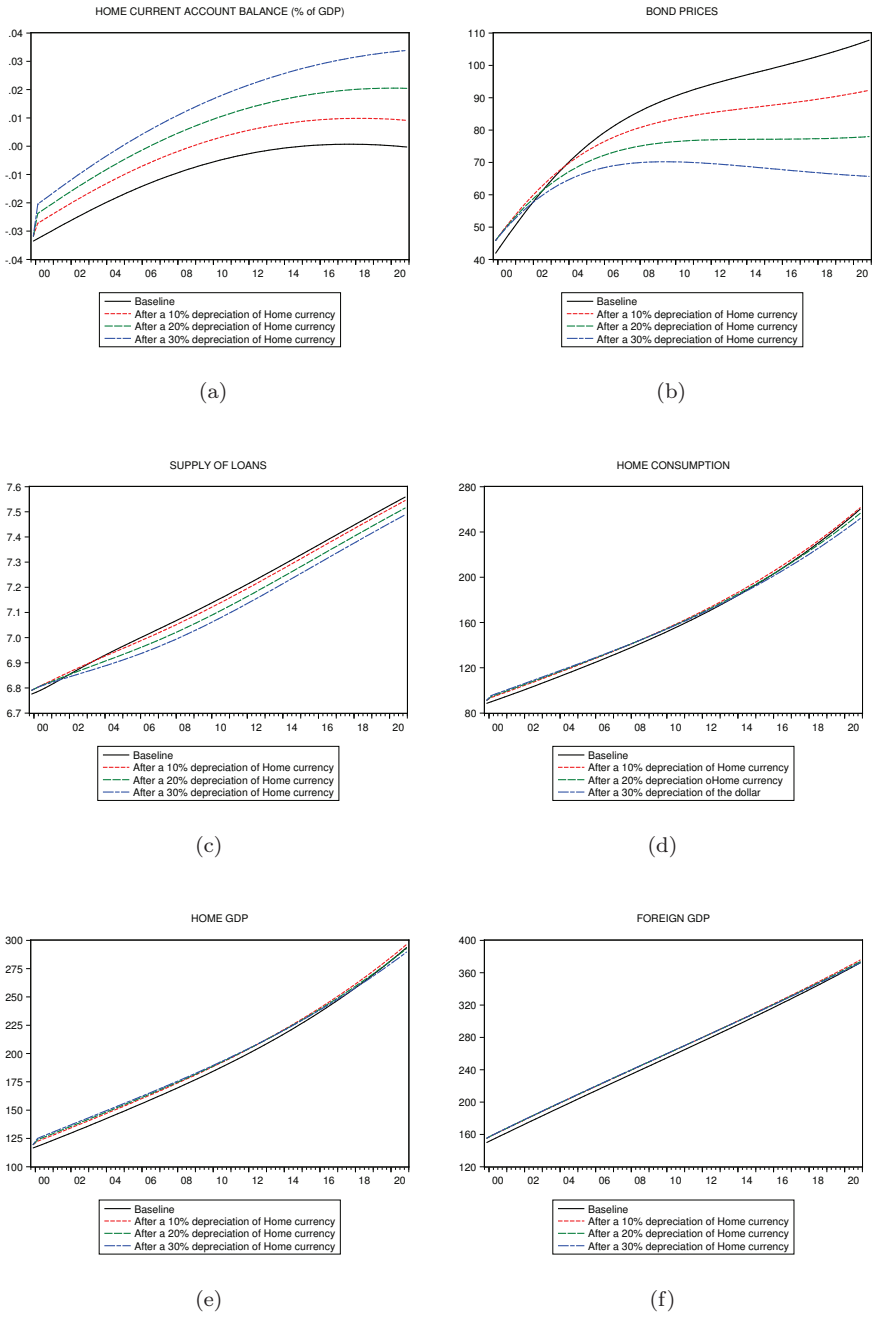


Figure 4: Baseline results and effects of a depreciation of the Home currency

This explanation is supported by the simulations following a shock on the exchange rate. A depreciation of the Home currency from 1 to 1.2 (20%) is sufficient to bring the current account balance to zero, as can be observed in Figure 4 (a). 4 (b) shows the new trajectory for the supply of loans, which is lower as compared to the baseline scenario. The price of Home bonds shown in 4 (c) also stabilizes at a lower value, so that long-term interest rates are higher in the second scenario.

Finally, the trajectories of Home GDP with and without accumulation of current account imbalances in chart (e) raise interesting conclusions and questions. The depreciated Home currency[10] leads to a higher GDP at Home for many years when compared to the baseline scenario, but the relationship is reversed in the medium to long-run as the rate of GDP growth is smaller. The simulation for consumption shows the same pattern as shown in (d), supporting the importance of wealth effects on consumption as a source of GDP growth in the case of a high current account imbalance. Foreign GDP does not show a reduction following the shock, which is probably due to the offsetting effect that the initial increase in Home GDP has on the Foreign level of exports (chart (f)). [11]

Figure 5 presents the results of a positive shock in the propensity to consume out of income in Foreign c_0^*. As observed in chart (a), an increase in the Foreign propensity to consume completely re-balances the current account in both countries for a period of 30 quarters, after which the deficit starts increasing again. What is behind such process can be made more clear when observing the trajectories of the other variables. As in the previous scenario, the increase in bond prices and in the supply of loans is much slower after the shock, as observed in charts (b) and (c). However, the magnitude of the deceleration seems to be larger than with the depreciation of the dollar, also causing Home consumption to fall below the baseline trajectory at a much earlier point in time (chart (d)). The initial increase in Home consumption can be explained again by the initial positive impact of a decrease in the trade deficit on the private sector's disposable income. After around 20 quarters, consumption starts growing less than in the baseline scenario, causing GDP to do the same about four quarters later (chart (e)).

Finally, the path taken by Foreign GDP shifts upwards following the shock due to the increase in consumption, which explains the ineffectiveness of this mechanism in re-balancing the Home current account for a long period of time, but Foreign GDP grows at a lower rate than in the baseline scenario. This can

[10] The model is intrinsically unstable, which means that the shocks to the parameters in the simulations are not applied to steady-state values of the different endogenous variables. The choice of when to introduce the shocks is somewhat arbitrary and aimed to capture the effect of re-balancing the current account in a particular point in time. Choosing different time periods for re-balancing did not change the main results.

[11] The exact same results are observed, and therefore will not be presented here, if the marginal propensity to import at Home ϵ_0^* is reduced (replacing the exchange rate as the shocked variable that re-balances the current account). This similarity highlights that eventual revaluations of international reserves in Foreign due to the depreciation of the Home currency did not play an important role in the patterns previously described.

be explained by the effect that the slower growth of Home GDP has on growth of Foreign exports. After around 40 quarters, the level of Foreign GDP is already lower than in the baseline scenario.

On the other hand, slower growth in Foreign also affects Home exports, helping explain why the Home current account balance starts deteriorating around 30 quarters after the shock. The results basically contradict Bernanke (2005)'s savings glut hypothesis, as a reduction in savings in Foreign by itself, when the interest rate is determined in the market for stocks rather than in a loanable funds market, is not enough to re-balance the current account permanently (assuming the Home debt-led growth regime as given).

Given the results of the two experiments, it becomes clear that the repercussions between the income levels of the two countries via trade are crucial for the outcome of the re-balancing mechanism introduced, as is also argued by Keynes (1980) and Robinson (1966). Moreover, given the setup of this model, these repercussions may amplify the negative impact of a reduction of the Home current account deficit on the growth rate of Home consumption and GDP, which happens via the impact on bond prices and the supply of loans.

Figures 6(a) and (b) show the ratio of Home and Foreign consumption and GDP, after the two re-balancing shocks, to the baseline. It is clear that none of the two re-balancing mechanisms is beneficial for the two countries in the medium-run. These results have two main implications, which will be further discussed as a conclusion to the paper. First, the particular type of adjustment mechanism introduced is relevant for the net effect of re-balancing the current account in each country in the short- and medium-run. Second, the particular growth regimes in the two countries upon which the current account imbalance was built is crucial for assessing the potential benefits of re-balancing the current account.

5 Conclusion

Before the formulation of the Bretton Woods system, Keynes (1980) was concerned that the problem of maintaining equilibrium in the balance of payments had not been solved by the laissez-faire system and was a major cause of impoverishment and discontent. He argued that relying on freely fluctuating exchange rates, the free flow of gold or even on international loans as a means to equilibrate the system would place the burden of adjustment on the debtor countries, which at the time were weaker and smaller economies. Moreover, the use by debtor countries of competitive deflation (to bring down wage and price-levels) or exchange rate depreciation could create another problem, by their potential adverse effect on the terms of trade. The new international system should then attribute the initiative to creditor countries, who would be responsible for investing abroad, reducing tariffs and stimulating domestic demand and employment.

As the US switched its position from creditor to debtor around 1980 (with China taking the main creditor role since the 1990s) and the capital account

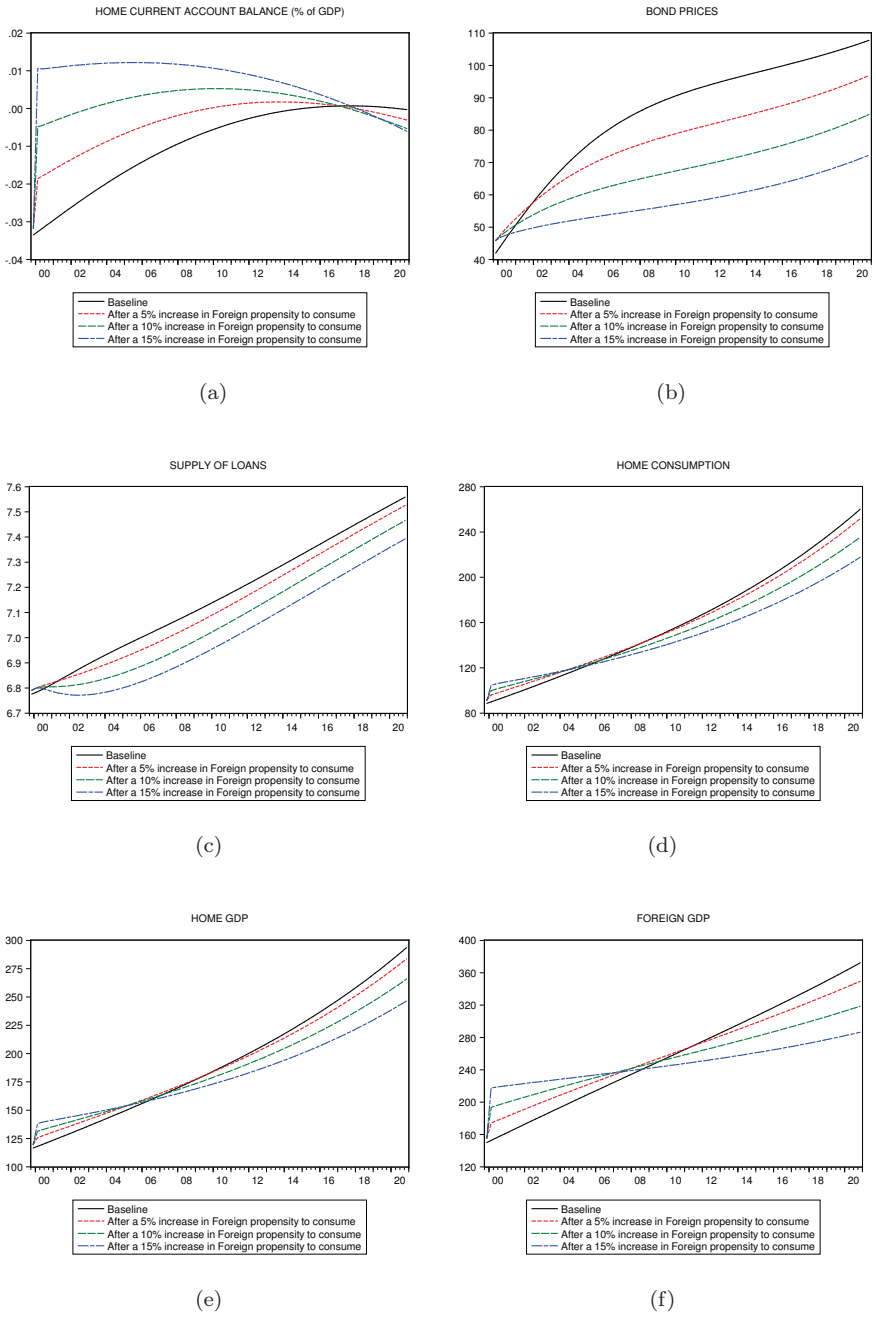
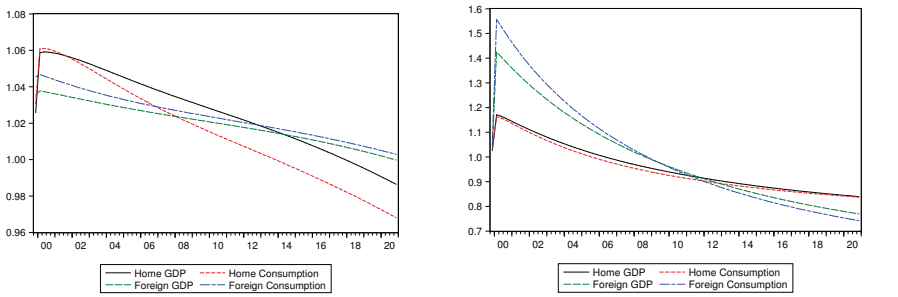


Figure 5: Baseline results and effects of an increase in the Foreign propensity to consume



(a) 30% Home currency depreciation (b) 15% increase in Foreign prop. to consume

Figure 6: Ratio of Home and Foreign variables to the Baseline after the two types of re-balancing

was further liberalized, the accumulation of current account imbalances may have assumed a different character ((see Ertuk (2009)), with its correction also having different underpinnings. It is argued in this paper that, using Keynes' terminology, 'the burden of adjustment' did not fall on the deficit country (the United States) in this case. The safe-haven status of US dollars and US government bonds, as well as the debt-led features of the country's domestic demand, may have allowed the US economy to grow even more with a current account deficit than it would have otherwise. An adjustment in this case, being via deflation or depreciation in the deficit country, or via increase in consumption in the surplus country (as in Keynes' suggestion), could be detrimental to both countries' economic growth in the short- to medium-run.

By starting from the view that current and capital account factors may be interconnected in the explanation for the rise in current account imbalances over time, this paper has constructed a simplified SFC model by combining a Home debt-led with a Foreign export-led economy, in which the Foreign Central Bank pegs the exchange rate to the Home currency and accumulates international reserves in the form of Home long-term bonds. The demand regime at Home is assumed to be debt-led in the sense that (gross) wealth effects on consumption are strong, and the bank's supply of loans is based on their own leverage ratio and that of the private sector's. If the interest rate on bonds is determined in the market for stocks, instead of in a market for loanable funds, an initial current account deficit between the two countries (created by any factor) generates capital gains on the holding of bonds by the Home private sector, which in turn creates wealth effects on consumption and perpetuates the current account imbalance. These real-financial linkages, aside from introducing such unstable features, are shown to be crucial for the assessment of how an eventual re-balancing of the current account can benefit economic growth.

First, a Home depreciation (or a decrease in the propensity to import at Home, for instance, by the adoption of protectionist measures) is shown to

achieve a re-balancing of the current account at the cost of a negative impact in the growth rate of Home bond prices, consumption and GDP. Second, in the case of an increase in the propensity to consume in Foreign, not only growth in consumption and GDP is reduced, but also the initial re-balancing in the current account is not maintained in the medium-run. The latter result does not support a "saving glut" as the cause for current account imbalances. In both cases, the implication is that re-balancing the current account can be detrimental to economic growth in both the deficit and the surplus countries.

In this context, if the current account deficit in the United States is believed to be unsustainable in the long-run due to the eventual burst of asset price bubbles and subsequent de-leveraging, as made clear by the 2008 crisis, or to future changes in the role of the dollar as a safe asset (as argued for instance by Eichengreen (2004)), any proposed solution to re-establish global economic growth and the stability of the world economy, rather than building on an exchange rate appreciation or a reduction of savings in China, needs to involve a deeper changes in the system. To be more specific, the solution may require changing both the US and China's growth regime (e.g. by changing the driver of consumption in the US from borrowing to higher wages as argued by Palley (2009)) and moving toward a domestic demand-led regime in China as proposed by Kregel (2010), while imposing stronger financial regulation (see Eatwell and Taylor (2001)), as well as capital controls (see Davidson (2004) and Ocampo (2007)). Further, a full 'Keynes solution' would require the establishment of a transfer mechanism by which the surplus country spends in the deficit countries' exports and/or on foreign direct investment, which could be done by means of an international monetary clearing union (Keynes, 1929; Johnson, 1956; Davidson, 2009, 2011; Arnim and Prabheesh, 2012)). The results presented in this paper may be used to support these ideas.

The model can be extended in three main directions to incorporate more realistic features and provide additional insight into the effects of the accumulation of current account imbalances between the US and China. First, the importance of the US housing market as a driver of US debt-led consumption would require the introduction of a shadow banking system which securitizes mortgages as a fourth sector in the economy (see Mehrling (2010) for a thorough description of such mechanisms). Second, income distribution in both countries has also played a major role in the growth regimes and trade patterns in question. In the US in particular, it can be argued, as in Taylor (2010) and Palley (2011), that it was the fall in the wage share since the 1980's which has set the stage for a debt-led consumption regime. As the functional distribution of income helps determine unit labor costs, eventual redistributions of income toward labor in one or both countries may or may not help correct current account imbalances, with different impacts on their level of economic activity (see Von Arnim et al. (2012), for a two-country model along those lines). Third, the restriction of the model to two countries eliminates many degrees of freedom, therefore imposing simplifications to avoid overdetermination. Moreover, the reduction of China's current account surplus with other countries - and in particular with underdeveloped economies - is likely to improve the net effect of re-balancing on the

world's effective demand, so that a richer analysis could be provided with the inclusion of a third country in the model.

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Appendix

Parameter and starting values

$c_0 = c_0^* = 0.8$;
$c_1 = c_1^* = 0.04$;
$\epsilon_0 = \epsilon_0^* = -2.1$;
$\epsilon_1 = \epsilon_1^* = 0.6$;
$\epsilon_2 = \epsilon_2^* = 1$;
$\lambda_{10} = 0.45$; $\lambda_{20} = 0.35$; $\lambda_{30} = 0.2$;
$\lambda_{12} = \lambda_{21} = -4$;
$\lambda_{11} = \lambda_{22} = 5$;
$\lambda_{40} = \lambda_{50} = 0.5$;
$\lambda_{41} = \lambda_{51} = 5$;
$\theta = \theta^* = 0.15$;
$\bar{L} = 1$;
$\delta = 0.004$;
$\eta_1 = 0.2$; $\eta_2 = 5$
$\beta = 0.005$
$bot = 0.01$; $top = 0.09$;
$\bar{e} = 1$;
$r = r^* = 0.045$
$B^s = 80$; $B_b = 30$; $B_p = 50$
$BL^s = 10.5$; $BL_f = 5.5$; $BL_p = 5$
$B^* = 50$; $B_b^* = 30$; $B_p^* = 20$