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When Minsky and Godley Met Structuralism: A Stock-flow Consistent Approach to the Currency Hierarchy

by

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I dedicate this to my late grandfather, D.G. Nayar. I thank Dimitri Papadimitriou and Gennaro Zezza for their invaluable comments, guidance, and encouragement. I also thank Angie Huerta for discussions. I also dedicate this to Pavlina Tcherneva and Randy Wray, for their massive contributions to my intellectual development. This would not be possible without the time and effort of Lindsey Carter, Levy's editor. All errors are mine.

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ABSTRACT

Underdevelopment is often conceived as being reproduced domestically. This paper emphasizes the international forces that enable the persistence of underdevelopment. We first explore how the currency hierarchy imposes a dependency relation between developed and underdeveloped economies. We improvise and quantify the currency hierarchy using ratios from the consolidated sovereign balance sheet. Using the improvisation of the currency hierarchy, we identify that a weak currency must compensate its position by resorting to three mechanisms: changes in interest rates, changes in exchange rates, and accumulation of international reserves to improve balance sheet structure. We employ these relationships to formulate two novel, financial post-Keynesian behavioral equations: an international reserves function and a domestic interest rate function. These equations are simulated in a stock-flow consistent model. We simulate the transmission of international shocks and domestic fiscal expansion. The key findings are (1) that the intensity of economic activity in the emerging economy is reliant on the level of economic activity (and policy) in the developed economy and (2) that any attempts to stimulate—through government spending—the emerging economy benefit primarily the developed economy while harming the emerging economy's private sector, assuming free capital and goods mobility. This indicates the existence of a balance-of-payment constrained expansion originating from the demand for international reserves as a margin of safety. Simulations show import controls to be a solution. We find government spending complemented by import substitution to be the most appropriate response to a crisis of international origin and suggest the need for international cohesion between emerging economies to create a more conducive international financial and trade system, halting the reproduction of underdevelopment.

KEYWORDS: Minsky; Godley; Stock-Flow Modeling; Structuralism; Currency Hierarchy; Balance-of-Payment Constraint; International Reserves

JEL CLASSIFICATIONS: E12; F30; O11; O23; E00

1 INTRODUCTION

"Money in capitalism is a social force which exists not only on the level of wealth owners but is also a force which stimulates economic development (or fails to do so)." (Herr and Nettekoven 2022)

Intuitively speaking, the rapid innovation and technical progress we confront today should have been disseminated across the globe to solve several issues. Only in a "lunatic asylum," borrowing the phrase from Keynes (1964), would technology not be shared, accumulation not be productively invested, and capacity be underutilized. On the face of it, growth is spatially self-reinforcing (Thirlwall's law), and hoarding wealth offers potentially smaller returns than using it productively. By this standard, there must be convergence and catching up between the developed and underdeveloped countries. Yet, intriguingly, the world's configuration is what it is – and there is no convergence between the developed and underdeveloped countries. What may appear to be "lunatic" may, however, just be a situation we do not yet understand. Keynes's (1964) instinct is that these answers lie in uncertainty, finance, liquidity, and a monetary theory of production. Building on this thought, this paper attempts to illustrate the difficulties faced by countries with weak currencies.

Keynes (1964), in Chapter 17 of *The General Theory,* emphasized the role of money as the cause for chronically-deficient, effective demand and unemployment. The "peculiarities" of money serve as a promise of certainty in the inherently and "fundamentally uncertain" economic system that is capitalism. The decision to hoard or not use money productively, due to the uncertainties created by the heterogeneity of time and space that emerge from the production process, results in an insufficient creation of income, output, and employment. Keynes (1964) called this tendency to caprice toward money or liquid resources the "liquidity preference."

Crudely, the liquidity preference can be understood as the force or implicit return that makes a capitalist chose a 1 percent return deposit over a 10 percent return on a business investment. Thus the liquidity premium (an implicit return) on the deposit is equivalent to forgoing a 9 percent return which could be realized on investment in a business. The uncertainty (default,

liquidity, and price risk) involved with investing in the business that could yield a 10 percent return makes the capitalist choose to store their wealth in bank deposits[1] rather than investing in a business.

Consistent with Chapter 17 of Keynes's (1964) *The General Theory*, we argue that the existence of a high liquidity premium on money or other liquid assets (low liquidity premium on other assets) discourages physical investment, which in turn impedes structural change and development in economies that need it most. To understand the international financial constraints that hinder development, in addition to the capitalist system and domestic liquidity preference portrayed by Keynes, we also need to account for the preference for currencies. Or, more specifically, the preference to denominate debt and acquire assets denominated in different currencies. The implicit return on the currency that "rules the roost" (the US dollar) discourages the creation liabilities and ownership of assets in the currencies of underdeveloped economies. The liquidity preference for the dollar also encourages the hoarding of dollars and dollar-denominated debt by non-dollar–creating economies. The desire to hoard a foreign currency combined with an inability to assume liabilities and sell assets in one's own currency not only severely discourages investment but also impedes the policy space of nations with weak currencies and subordinates their policy decisions to changes in international financial conditions.[2]

When there exists an implicit return on the dollar and dollar-denominated debt that discourages a carry trader from engaging in a transaction which seems reasonable, we see the existence of a hierarchy between currencies. For example, the carry trader does not engage in the arbitrage between the dollar and the rupee even if the rupee offers a higher interest rate. This is because of uncertainty regarding exchange rate and default risks. The reason for this high liquidity premium is the dollar hegemony, forced and reinforced by the configuration of the international financial system, which features the dollar as the apex means of payment and encourages the creation of

[1] Or, more accurately, forego their capacity to borrow and make an arbitrage between the rate of return on investment and the rate of interest on borrowing. This footnote is important to clear up the fact that Keynes is consistent with endogenous money.

[2] By international financial conditions, we typically mean changes in the policy rate of foreign countries and changes in the global liquidity preference.

debt and ownership of assets denominated in dollars. Thus, an emerging economy faces not only a high liquidity premium from uncertainty on investment relative to the domestic currency, but also a high liquidity premium from the uncertainty of assets and liabilities being denominated in their domestic currency and an inability for macroeconomic policy autonomy.

This paper will take a new approach (or rather revive an old approach) to understand the massive accumulation of international reserves by emerging economies in the last couple decades (Rodrik 2006). To do so, we reinterpret the notion of a currency hierarchy such that we can try to have a quantitative understanding of its implications (Kaltenbrunner 2015; Andrade and Prates 2013). We identify three forces that must compensate for a weak currency. The weaker currency can allow its central bank's policy rate and exchange rate to be sensitive to international financial conditions, and its central bank can improve its balance sheet structure by accumulating international reserves, increasing its liquidity and thus reducing the uncertainty of those denominating debt or purchasing assets in non-dollar currencies. While many believe the accumulation of international reserves to be a solution or an escape from the classic policy trilemma, the model in this paper will illustrate how the accumulation of international reserves as a margin of safety severely constrains the ability of the government to stimulate economic activity. We show in the model that the demand for reserves as a margin of safety—similar to a capital outflow or a reduction in net exports—results in the imposition of a balance-of-payment constraint to fiscally led expansions. We will also illustrate, albeit with more subtlety, how the accumulation of reserves, like the accumulation of any liquid asset, tends to discourage investment. Finally, we will illustrate how the accumulation of reserves contributes to the transmission of international financial crisis.

The next section reviews and improvises our conception of the currency hierarchy, as explained above. The section following will introduce two new behavioral equations: the first will illustrate the accumulation of international reserves as a margin of safety, in the sense of Minsky (2008b); and the second will put forth a novel equation to understand the setting of the central bank policy rate, as a policy choice. The fourth section will set up the stock-flow consistent model. The fifth section will discuss the results in the presence of three shocks: the first shock illustrates the reaction of the emerging economy to a crisis or austerity in the developed economy; the second

shock illustrates the reaction of the emerging economy to a stimulation attempt by its government in the presence of free trade and free capital mobility; and in the final shock scenario we constrain trade. The sixth section will evaluate, using simulation, which policy works best in times of a crisis that originated internationally. In the final section, we conclude with our policy recommendations from the simulations and theory.

2 REVISITING THE CURRENCY HIERARCHY

The currency hierarchy can be understood as a structural preference ordering of currencies. Like Kaltenbrunner (2015), we understand this preference ordering to be predicated on the difficult to measure and in-commensurable concept of liquidity (Carabelli 2021). We, however, make an attempt to quantify this mysterious and inherently elusive concept of liquidity. The purpose of this quantification is not to rank currencies but to illustrate how compensating for a weak currency can have negative impacts on the economy. This is very important to keep in mind. Nair (2023) explains that the emergence of the currency hierarchy necessitates two conditions: (1) the uncovered interest rate parity and (2) the deviation from the uncovered interest rate parity. The uncovered interest rate parity imposes a relationship between the policy rates of different central banks. This imposes an international economic interdependence between nations through the interest rate and its implications on economic activity, or through the consequences of not changing the interest rate in line with other central banks (such as capital flight, etc). Important to note is that when one central bank changes interest rates, it necessarily has some impact on the economies of other nations through the uncovered interest rate parity, even if they did not desire or consciously make any changes. The deviation from the interest rate parity indicates that there exists some systemic force that prevents arbitrage from equalizing the policy rates of different central banks. Using the example explained in the previous section, we can attribute this systemic force to a liquidity preference. Thus the deviation from the interest rate parity suggests that there can be an interdependence between the economic activities of different nations even without changes in the policy rate of any central bank. The interdependence may arise from changes in global liquidity preference. Even more importantly, the deviation from the parity tells us that there exists a hierarchy which implies an asymmetrical relation between central banks.

This points out that it is not actually an inter-dependence between economies but a dependency of some economies on others. The dependency channel is one way that the countries higher positioned on the currency hierarchy call the shots for the countries below. Changes in countries with better currencies significantly impact those with weaker currencies while the reverse, if even possible, does not occur to the same extent.

We take a three-dimensional approach to understanding the liquidity of a currency. Two of these dimensions are institutional and structural while one is cyclical and responsive to changes in economic and financial conditions. The first is the presence of a lender that prioritizes liquidity over its own profitability, thus maintaining a thick spot market and ensuring liquidity to the currency/instrument. This function may be provided by a central bank or multilateral institution that has sufficient claims on the key currency, the ability to call forth the key currency at will, or the ability to create the key currency. The second is the existence of sufficient demand for real resources produced by the country. If there is a strong enough demand for the country's real resources then there will be a strong enough demand for its currency which ensures a good degree of liquidity in currency markets (Papadimitriou 2023).[3] The last factor relies on the perceived liquidity of the currency issuer through the examination of ratios derived from the consolidated sovereign balance sheet. The ratio we choose to emphasize is the gross-gearing ratio which is the sum of liabilities of the sovereign[4] divided by international reserves (or the liquid asset in this context).

There are two reasons we choose to neglect or hold constant the first two dimensions. Firstly, changes in economic activity, in the short run are unlikely to be the cause of changes in the aforementioned structural and institutional factors. The first two factors are also much less likely to be deemed important for currencies at the bottom of the hierarchy, since the entire problem they face is the absence of adequate structural liquidity for their currencies. They instead have to depend on cyclical demand for their currencies, which is why their policy tends to be pro-

[3] I am thankful to discussions with Dimitri Papadimitriou for reaching this conclusion.
[4] Since we think in terms of a consolidated sovereign balance sheets these would only be the liabilities that are held by the foreign sectors, since internal financial liabilities cancel out.

cyclical. Thus, we postulate and assume that it is the last factor that is most relevant to the argument we are trying to illustrate.[5]

We can understand the different mechanisms through which a weaker currency can compensate for changes in international financial conditions originating non-domestically using a modification of the interest rate parity formula. The modification below adds a residual component to denote the currency hierarchy and liquidity. This variable, as explained previously, is determined by several forces.

$$\Delta xr = (r^d - r^f) + (l^d - l^f) \quad (1)$$

Where *xr* refers to the exchange rate, r^d refers to the domestic[6] interest rate, r^f refers to the foreign interest rate, l^d refers to the liquidity premium on the domestic currency, and l^f refers to the liquidity premium of the foreign currency. In this equation, if we consider the variables with the subscript *f* to be exogenously set by the developed foreign sector which we can say is the key-currency issuer, then one or a combination of the other three variables must adjust.

Changes in each of these variables have different effects on the economic activity of the domestic underdeveloped economy. Policy decides which variables change, and to what degree. Thus it is important to have a deeper understanding of the domestic economy and its international relations to make the most appropriate policy choice. Let us say that the foreign interest rate increases (or global liquidity preference l_f). In this case, the domestic economy can react by increasing its own interest rate, by allowing its currency to depreciate or accumulating more international reserves to increase its gross gearing ratio and thus increasing its liquidity premium, or different combinations of these three variables. We believe that each of these three policy choices has a negative effect on the domestic economy but through different channels. For example, an increase in interest rates and depreciation increases financial fragility and external debt burden, resulting in a depreciation-inflation spiral, and also possibly discouraging

[5] Thoughts in this paragraph are a result of discussions with Pavlina R. Tcherneva.
[6] Domestic refers to the underdeveloped economy.

investment. Increasing the accumulation of reserves imposes an additional cost on the sovereign, as it must give up some part of its spending power to purchase key currency–denominated debt which likely results in a negative carry (Rodrik 2006). This policy choice must be made strategically, so that we chose to inflict the damage on the most robust channels. The worrisome implication is that the domestic economy may have to take these recessive steps independent of their actions or decisions. Changes in the foreign interest rate are usually in response to domestic economic activity and inflation targeting. Changes in global liquidity preference depend on several factors outside the power or actions of the domestic economy (Pettis 2001; Rey 2015). Thus, the currency hierarchy imposes recessive pressures on the underdeveloped economy through no fault of its own.

3 NOVEL BEHAVIORAL EQUATIONS

3.1 International Reserves Function

The massive accumulation of international reserves by emerging economies has puzzled economists for the last couple of decades (Rodrik 2006; Bortz and Kaltenbrunner 2018). The shift to the flexible exchange rate regime, post-Bretton Woods system theoretically implies the redundancy of international reserves. International reserves were no longer required to peg the exchange rate, or for sterilization purposes. Balance-of-payment constraints, deficits and surpluses, were to be met through the adjustment of the exchange rate. Yet, the stock of international reserves has been accumulating in emerging economies which do not experience a current account surplus. This suggests that countries have been intentionally purchasing international reserves. Rodrik's (2006) analysis provides further evidence to believe that the accumulation of international reserve has not been for pegging exchange rates or sterilization. We instead posit that the build of international reserves has been to improve the balance sheet structure and compensate for a weaker currency through the liquidity premium channel explained in the previous section. The build of international reserves is desired as a margin of safety, as defined by (Minsky 2008b). This margin of safety perspective is also supported by rising gross capital flows, financialization, and subsequently rising global imbalances (Harvey 2009; Kregel 2007). As the quantity of claims and liabilities of sovereign nations rise, the more international

reserves they desire to hold as a precaution and hedge against uncertainty. This perception is also consistent with economic exchange and interest rate volatility. As volatility increases, so does the desired margin of safety (Kregel 1997a). For these reasons, we propose a new behavioral equation that reflects international reserve accumulation as a Minskyan margin of safety.

In the model, international reserves are held in the form of bonds issued by the key currency country through the domestic central bank. Building on the intuition of the extract above, this chapter formalizes an international reserves function in a fixed exchange rate regime with private finance. While there is some divergence from reality because we do not use a flexible exchange rate, we can justify that this difference would not make a significant impact on the sovereign demand for international reserves (Nair 2023). In a flexible exchange rate regime, the primary difference would be that the demand for reserves would come from the private sector instead of wholly from the central banks (Nair 2023). Thus, this equation could be used as a total national demand function for foreign (key currency) bonds instead of a demand function specifically for central banks, in the case of an extension into a flexible exchange rate model. Thus, the central bank's demand for foreign bonds can be articulated:

$$B_{CB}^{R} = \left(FA^{R} - p_{mos}\left(\frac{1}{r_{B}^{S}}\right)Y^{f}\right) \tag{2}$$

$$FA^{R} = B_{R}^{S} + E_{R}^{S} + L^{N} \tag{2a}$$

$$Y^{f} = x + r_{B}^{N}B^{N} \tag{2b}$$

Where FA^R represents the total claims the rest of the world (north) has over the domestic economy. This is equivalent to the sum of domestic bonds held abroad (B^R_S), the domestic equity held abroad (E_S^R), and the foreign loans lent to the domestic economy (L^N). The parameter, p_{mos}, is the probability weight that signifies the degree of certainty regarding the level of future receipts of income, and r_B^S is the interest rate on the most risk-free asset—domestic treasury bonds. Y^f is the sum of foreign receipts, exports (x), and interest on foreign bonds ($r_B^N B^N$).

In theory, the margin of safety parameter would be determined in a Minskyan fashion. In the international context, this would mean that the margin is highly dependent on the global liquidity cycle. The more frequently expectations are realized, the smaller the margin of safety becomes (Kregel 1997b). This change is reflected as the level of the probability weight (p_{mos}) rises. Note the inverse relation between the margin of safety and the probability weight. However, for simplicity, the probability weight will be inputted exogenously in the model. The margin of safety, in this context, is dependent on the probability weight. This is akin to Minsky's formulation of his demand price using his capitalization factor (Minsky 2008a). The uniqueness of the equation lies in the capitalization of foreign income in the Minskyan style. Wherein the discount rate is multiplied by a probability weight (this term is the capitalization factor).

Equation (2) tells us that the demand for international reserves, as a margin of safety, equals the difference between the value of debt and the risk-adjusted capitalization of the net present value of income denominated in foreign currency. The country thus desires to hold that level of reserve balances which would bridge the gap between its future earnings capacity and the current value of its liabilities. The higher the value of its liabilities to the foreign sector, the more capital flight that must be precautioned and hedged against. The higher the certainty of its earnings and the higher the risk-adjusted net present value, the smaller the margin of safety international reserves required. This formulation could be further specified by attaching different probability weights to each source of income, as Minsky (2008a) would have done. This would signify the spectrum of uncertainty regarding income generated by different assets, predicated on the perception of exchange, default, and price risk. This approach is not pursued in this piece but would be an interesting task for another project.

3.2 The Domestic Interest Rate Function

This section emphasizes the role of the interest rate in nullifying the presence of the currency hierarchy. The previous section explained how the inducement to hold an asset/currency depends not only on the interest rate differential but also the liquidity premium, which changes with the international financial conditions. In light of the theory presented there, we could imagine proactive central banks choosing to subordinate their monetary policy to compensate for a weak

currency. A rise in interest rates in response to unfavorable changes in financial conditions makes the currency and assets denominated in that currency more attractive, thus stabilizing prices and preventing capital flight. A rise in interest rates could also contribute to increasing the stock of reserves, which in turn reduces the liquidity premium providing an additional indirect compensation.

The (extent of) subordination of monetary policy to international financial conditions is a choice, and in practice any central bank can pursue the interest rate they desire—ex-ante. However, this does not mean that any interest rate is compatible with the smooth functioning of the economy. As explained in the previous section, the policy maker must carefully decide which variables to adjust, depending on which channels would harm the economy least. Below is an equation that depicts the monetary policy choice of central banks' degrees of subordination (or not) to the key currency nation's monetary policy.

$$r_B^S = r_{B-1}^S + \alpha\left(\Delta r_B^N + mos(l^S)\right) \tag{3}$$

$$l^S = \frac{B_R^S + E_R^S + xr(L^N)}{xr(B^N)} \tag{4}$$

Here $r_B{}^S$ is the interest rate on domestic bonds in the current period and $t-1$ refers to the last period. The policy choice is depicted by α. If α is zero, the interest rate on bonds is exogenously determined by the central bank. The higher the value of α, the more the interest rate on domestic bonds is subordinated to international financial conditions. Once again, these international financial conditions are captured not only by changes in the interest rate in the key currency economy ($\Delta r_B{}^N$) but also changes in the liquidity premium and balance sheet structure of the domestic economy (l^S) adjusted for a margin of safety (*mos*) (Ramos 2019). The liquidity premium states the excess over the interest rate parity that the domestic economy must offer in order to compensate for liquidity risk.

Equation (4) explains our conceptualization of the liquidity premium. As reasoned in the previous section, we only consider the cyclical indicator of the liquidity premium. This is a balance sheet ratio that signals the liquidity of the consolidated sovereign balance sheet. Equation (4), which is a gross-gearing ratio, tells us that the more liabilities the sovereign has to outsiders (holding the quantity of liquid international reserves consistent), the lower the perceived liquidity of the sovereign, requiring the sovereign to lose some policy space with respect to monetary or exchange rate policy, or alternately requiring austerity to reduce current account outflows. Likewise, the higher the quantity of liquid international reserves the sovereign possesses, given a quantity of liabilities, the higher its liquidity is perceived to be. This provides the sovereign with more space for monetary and exchange rate policy, and justifies an increase in fiscal space without concerns about balance-of-payment constraints in the future. In the context of the model to follow, the consolidated liabilities of the sovereign are its bonds issued to the foreign sector (B^S_R), its equity issued to the foreign sector ($E_R{}^S$), and the loans it borrowed from the foreign sector (L^N). The role of the liquid international reserve asset is played by the foreign bonds held by the sovereign (B^N).

4 SETTING UP THE STOCK-FLOW CONSISTENT MODEL

4.1 Why a Stock-Flow Consistent Model?

A stock-flow consistent (SFC) model is a monetary and sectoral modeling tool that allows the interaction of a theory with the real-world dynamics of accounting. SFC models are predicated on a consistent accounting structure. The fundamental principles of SFC models ensure that every money flow originates from a money stock and flows into a money stock (or creates debts and credits/ IOUs in the system). An SFC model, thus, allows one to test their theory in the presence of the rules of accounting (i.e., the only certain and invariant real-world rules). The SFC model allows the theorist to learn more about the dynamics of their theory by interacting with fundamental economic dynamics. An SFC model, being a complex system, does not always reveal the expected results. Results can be full of surprises that may allow the researcher to better understand their theory. It would also allow the researcher to understand whether the assumptions behind the theory (calibration) are realistic in the presence of accounting rules. If a

theory holds true in an SFC framework, this does not make the theory a truth. If the theory does not hold in an SFC model, it does not make the theory a non-truth. The creation of the model is about the process of learning rather than testing.

According to Nikiforos and Zezza (2017), the SFC framework has four fundamental principles that enforce accounting consistency. First, flow consistency ensures that every money flow goes somewhere and comes from somewhere. An expenditure cannot be made without creating an income and an income cannot emerge without an expenditure. This is commonly called horizontal consistency. Vertical consistency ensures that every debit has a credit and vice versa. Second, stock consistency ensures that the financial liabilities of one sector (agent) are financial assets of another sector (agent). This ensures that the sum of financial assets and liabilities net out in a closed system. The third principle, stock-flow consistency, ensures that every flow originates or flows into a stock. This ensures that net savings, positive or negative, affect the quantity of stocks held by the unit. The last principle, quadruple entry, implies that every transaction is recorded at least four times. These principles ensure that an expenditure of one sector is the receipt of others, the deficit of one sector is the surplus of others, and that the financial assets of one sector are the liabilities of others.

Any theory which emphasizes balance-sheet structure must operate in a SFC framework. Previous sections explained that the balance-sheet structure of a sovereign and the units within it, to a large extent, determine the severity of the implicit international financial constraints that are imposed on them by the currency hierarchy. Thus, it is important for assets, liabilities, and the balance sheet to evolve respecting the rules of accounting. Constraints placed by accounting would allow us to acknowledge assets, and liabilities must be sacrificed to accommodate demand for international assets. It also demonstrates the extent to which changes in portfolio influence changes in-flows (income/expenditure) over time which, in turn, affect the long-term–balance sheet structure, thus capturing the dents in the future earnings capacity that result from hoarding international reserves.

Without the aforementioned accounting principles, a non-SFC model need not acknowledge the consequences on flows when there is, for instance, an increase in demand for international

reserves for precautionary reasons. In addition, the failure to recognize accounting could imply that the balance sheet structure would not evolve accordingly, and that even long-term effects will be overlooked in addition to short-term flow effects. For example, the holding of higher levels of international reserves requires either an equivalent reduction of assets or an increase in liabilities. If a researcher fails to recognize this, they may ignore the effects of the decline in assets or the increase in liabilities on transaction flows in future periods. It could also give an incorrect picture of the balance sheet structure of the unit. For these reasons, this work does not see any substitute to SFC modeling.

4.2 Matrices and Structure

The SFC-predicated modeling culture was popularized by the Godley and Lavoie (2012) handbook, *Monetary Economics*. Most contemporary SFC literature uses the models of Godley and Lavoie (2012) as a benchmark. The contributions of contemporary SFC literature lie primarily in the extension and modification of the benchmark model structure present in this book. However, the book contains only two open-economy models. Both models presume countries at an equal level of development, with powerful currencies (i.e., UK and US). Therefore, the models do not emphasize any significant differences or asymmetries in the portfolios or flows of the two nations.

For this reason, we create an SFC model, more specifically a TFM from scratch. Our TFM emphasizes the balance sheet asymmetries between the center—the key currency issuer (the foreign sector)—and the periphery which has a weaker currency that is not used internationally (domestic country). The foreign sector holds international assets only for speculation while the latter has a more structural commitment to international reserves for the purposes of transactions and precaution, in addition to speculation. Since the demand for international assets for the peripheral economy is near insatiable, the center has the asymmetric power to cause changes in the balance sheet structure of the periphery. This is because the center can issue the internationally accepted means of payment, at no cost, for purchasing the physical or financial resources from the periphery, but the inverse is not true. The periphery—to acquire the international means of payment—must either compromise its portfolio through the creation of costly liabilities or compromise its economic production structure to earn the means of payment

using the underdevelopment-friendly laws of comparative advantage. The cost of holding international reserves as a margin of safety is a benefit for the key-currency issuer.

The first feature of the TFM is that it assumes a small open economy. The rest-of-the-world (center/foreign) sector's income is made exogenous, thus assuming that the actions of the periphery do not influence the rest of the world's income. From the flow of funds section of the TFM (or the balance sheet matrix), we can observe that the center holds multiple liabilities of the periphery while the periphery holds only a single liability of the center. We can also observe that only the peripheral country borrows from the center. This is because the center already has the benefit of being the most stable currency and, in theory, would charge the lowest interest rate on borrowing. Only other countries would therefore borrow from the center, and the center would not borrow from other countries. There is an exception to this rule, in the case of carry trade. During carry trade, the center may borrow from the periphery with the objective of making speculative gains. This is not included in the model as we want to focus on structural factors, and not speculative ones. It could, however, be included in an extension which allows prices of assets and currencies to change (capital gains).

The periphery is dependent on the center for liquidity but not the reverse. Liquidity and solvency are problems that the key-currency economy cannot face, except through self-imposed constraints (Wray 2012). However, we must note one significant caveat to this model. Without the foreign sector being able to hold the liabilities of sectors within its boundaries, the model forces the foreign sector to hold the periphery's liabilities as assets. This underplays the effect of capital flights. The only way capital flight ensues is through a reduction in the net wealth of the foreign sector. The net wealth of the foreign sector is more accurately described as the net claim of the foreign sector over the domestic economy.[7] Future models could address this by further disaggregating the foreign sector or by adding countries. The addition of countries is also essential to illustrate the dynamics of a currency hierarchy, rather than just the relationship between a key-currency–issuing country and a key-currency–using country—as is done in this thesis. The balance sheet matrix below, reflects the asymmetric balance sheet structure.

[7] This is because in reality it is highly likely that the foreign sector holds assets and liabilities of other countries and itself.

For ease of reading the superscript denotes the issuer of the liability while the subscript denotes the holder of the asset. The name of the asset or liability can be found on the first column of the balance sheet matrix. The plus sign indicates that the entry is an asset while the minus sign indicates that the entry is a liability. The rows sum to zero because assets equal liabilities. This is true for all columns except the one that denotes physical capital, which is a real asset and thus does not have a corresponding liability. The columns sum to zero because the change in the sum of all assets equals the net-worth of a sector. The plus sign denotes the holding of an asset. The minus sign denotes the holding of a liability.

Table 1: Balance Sheet Matrix

	HH	Firm	Bank	Gov	CB	xr	RoW	RoW (fin)	Total
CB Reserves			+Res		-Res				0
Deposit	+D		-D						0
Loan		$-L^{S}$	$+L^{S}$						0
Dom Bonds	$+B_{SH}$			$-B^{S}$	$+B_{CBS}$		$+B_{SROW}$		0
Equity	$+E_{H}$	-E					$+E_{ROW}$		0
RoW Bonds	$+B_{ROWH}$				$+B_{CBROW}$	xr		$-B_{ROW}$	0
RoW Loans		$-L_{ROWF}$	$-L_{ROWB}$			xr		$+L_{ROW}$	0
Fixed Capital		+K							0
Net Worth	NW_{H}	+K	0	NW_{G}	0		NW_{ROW}	0	K
Total	0	0	0	0	0	0	0		K

Below is the transactions flow table. Like in the case of the balance sheet matrix, the first column states the transaction or balance sheet item, and the first row states the sector. We see that there are a total of six domestic sectors and two foreign sectors. Albeit, effectively there are only two domestic sectors and one foreign sector. This is because only three sectors are allowed to have net-lending balances, the other sectors transfer their net incomes to these three sectors.

The plus sign on the TFM denotes a source of funds while the minus sign denotes a use of funds. For example, consumption is a use of funds in the household sector and thus has a negative sign, while it is a source of funds for the production sector and thus has a positive sign in that column. In the case of assets, bank deposits are a source of funds for commercial banks, since households transfer their net lending to commercial banks which fund bank assets. While it is a use of funds for households, since they use their net lending (net saving) to purchase deposits. Once again, each row sums to one because spending must create income (flow–flow consistency). Columns sum to one because spending has to either come from earnings, borrowings, or proceeds from the sale of assets.

Using the TFM, we can construct the accounting identities that enforce the principles of stock-flow consistency. There are thirty accounting constraints in total. An exhaustive list of the accounting equations can be found in the appendix.

Table 2: Transactions Flow Matrix

	Emerging Nation						xr		RoW		Totals
Sector/Item	Prod	HH	Firm		Bank	Gov	CB	xr	Non-Fin	Fin	
			Current	Capital							0
Transaction Flows											
Production flows											
Consumption	+C	-C									0
Investment	+I			-I							0
Gov Exp	+G					-G					0
Imports	-M							xr	+M		0
Exports	+X							xr	-X		0
Tax		-T				+T					0
Wage	-W	+W									0
Profits	-PI		+PI								
Depreciation	-Dep			+Dep							0
Interest Payments											
CB Reserves					$+r_{Res} * Res_{-1}$		$-r_{Res} * Res_{-1}$				0
Deposit		$+r_D D_{H-1}$			$-r_D D_{-1}$						0
Loan			$-r_L^S L_{F-1}^S$		$+r_L^S L_{-1}^S$						0
Dom Bonds		$+r_B^S B_{H-1}^S$				$-r_B^S B_{-1}^S$	$+r_B^S B_{CB-1}^S$		$+r_B^S B_{ROW-1}^S$		0
RoW Bonds		$+r_B^{ROW} B_{H-1}^{ROW}$					$+r_B^{ROW} B_{CB-1}^{ROW}$	xr	$+r_B^{ROW} B_{-1}^{ROW}$	$-r_B^{ROW} B_{-1}^{ROW}$	0
RoW Loans			$-r_L^{ROW} L_{F-1}^{ROW}$		$-r_L^{ROW} L_{B-1}^{ROW}$			xr		$+r_L^{ROW} L_{-1)}^{ROW}$	0
Profit Transfer											
CB						$+\pi_{CB}$	$-\pi_{CB}$				0
Bank		$+\pi_B$			$-\pi_B$						0
Firm		$+\pi_F$	$-\pi_F$	0					$+\pi_F$		0
Fin profs row									$+\pi_{ROW}$	$-\pi_{ROW}$	
Net Lending	0	NL_H	0	$-\Delta K$	0	NL_G	0		NL_{ROW}	0	0
Flow of Funds											
CB Reserves					$-\Delta Res$		$+\Delta Res$				0
Deposit		$-\Delta D_H$			$+\Delta D$						0
Loan				$+\Delta L_F$	$-\Delta L$						0
Dom Bonds		$-\Delta B_H^S$				$+\Delta B^S$	$-\Delta B_{CB}^S$		$-\Delta B_{ROW}^S$		0
Equity		$-\Delta E_H$		$+\Delta E$					$-\Delta E_{ROW}$		0
RoW Bonds		$-\Delta B_H^{ROW}$					$-\Delta B_{CB}^{ROW}$	xr		$+\Delta B^{ROW}$	0
RoW Loans				$+\Delta L_F^{ROW}$	$+\Delta L_B^{ROW}$			xr		$-\Delta L^{ROW}$	0
Change in Wealth		$-\Delta V_H$	0	ΔK	0	$-\Delta V_G$	0		$-\Delta V_{ROW}$		0

5 SIMULATION RESULTS

We ran three scenarios of our model, in addition to the baseline. The model is shocked at the 100^{th} period. The first scenario attempts to capture how the novel behavioral equations in the third section contribute to the transmission of crisis. We apply a shock to the GDP of the foreign economy. The income of the foreign economy is reduced by 6.25 percent; this shock may have been due to austerity or crisis. This allows us to understand how changes in foreign GDP affect the domestic developing economy. In the second scenario, we simulate the impact of increasing domestic government expenditure on the domestic developing economy. Government spending is increased by around 17 percent. Because we expect balance-of-payment constraints to set in during the second scenario, in the last scenario, we add a 3 percent reduction to the import

propensity of the developing economy to the rise in government spending to emulate an import substitution or barrier.

We try to capture, using these simulations, how the developing economy is both negatively affected by external forces such a fall in foreign income, and is unable to stimulate its own economy through government spending, under free trade and capital mobility.

We report most graphs in a scale that is relative to the baseline. Thus the baseline will always be one. This is because the model is not empirically calibrated to real world initial values of parameters. Thus the absolute values of stocks and flows have little meaning. What we are interested in are changes in the stocks and flows from the baseline in consequence to the aforementioned shocks. Below is the graph that shows the reaction of the domestic economy's economic activity to the shocks. The absolute value of the baseline has converged, so the convergence of these relative values also show convergence in each of the scenarios. The only way income can change relative to the baseline is if the income in the scenario changes, thus all changes are attributed to the shock as the baseline is constant.

Figure 1: Impact of Shocks on Domestic Income

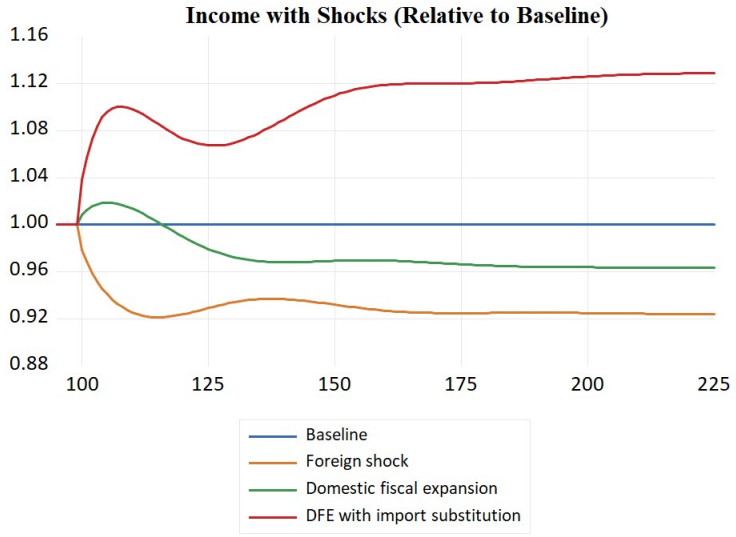
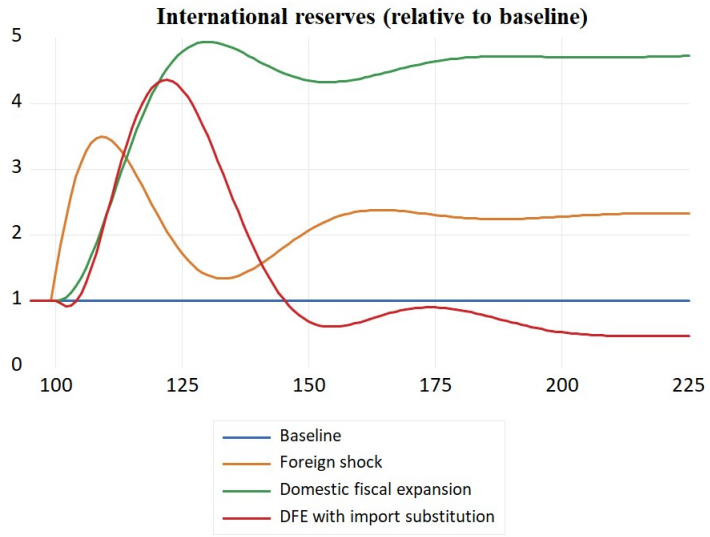


Figure 2: Stock of International Reserves



5.1 Scenario 1: Foreign Shock

From Figure 1, we observe the foreign shock of 6.25 percent (i.e., the fall in foreign GDP decreases domestic income by 8 percent). The obvious channel through which a shock in foreign income impacts the domestic economy is through the foreign sector's demand for the domestic economy's exports. Because the domestic economy's income fell more than the shock applied to the foreign sector, we can determine that the transmission of the shock had some sort of multiplier and there were other channels through which the shock was transmitted. In this subsection we will look deeper into the channels that cause domestic income to decline by a value greater than the inflicted shock on foreign income.

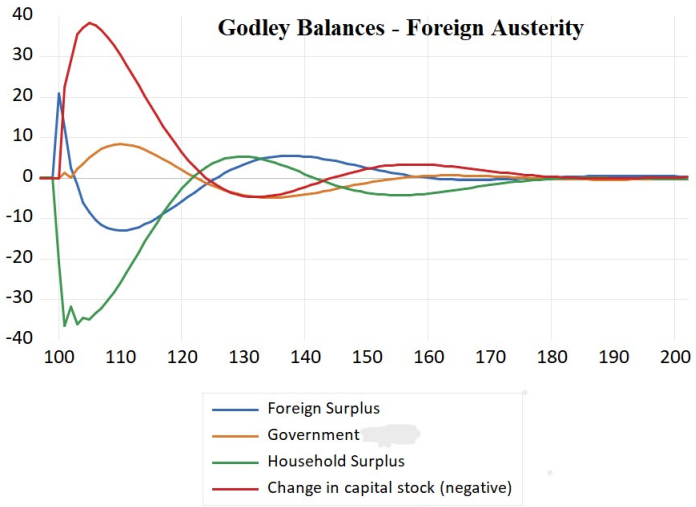
We can see from Figure 2 that the quantity of international reserves, at steady state, held by the domestic central bank rose a little over twice what was held in the baseline. We can also observe from Figure A1 (located in Appendix C) that the claims that the foreign economy had over the domestic economy rose by 10 percent (at steady state), initially increasing by almost 30 percent. In addition to increasing the demand for international reserves by the domestic central bank, this increased the outflow of interest payments on financial assets from the domestic-peripheral economy into the foreign economy. This will result in a fall in disposable income by reducing

the profits and increasing the interest payments of each sector.[8] This decline in disposable income also implies a reduction in consumption expenditure, which is a function of disposable income. The fall in consumption expenditure in turn reduces income which reduces the target-level capital, which is a function of income. This in turn causes a decline in investment which is a positive function of the deviation of capital from the target level of capital, further reducing income. This is in addition to the fall in income caused by the fall in exports to the foreign economy. Note that concurrently, wages, which are a function of income, also fall due to the fall of income which, in turn, further depresses disposable income. The rise in stocks of international reserves also result in a negative carry, because the interest rate on foreign bonds is lower than that on any liabilities of the sovereign, which also does not help to push up disposable income.

We see that there is initially a sharp 6 percent drop in the gross receipts of foreign income (Figure A2). This is caused by the fall in demand for exports due to the decrease in foreign income. The temporary recovery of gross foreign receipts, when it is only 2 percent lower than the baseline, is driven by an increase in holdings of international reserves which generate some interest payments. This declines as the holdings of international reserves decline and the foreign claims over the domestic economy rise. We also observe similar trends in the current account balance (Figure A3), which suggests an initial deficit due to fall in exports followed by a surplus driven by the rise in interest receipts on international reserves. This surplus once again turns into a deficit because of the increase in foreign claims that the foreign sector holds over the domestic economy.

[8] Nair (2023) has the graph to show this actually happens. However we can save space and justify this logic by simply referring to equation (3) in the appendix. It is an accounting identity which suggests that rise in interest outflows reduces disposable income and profits for banks and central banks.

Figure 3: Godley Balances - Scenario 1



We can also see from the Godley (2012) balances that the foreign austerity, which initially causes a foreign surplus, results in unsustainable processes of a household/private sector deficit. The recessive impact of foreign austerity also results in a decline of the government deficit. This shows that the government does not absorb the shock, and allows the household sector to be the one that absorbs the deficit. We also see a contraction of the capital stock (physical capacity) driven by the fall in income, which had caused a fall in the desired capital stock level. The fall in capacity is a serious concern for any developing economy, as developing economies are already capacity constrained.

The fall in the net wealth of all sectors (Figures 10,11, and 12) suggests that the austerity was not constrained to the foreign economy but was an international austerity. One that the domestic economy need not have desired. The net wealth of all sectors declines significantly before rebounding and converging at a steady state lower than the baseline. Household wealth fell by about 10 percent while the wealth of the government and foreign sectors fell by much less, indicating that the private domestic sector (household) took the hardest hit. The decline in the wealth of the foreign sector results in a negative effect on the claims the foreign sector has over the domestic economy via the portfolio choice equations. This negative effect on foreign claims can be observed in Figure A1 in Appendix C. This negative effect offsets the holdings of

international reserves. This is the reason for the initial peak in the level of international reserves followed by convergence to a smaller increase relative to the baseline.

5.2 Scenario 2: Domestic Fiscal Expansion

The advanced, open-economy model in Godley and Lavoie (2012) demonstrates that an increase in government expenditure increases the domestic income's steady state level almost one-to-one.[9] However, on examining Figure 1, we see that this is not the case in our model which accounts for asymmetries. We see that an increase in government spending, by 17 percent, results initially in a 2 percent increase in domestic income. After around 20 periods, however, the level of income declines until it converges at 4 percent less than the baseline. This is a surprising result, since an increase in government expenditure is typically expected to increase the domestic economy's level of income. In this section we will attempt to uncover the resulting dynamics in this counter-intuitive outcome in the heterodox world. While this result does coincide with the mainstream suggestion that government spending can crowd out economic activity and thus depress economic output, the mechanisms behind this model are very different from the mechanics that the mainstream hypothesizes. Our model uses an endogenous money approach and has exogenous interest rates. Thus, scarce savings or rising interest rates from a loanable funds market cannot be the cause of the fall in domestic income.

We can observe from equation (2) in the appendix, GDP equals the sum of consumption, investment, government spending, and net exports. We can immediately identify that the initial rise in income can be attributed to the rise in government spending through a simple pump-priming (aggregate-demand management) effect. However, almost immediately, we can see an offsetting effect of the pump-priming through a balance-of-payment strain. The rise in domestic income causes a fall in the net exports, given the import propensities of both countries. The current account balance slowly offsets the effect of the rise in government expenditure (Figure A3). The current account deficit is rising because of the rising trade deficit and the rising financial flow deficit. Thus, over time, net exports fall more than the rise in government spending, which is what causes the initial offsetting and later decline of domestic income.

[9] This experiment was performed using the code of Godley and Lavoie (2012), uploaded by Gennaro Zezza.

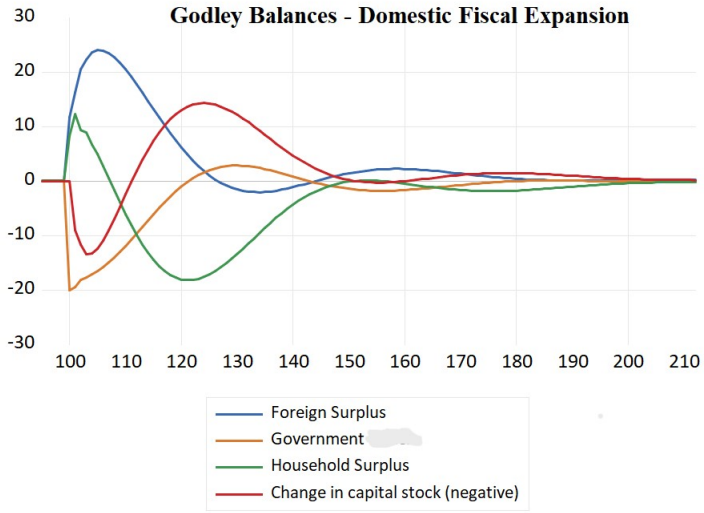
We can observe a sharp rise in the holdings of international reserves by the domestic central bank (Figure 2). This sharp rise saw international reserves increasing almost five-fold in the first 30 periods and stabilizing at around that value. This rise in demand for international reserves is driven by the sharp increase in foreign claims over the domestic economy—an almost 50 percent rise. This rise in claim is driven by the fact that the foreign sector accrues most of the surplus resulting from the government deficit, meaning they are the buyers of the government's liabilities, thus accelerating global imbalances and the financial flows that accompany it. This was followed by only a 6 percent increase in gross income receipts from abroad, driven by the rise in holdings of international reserves which produce interest.[10] Thus the rise in holding of international reserves is driven by the difference between the value of foreign claims on the domestic economy, minus the capitalized value of gross foreign receipts. We can also observe that the increase in government expenditure results in a significant rise in the wealth of the foreign sector—by almost 15 percent (Figure A6). While the household sector's wealth falls by almost 8 percent (Figure A5). The government wealth also falls by around 15 percent (Figure A4). This implies that, even from a long run perspective, the domestic economy was worse off, and government spending primarily benefited the foreign economy—with government wealth, physical capital (i.e., scalar times income), and household wealth all being adversely affected. This is not the first time that such a result has been hypothesized. Kregel (1999) suggests the possibility of a similar result in the case of the European Monetary Union. The rise in government spending and the government deficit, instead of pushing up the private balance, accrues to the external balance (Kregel 1999, 40).

We also observe that the disposable income falls after about twenty periods. This is because of the decrease in wealth of the domestic sectors which result in increased flows into the foreign economy instead of the domestic economy. The rise in relative wealth of the foreign economy implies the rise in relative holdings of domestic assets and thus a rise in outflow of financial flows, and thus a fall in domestic disposable income. To add to this, holdings of domestic assets

[10] Since we make the small, open-economy assumption, there is no feedback effect that increases the spending of the foreign country in response to the increase in spending of the domestic country. Thus, gross foreign receipts do not increase significantly.

by the domestic sectors are replaced with holdings of foreign assets which have much lower yields, i.e., the cost of reserves argument. The fall in disposable income implies the same recessionary channel that was explained in the previous section. The lower disposable income, the lower the consumption which implies a lower level of income. The lower level of income subsequently results in a lower target level of capital which, in turn, pushes down the level of investment. The fall in the level of investment results in a further fall in the level of income and so on. Note that, concurrently, wages, which are a function of income, also fall due to the fall of income which, in turn, further depresses disposable income.

Figure 4: Godley Balances - Scenario 2



On analyzing the Godley balances, we see that government spending, or the rise in the government deficit, initially benefits both the household and foreign sector by boosting their surpluses at the same rate until around the 110th period. After this point, the household surplus falls sharply while the foreign surplus continues to expand. The government deficit during these periods seems to behave pro-cyclically with the household deficit, implying the inadequacy of policy. This is an example of a deficit of the "bad" kind (Wray 2019). Since there is a concomitant fall in the household surplus and a rise in the government deficit. The bad deficit point is also followed by evidence of falling income which implies falling tax revenues and thus no recovery for the initial rise in government spending. Capital stock, after increasing initially,

falls much more sharply and for a longer period of time. This implies an increase in capacity constraints for the developing economy. On the other hand, the foreign sector barely finds itself running a deficit.

It is clear from this that, in the long run, not only does the rise in the government deficit result in the household sector surplus and capital stock to deteriorate, it benefits the foreign sector, thus increasing the divergence between developed and underdeveloped countries. This leaves us with a very unsatisfying result: government spending encourages the divergence of income and wealth inequality between developed and underdeveloped countries. The driving forces behind this result are rising global imbalances and current account outflows (which are a vicious cycle[11]), both of which are stylized facts of free trade and capital mobility. In the next simulation, we will emphasize that the issue is not government spending but an inconducive international financial system.

5.3 Scenario 3: Domestic Fiscal Expansion with Import Substitution

This scenario is complementary to Scenario 2 in the previous section. We have the same fiscal stimulation as the previous scenario. In the previous scenario, we observed that it was primarily the foreign sector that benefited from a rise in government spending. Leaving one with such a conclusion could turn them against government spending and may promote the logic of austerity. Since we identified the problem as rising global imbalances and rising current account outflows, we try to offset these outflows by reducing the import propensity of the domestic economy. We could explain this fall in the import propensity by imagining that the domestic economy, in addition to boosting its government stimulus, decided to pursue industrial policy or control trade to some small extent which results in the import propensity falling by 0.3 percent. From Figure 1, we can clearly see that complementing government spending with a declining import propensity is extremely beneficial to the domestic economy. We find that domestic income rises by 12 percent from the baseline, at steady state.

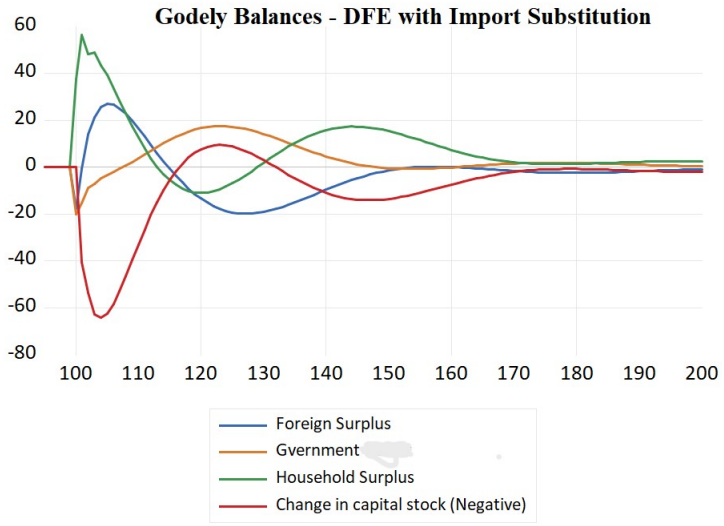
[11] Since rising debt implies rising interest payments and financial flows, which if cannot be paid, must be capitalized and contribute further to rising imbalances.

An initial fall in the rate of income increase is caused by the initial rise in the net wealth of the foreign sector (Figure A6). This rise in net wealth is driven by the initial current account deficit,[12] driven by a rise in financial and trade flows. The rise in financial and trade flows is driven by the same factor as the previous section: the rise in domestic income. However, we also observe a rise in the net wealth of the household sector which has a positive effect on disposable income, which in turn drives the expansion channels of the economy.[13] The fall in import propensity allows leakages (external outflows) to be slow enough that the emerging economy has enough time to benefit from the stimulation. The rise in the wealth of the household, being significantly higher than the rise in wealth of the foreign sector, increases financial inflows into the domestic economy (since the domestic sector holds more foreign claims). This, in turn, reduces the demand for international reserves, which after initially increasing four-fold (relative to the baseline), reduce significantly.

We also observe that the expansionary effects of this policy, while initially resulting in a marginal increase in the government deficit, result in an almost 15 percent fall in government deficit. This shows the importance of import substitution to the sustainability of public debt. Here we observe a "good deficit," wherein government spending caused a fall in the deficit through a rise in tax revenues (Wray 2019). On the other hand, we saw that in Scenario 2, we had a deficit of the "bad" kind (Wray 2019), driven by leakages and falling tax revenues. Thus the importance of import substitution as a complement to government spending for an emerging economy cannot be stressed enough. Presented below is the evolution of the Godley balances. We see that the initial rise in the government deficit does all the right things. It increases the household surplus, it increases the stock of capital, and it even stimulates the developed economy to a lesser extent. We see that the stimulation of the private sector results in a "good deficit" with tax revenues increasing to offset the government deficit created in the initial periods Wray (2019).

[12] After a very brief current account surplus.
[13] The disposable income channel is explained in scenario one and two.

Figure 5: Godley Balances - Scenario 3

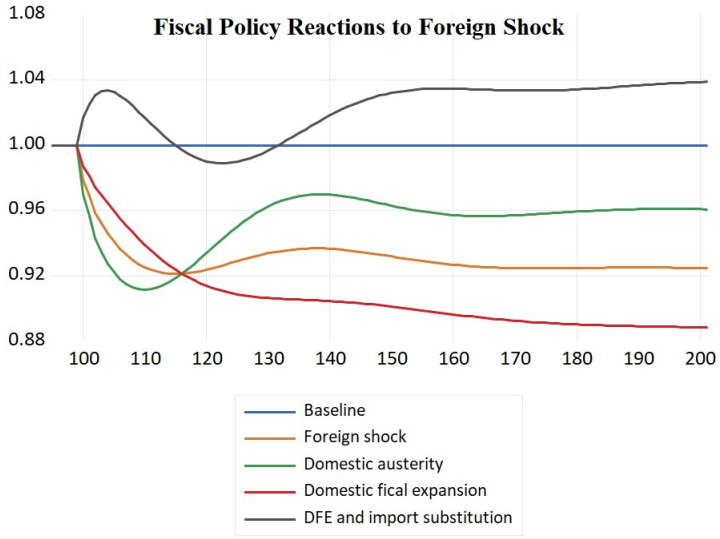


We also see that the government deficit rises as the household surplus falls, displaying countercyclicality. Thus, we can conclude that import substitution is required for the emerging economy to successfully stimulate its economy, and reap the benefits of this stimulation both in the short and long runs. In this case, the benefits do not simply flow out to the developed economy, as they did in the previous scenario. We see that capital stock expands, thus reducing capacity constraints, identified as the primary impediment to development and structural change.

6 POLICY RESPONSES TO FOREIGN SHOCKS

In this section, four potential policy recommendations for the underdeveloped domestic economy when the foreign developed country's income falls by 6.25 percent. First, we see what happens if the government does nothing. This is identical to Scenario 1. Second, we see what happens if the government follows the austerity policy by reducing government spending. The fall in government spending is equivalent to the rise applied in Scenario 2. Third, we explore what happens if we increase government spending. Fourth, we complement the increase in government spending with a decline in the import propensity. The results of the simulation are reported below.

Figure 6: Policy Responses to Foreign Shock



In response to the foreign shock, the best response was to raise government spending, complemented by policy that causes a fall in the income propensity of imports. In this case, the level of income only fell relative to the baseline for a short period and converged to an income level 4 percent higher than the baseline. The next best choice was foreign austerity which resulted in income fluctuating between 3 and 10 percent less than the baseline, converging at 4 percent less than the baseline. However, austerity causes a significant amount of sharp income volatility which is undesirable. When we attempted to conduct the same experiment with much sharper austerity, reducing government spending by almost 70 percent less than the baseline, we found that income converges to roughly the same level as the scenario of domestic fiscal expansion with import substitution. However, the volatility of income in response to the policy was significant. Income fluctuated between 15 percent less than the base line and 4 percent more than the baseline with income being less than the baseline for a long period of time. If we had a financial post-Keynesian investment function instead of a quasi-Kaleckian one, we would have been able to better document the negative effects of income volatility on investment, and thus even the rise in income in the austerity scenario is an overstatement. The next best solution was to not change anything in response to the shock, where the level of domestic income fell by

around 8 percent. The worst policy performance was in increasing government spending without any import substitution.

While it is true that government spending on its own seems to be a weak response to a crisis of an international origin, we have to acknowledge that government spending, when complemented by import substitution is by far the best solution. In the latter case, income is almost 10 percent higher than the next best policy choice and 16 percent higher than the worst policy choice. Since the crisis was not the fault of the domestic developing economy, the international financial system must accommodate non-neoliberal policy to ensure that the crisis does not increase the divergence between the developed and the underdeveloped economies. Morally, it is completely reasonable to demand controls and barriers during times when crises are transmitted internationally.

7 LIMITATIONS AND CONCLUSIONS

7.1 Limitations of the Model

As a teacher of mine, Anand Shrivastava, once said: *"All models are wrong but some models are useful."* This model is also wrong and incomplete for several reasons. This section will attempt to summarize some of the most significant limitations of the model, to make it easier for any researcher to improve the insights provided by the model. Even with improvisations, the model will continue to be incomplete, but addressing concerns will make the model's message more robust.

Coming from a Minskyan and financial post-Keynesian tradition, we are first to point out the subordination of the investment function in the model. Using the benchmark post-Keynesian investment function from Godley and Lavoie (2012) in the previous chapter, we explain how the model fails to capture several recessive channels and subordinates the investment decision to past consumption decisions and disposable income. For this reason, we must admit that the simulation of the investment decision need not be accurate. This is especially true for the previous section, as explained above, that compared policy choices.

This model also fails to capture changes in asset prices and changes in the exchange rate, which are both important channels in understanding the persistence of underdevelopment and fragility. Once again, this is explained in detail in the previous section. Perhaps most importantly, this model does not have a theory of the exchange rate, although we employ a fixed exchange rate.[14] This model operates on a given and not fixed exchange rate. A given exchange rate model implies that the pegging of the exchange rate has no behavioral implications on the stock of international reserves, the domestic interest rate, or domestic fiscal policy. This is a serious limitation because we do not observe a consequence channel of the emerging economy trying to maintain a peg. This can be fixed by allowing the domestic central bank to hold an additional foreign asset that has to be adjusted to maintain the peg. Alternatively, we could ascribe a behavior to the exchange rate such as equation (3) from Section 3.

We also admit that the model is not sufficient to capture the heterogeneities presented by the currency hierarchy, as this would require more than a two-country model. The use of only two countries, combined with not allowing the foreign economy to purchase its own liabilities, impedes capital flight.

7.2 Conclusions

This paper improvised on the existing currency hierarchy literature. These improvisations allowed us to uncover certain relationships implied by the liquidity-predicated currency hierarchy. The two relationships emphasized in this thesis were the demand for international reserves for the precaution motive as a margin of safety to improve sovereign balance sheet structure, and the relationship between domestic and foreign interest and exchange rates. These behavioral equations were then inputted into a stock-flow consistent model to understand how an emerging economy would respond to shocks, keeping in mind the influence of the currency hierarchy. The model showed us the transmission of international shocks from the center to the periphery, and also illustrated how the periphery may struggle to stimulate its own economy through government spending. The takeaway from this thesis is not that government spending

[14] This was pointed out to the author by Sam Levey during the proceeds of the *Association for Institutional Thought* conference, 2023.

has a negative effect on the emerging economy but that government spending needs to be complemented by import substitution to have positive results. We also saw that austerity in the center adversely impacts economic activity in the south.

In a nutshell, we saw that stimulative action carried out by the periphery's government, on its own, benefits the center, and recessive pressures in the center harm the periphery. These simulations highlight the need for mechanisms that prevent an asymmetric transmission of crisis from the center to the periphery. We also highlight the need to have mechanisms which allow the government to undertake effective stimulative policy, without only the center benefiting. To craft policies that prevent the unfair transmission of contractions from center to periphery, and the unfair benefiting of exclusively the center during fiscal expansion of the periphery, we need to think about international cohesion. Stock-flow consistence displays a world-systems perspective, where we see that, when one economy does better than the other, there is a divergence tendency. This is because the rise in the wealth of one economy implies future cash inflows which can be inferred by a rise in stocks, thus causing a snowballing of one economy relative to the other. The importance of international cohesion, at least among emerging economies, arises because of the absence of non-partisan international organizations. Current international organizations support neo-liberalism which involves free capital mobility, free trade, and private finance. These principles are clearly incompatible with the goal of blocking asymmetric international transmission of crisis and pro-development policy. As the simulation showed, at the least we would need import substitution to allow fiscal expansion in the periphery to positively impact economic activity. Even the idea of trade and capital controls is taboo from the perspective of prevailing international organizations.

The ideal solution, in theory, which eliminates the currency hierarchy all together, is Keynes' (1980) Bancor plan. These plans design payment systems such that global imbalances are resolved by forcing surplus economies to spend their current account surpluses, thus stimulating economic activity in all participant countries. This is done through the creation of an account book and a unit of account which is "imaginary" and cannot be withdrawn. The two caveats of these plans are that they need to be improvised to support structural change which may require the tolerance of current account deficits for small developing economies, and that they are far too

radical, implying a high resistance to change. This plan would require a very powerful international cohesion between countries to overthrow the currently prevailing dollar hegemony and ensure that no other currency arises as a hegemony. We would also require a non-partisan board of academics to decide thresholds of tolerance for deficits and surpluses without creating conflict.

There exist other solutions, which do not necessarily address the elimination of the currency hierarchy but contribute to the suppression of its recessive effects. The main appeal of these policies would be that they are slightly more practical and do not require a restructuring of the entire international financial system. Nonetheless, they would all require international cohesion of some sort to overthrow the neo-liberal ideology of current international organizations. The first such solution would be the use of capital and trade controls—as explained above—to relax balance-of-payment constraints. Advocating for import substitution and going against free trade and the free mobility of capital will not be an easy task.

Another interesting solution presented by Diamand (1978), Bresser-Pereira (2016), and Kregel (2018) is that of multiple exchange rates. This solution would involve the use of different exchange rates for different sectors of the economy. The government depreciates the currency or, alternatively, subsidizes industries for sectors it wishes to stimulate, so that they may be competitive internationally. This would promote structural change, provide some policy autonomy to emerging economies, and improve their position in the currency hierarchy if they are able to make their currencies scarce (increase demand for their currencies) with current account surpluses. Another alternative, imported from Nair (2023), would be financial regulation that ensures that the currency dealer behave as the Cambists assume they do. This would ensure that dealers profit only from bid–ask spreads and not from taking speculative positions. The Cambist approach, as explained in Nair (2023), passes on differences between interest rates and liquidity to the forward premium instead of directly influencing the spot exchange rate. Thus, the adverse impacts of the international transmission are passed on to the financial sector instead of the productive sector. Yet another solution is macro-prudential policy. Macro-prudential policy can both discourage foreign borrowing and incentivize foreign investment in the peripheral

economy, thus easing the balance-of-payment constraint, ensuring higher levels of stability and creating the conditions for peripheral growth.

What all these solutions have in common is the need for international cohesion, which cannot be emphasized enough. If development is to ensue, emerging economies will need to come together to reform the currently dominant neo-liberal regime.

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A ACCOUNTING EQUATIONS

A.1 Top-Half of Transactions Flow

A.1.1 *Verticals*

GDP - Income Side

$$\pi = Y - W - Dep \tag{1}$$

GDP - Expenditure Side

$$Y = C + I + G - M + X \tag{2}$$

Disposable Income

$$YD_R = W + R_D^S D_{H-1}^S + R_B^S B_{H-1}^S + (xr) R_B^{ROW} B_{H-1}^{ROW} + \pi_F^S + \pi_B - T \tag{3}$$

Household Wealth

$$V_H = V_{H-1} + YD - C \tag{4}$$

Stock of Capital

$$K = K_{-1} + I - Dep \tag{5}$$

Government Wealth

$$V_G = V_{G-1} + T + \pi_{CB} - G - R_B^S B_{-1}^S \tag{6}$$

Foreign Wealth Against Domestic Economy

$$V_{ROW} = V_{ROW-1} + M - X + R_B^S B_{ROW-1}^S + \pi_F^{ROW} + \pi_B^{ROW} \tag{7}$$

Domestic Bank Profits

$$\pi_B = R_L^S L_{-1}^S - xr(R_L^{ROW} L_{B-1}^{ROW}) + R_{Res}^S Res_{-1} - R_D^S D_{-1}^S \tag{8}$$

Domestic Firm Net Profits

$$\pi_F = \pi - R_L^S L_{F-1}^S - (xr) R_L^{ROW} L_{F-1}^{ROW} \tag{9}$$

Domestic Central Bank Profits

$$\pi_{CB} = R_B^S B_{CB-1}^S + (xr) R_B^{ROW} B_{CB-1}^{ROW} - R_{Res}^S Res_{-1} \tag{10}$$

Foreign Financial Sector Profits

$$\pi_B^{ROW} = R_L^{ROW} L_{-1}^{ROW} - R_B^{ROW} B_{-1}^{ROW} \tag{11}$$

A.1.2 *Horizontals*

Distribution of Firm Profits to Domestic Economy

$$\pi_F^S = (\frac{E_{H-1}^S}{E_{-1}^S}) \pi_F \tag{12}$$

Distribution of Firm Profits to Foreign Economy

$$\pi_F^{ROW} = \pi_F - \pi_F^S \tag{13}$$

Interest on Deposit

$$Int_D^S = R_D^S D_{H-1}^S \tag{14}$$

Interest on Domestic Bonds

$$Int_B^S = R_B^S B_{H-1}^S + R_B^S B_{CB-1}^S + R_B^S B_{ROW-1}^S \tag{15}$$

Interest on Foreign Bonds

$$Int_B^{ROW} = (xr) R_B^{ROW} B_{CB-1}^{ROW} + (xr) R_B^{ROW} B_{H-1}^{ROW} \tag{16}$$

Interest on Foreign Loans

$$Int_L^{ROW} = xr(R_L^{ROW} L_{B-1}^{ROW}) + xr(R_L^{ROW} L_{F-1}^{ROW}) \tag{17}$$

Interest on Domestic Loans

$$Int_L^S = R_L^S L_F^S \tag{18}$$

Interest on Domestic Bank Reserves

$$Int_{Res}^S = R_{Res}^S Res_B^S \tag{19}$$

A.2 Bottom-Half

A.2.1 *Verticals*

Household Deposits

$$D_H^S = V_H - (xr)B_H^{ROW} - E_H^S - B_H^S \tag{20}$$

Firm Loans

$$L_F = K - E^S \tag{21}$$

Loan Composition

$$L_F^S = L_F - xr(L_F^{ROW}) \tag{22}$$

Domestic Bonds Issue

$$B^S = -V_G \tag{23}$$

Central Bank Reserves

$$Res = D_H^S + xr(L_B^N) - L_F^S \tag{24}$$

MISSING EQUATION: Central Bank Reserves

$$Res = B_{CB}^S + (xr)B_{CB}^{ROW}$$

Foreign Loans Issue

$$L^{ROW} = xr(B^{ROW}) \tag{25}$$

Foreign Demand for Domestic Bonds

$$B^S_{ROW} = V_{R_W} - E^S_{ROW} \tag{26}$$

A.2.2 *Horizontals*

Equity Supply

$$E^S = E^S_H + E^S_{ROW} \tag{27}$$

Central Bank Demand for Domestic Bonds

$$B^S_{CB} = B^S - B^S_{ROW} - B^S_H \tag{28}$$

Foreign Bond Supply

$$B^{ROW} = xr(B^{ROW}_H + B^{ROW}_{CB} \tag{29}$$

Domestic Bank Demand for Foreign Loans

$$L^{ROW}_B = L^{ROW} - L^{ROW}_F \tag{30}$$

B BEHAVIORAL EQUATIONS

B.1 Flows Functions

Consumption Function

$$C = \alpha_1 YD_{R-1} + \alpha_2 V_{H-1} \tag{31}$$

Imports

$$M = \mu^S Y_{-1} \tag{32}$$

Exports

$$X = \mu^N Y^N \tag{33}$$

Income Tax

$$T = \theta Y D_{R-1} \tag{34}$$

Depreciation

$$Dep = \delta K_{-1} \tag{35}$$

Investment Function

$$I = \gamma(K^T - K_{-1}) + dep \tag{36}$$

Target Capital Stock Function

$$K^T = \kappa Y_{-1} \tag{37}$$

Wages Function

$$W = \nu Y_{-1} \tag{38}$$

B.2 Portfolio Choice Functions

B.2.1 *Household*

Return on Foreign Bonds

$$Er_{R_B^{ROW}} = R_{B-1}^{ROW} + \Delta xr \tag{39}$$

Return on Equity

$$Er_{E^S} = \frac{\pi_F}{E^S} \tag{40}$$

Disposable Income Wealth Ratio

$$DIWR = \frac{YD_{R-1}}{V_{H-1}} \tag{41}$$

Demand for Domestic Bonds

$$B_H^S = V_{H-1}(\lambda_{20}^S + \lambda_{21}^S R_{D-1}^S + \lambda_{22}^S R_{B-1}^S + \lambda_{23}^S Er_{R_B^{ROW}} + \lambda_{24}^S Er_{E^S} + \lambda_{25}^S DIWR) \tag{42}$$

Demand for North Bonds

$$B_H^{ROW} = V_{H-1}(\lambda_{30}^S + \lambda_{31}^S R_{D-1}^S + \lambda_{32}^S R_{B-1}^S + \lambda_{33}^S Er_{R_B^{ROW}} + \lambda_{34}^S Er_{E^S} + \lambda_{35}^S DIWR) \tag{43}$$

Demand for Equity

$$E_H^S = V_{H-1}(\lambda_{40}^S + \lambda_{41}^S R_{D-1}^S + \lambda_{42}^S R_{B-1}^S + \lambda_{43}^S Er_{R_B^{ROW}} + \lambda_{44}^S Er_{E^S} + \lambda_{45}^S DIWR) \tag{44}$$

B.2.2 *Rest of the World*

$$E_{ROW}^S = V_{ROW}(\lambda_{20}^{ROW} + \lambda_{21}^{ROW}(R_B^S - \Delta xr) + \lambda_{22}^{ROW}(Er_{E^S} - \Delta xr) + \lambda_{23}^{ROW}\frac{Y_{-1}^N}{V_{ROW-1}}) \tag{45}$$

B.3 International Reserves Function

Demand for International Reserves

$$B_{CB}^R = (FA^R - p_{mos}(\frac{1}{r_B^S})Y^f) \tag{46}$$

Gross Financial Claims Against Domestic Economy

$$FA^R = B_R^S + E_R^S + L^N \tag{47}$$

Gross Income Receivable in Foreign Exchange

$$Y^f = x + r_B^N B^N \tag{48}$$

B.4 Firm Loan Choice

$$L_F^{ROW} = L_F(\psi_4 + \psi_2 R_L^S + \psi_3 R_L^N) \tag{49}$$

B.5 Domestic Interest Rate Function

$$r_B^S = r_{B-1}^S + \alpha(\Delta r_B^N + mos(l^S)) \tag{50}$$

B.6 Liquidity premium calculation

$$l^S = \frac{B_R^S + E_R^S + xr(L^N)}{xr(B^N)} \tag{51}$$

B.7 Domestic Current Account

$$CA = (X - M) + R_B^{ROW} B^{ROW} - R_L^{ROW} L^{ROW} - \pi_F^{ROW} - R_B^S B_{ROW}^S \tag{52}$$

C SUPPLEMENTARY GRAPHS

Figure A1: Foreign claims over domestic economy

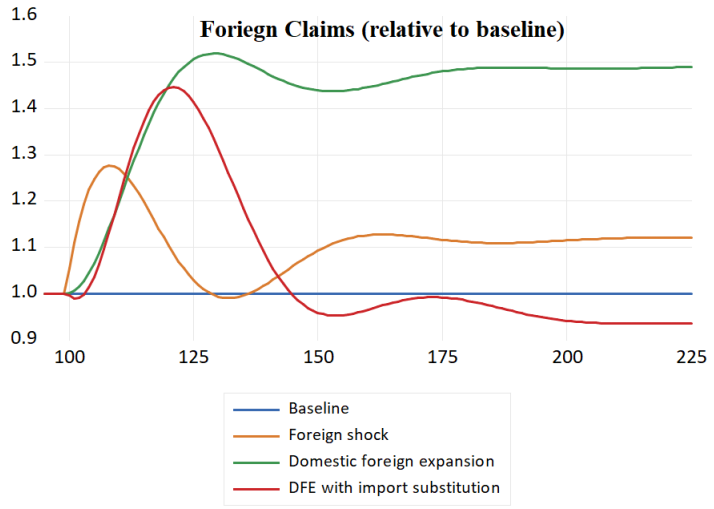

Figure A2: Gross Foreign Receipts of Domestic Economy

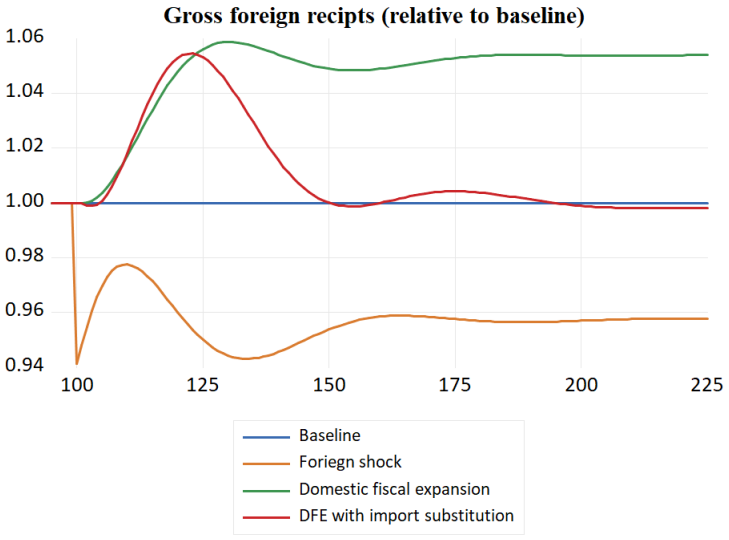

Figure A3: Current Account Balance

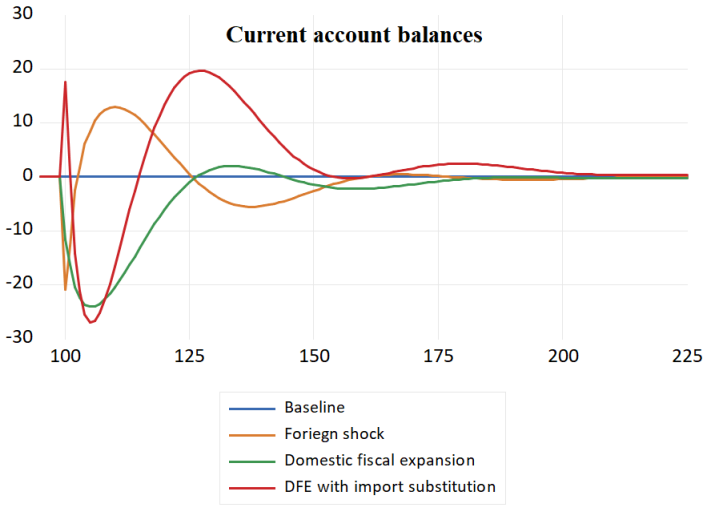

Figure A4: Government Wealth

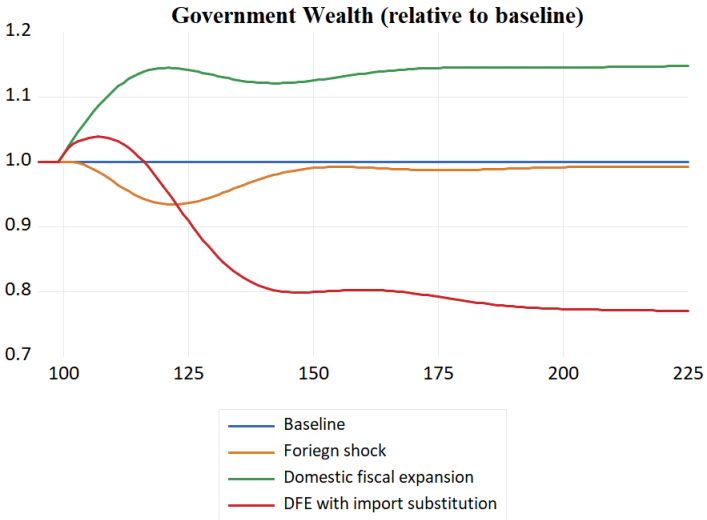

Figure A5: Household Wealth

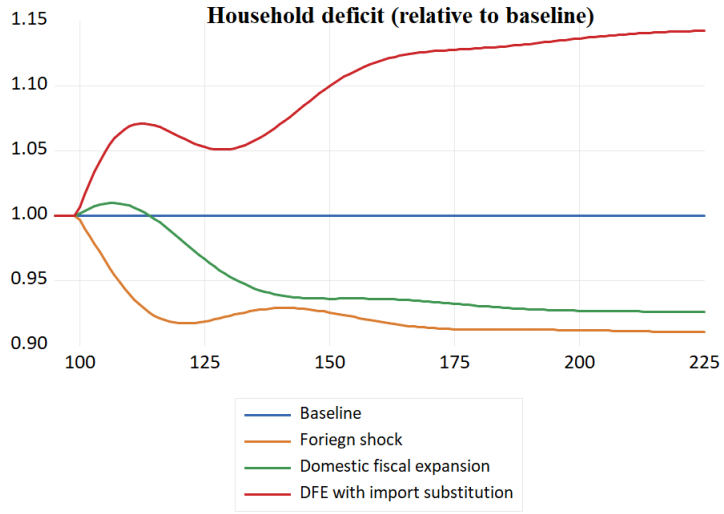

Figure A6: Foreign Wealth