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WHEN MINSKY AND GODLEY MET THE DEPENDENTISTAS: THE CURRENCY HIERARCHY IN A STOCK-FLOW CONSISTENT MODEL

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All models are wrong but some models are useful

- Anand Shrivastava

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I look forward to a career of battling the hollow promises and blatant lies of neo-liberalism.

PLAGIARISM STATEMENT

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Abstract

Underdevelopment often is conceived as being reproduced domestically. This thesis emphasizes the international forces that enable the persistence of underdevelopment. The first part of this thesis lays out a liquidity approach to underdevelopment which suggests that failure to create capacity arises from the asymmetries of international financial relationships. The second part of this thesis investigates a specific financial asymmetry, the currency hierarchy. We point out that the uncovered interest rate parity and the divergence from it are necessary conditions for the emergence of the currency hierarchy. Using ratios from the balance sheet of the currency issuer, we propose a quantification of the currency hierarchy. A weak currency must resort to three mechanisms; changes in interest rates, 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) 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) any attempts to stimulate the emerging economy through government spending benefit primarily the developed economy while harming the emerging economy's private sector, assuming free capital and goods mobility. This in turn does not allow an income-effect (tax revenue) to reduce government debt in the emerging economy. Simulations show import controls to be a solution. We suggest the need for international cohesion between emerging economies to create a more conducive international financial and trade system, halting the reproduction of underdevelopment.

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1 A LIQUIDITY APPROACH TO UNDERDEVELOPMENT

> 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 that we confront today should have been disseminated across the globe to solve several issues. Only in a "lunatic asylum", borrowing the phrase from Keynes, 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 gains 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 (1964) instinct is that these answers lie in uncertainty, finance, and a monetary theory of production. Building on this thought, this paper attempts to explain the persistence of underdevelopment considering uncertainty, money, and finance.

This thesis highlights the role of the contemporary international financial system, specifically, monetary asymmetries (currency hierarchy and dollar hegemony), as the force that creates a divergent environment between developed and underdeveloped countries. We argue that the divergence of development between nations can be attributed to the existence of the currency hierarchy. Consistent with chapter seventeen of Keynes (1964)'s *General Theory*, we argue that the existence of a high liquidity premium on money (low liquidity premium on other assets) discourages physical investment which in turn impedes structural change and development in economies that need it most. Crudely, the liquidity premium can be understood as the force 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 chose to store their wealth in bank deposits[1] than investing in a business.

In emerging economies, the currency hierarchy is introduced as the cause of this high liquidity premium on money (and low liquidity premium on other assets). If we are to consider an international version of chapter seventeen's own-rates framework, then the "money" that "rules the roost" is the international reserve currency (the dollar). Thus, the liquidity premium on the dollar (relative to other currencies and assets) is too high to induce investment in underdeveloped economies. Analogous to the above example of liquidity premium, is the force that convinces a carry trader to not exploit an arbitrage. 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 debt and ownership of assets denominated in dollars. Thus an emerging economy not only faces a high liquidity premium from uncertainty on investment relative to the domestic currency, but also faces a high liquidity premium from the uncertainty of assets and liabilities being denominated in their domestic currency.

In this section, the concept of the currency hierarchy will be introduced, and the approach toward understanding underdevelopment as a monetary phenomenon will be discussed. Prevailing literature on the latter, while present, does not draw deeply enough from Keynes (1964) understanding of uncertainty and liquidity. This is primarily because literature formulates the currency hierarchy on the means of storage function of money and identifies the high liquidity premium to impede development through the Schumpeterian credit-investment-income channel rather than the finan-

[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.

cial post-Keynesian expectations (liquidity premium)-credit/investment-income channel. Note that credit and investment cannot be separated in the financial post-Keynesian analysis, since there is no quantity rationing on credit.

1.1 An Introduction to the Currency Hierarchy

The currency hierarchy, as the term suggests, states that there exists a hierarchy between the different currencies (units of account) created by different sovereigns. The hierarchy of currencies suggest that different currencies are heterogeneous and agents/sectors are not indifferent on the choice of currency denomination of assets and liabilities. This heterogeneity is acknowledged to have real implications, on the decision to invest and the financial stability of an economy. The currency hierarchy intends to display a structurally determined preference ordering of currencies. The apex currency is the one that all the international account book and prices are denominated.

The first approach to the currency hierarchy orders preferences by liquidity, and how well a currency serves as a means of payment - domestically and internationally. The ability of a currency to be exchanged for the reserve currency (the dollar) determines the ranking of the currency. This ability is often contingent on the ability/desire of the market to absorb that currency (liquidity). Typically, the most preferred currency is one which has the most debt denominated in its unit of account (Kaltenbrunner 2015). This implies the existence of a stable demand for said currency. Alternately, the most preferred currency may also be understood to be the one which possess the strongest (thickest) spot market, which would imply the existence of a non-profit dealer that guarantees liquidity[2] (Davidson 1982). Currencies may also be deemed strong if the balance sheet structure of its sovereign issuer is robust, i.e. has sufficient level of liquidity as a precaution. The strength of a currency may also arise from a stable demand for real resources from the respective country. If this demand for real resources is consistent and allows current account surpluses, then the currency is scarce and in demand since other economies desire to purchase the real resources of the respective economy.[3] Thus a consistent demand for real resources can also result in a liquid market for a currency. This conception of the currency hierarchy is analogous to the concept of

[2] Liquidity is typically defined as the ability to transact in large volumes without significant changes of value.

[3] I acknowledge Professor Dimitri Papadimitriou for bringing to my attention this last point, which I feel has been overlooked by the currency hierarchy literature.

a money hierarchy, introduced by post-Keynesians such as Minsky (Bell 2001), modern money theory (Tcherneva 2016), the money-view (Mehrling 2012), and Marxists such as Foley (1989).

The second approach generates a hierarchy predicated on the store of value function of money (Andrade and Prates 2013; de Paula et al. 2017; Herr and Nettekoven 2022). Currencies with the most stable values are cited to be the strongest. The stability of value of a currency also derives from a stability of demand for the currency. This approach focuses on the stability of demand for the currency as a portfolio choice. However it does not explain how this stability of demand and value arises in the first place. The former approach focuses on the liability side while the latter focuses on the asset side (Ramos 2019). The next section will briefly explain why we adopt the former approach and the next two chapters will delve in more detail.

1.2 Underdevelopment as a Monetary Phenomenon

Herr and Nettekoven (2022) author a fantastic paper on the role of the currency hierarchy in the persistence of underdevelopment. They argue that the countries whose currencies are unable to perform the functions of money[4] at least domestically are the economies which will struggle the most to overcome the problem of underdevelopment. The paper identifies the peculiarity of money to lie in its 'asset-protecting function'. Herr and Nettekoven (2022) predicates the liquidity premium (an implicit return) and the hierarchy on the ability of the asset to preserve value, or have stability. This approach thus suggests that it is the store of value function of money that determines the liquidity premium and the strength of the currency. The less volatile the value of the currency is, the higher up the hierarchy it resides. This idea emphasizes the stability of demand for a currency generated from the demand for it as an asset to anchor value on a unit's balance sheet (Benney and Cohen 2022). The stability of value for the currency acts as a precaution and a hedge against uncertainty.

Herr and Nettekoven (2022) argue that a weak currency discourages domestic and international agents from issuing liabilities and borrowing denominated in the weak currency. This is because

[4] Recall that the functions of money are as a unit of account, means of payment, means of storage and medium of exchange.

of the uncertainty caused by the volatility of the burden of debt emanating from exchange rates volatility. Thus to borrow in the weak currency agents would be charged a higher interest rate by lenders to compensate for exchange rate risk further discouraging borrowing in that currency. Moreover, the weak currency, which performs as a poor store of value will not be the agents' consistently preferred portfolio choice (asset).[5] This implies that the creation of debt in the weak currency, even if it ensues, will place pressure on the exchange rate. This is because agents who are paid using the credit created in the weaker currency would prefer to hold more stable currencies. They would thus exchange their receipts of the weak currency for a stronger currency, possibly creating an excess supply of the weak currency and further weakening its role as a store of value. Herr and Nettekoven (2022) empirically evaluate the strength of a currency using both an asset side and liability side indicator; the fraction of total deposits in the dollars relative to total broad money (deposit dollarization) and the fraction of total credit denominated in dollars relative to total credit (credit dollarization). The exchange rate pressure opens doors to several undesirable phenomena such as an inflationary push through rising import costs and high pass-through, the risk of activation of a price-wage spiral, a change in the debt burden, and higher current account deficits in response to a depreciation when the Marshall-Lerner condition does not hold. Rises in interest rates on the other hand, increase cash commitments (interest payments) and debt burden of units and may even discourage investment – resulting in increased fragility (Minsky 2008b). The rise in interest rates may also result in fall of asset prices, since the older instruments that pay lower returns must be sold at a loss to compensate for the lower returns (to induce the ownership of these older assets). If lending is collateralized, this channel presents another avenue to financial fragility. For these reasons, countries may prefer to split the pressure between the interest rate and the exchange rate, and not allow just one of these prices to adjust.[6]

Using the asset and liability approach to understanding the strength of a currency, Herr and Nettekoven (2022) explain that in a weak currency economy, investment is impeded by the disability of domestic banks to issue reasonably (competitively) priced credit. The authors focus on a Schum-

[5] Except speculators who hope to profit from the volatility. This demand is however neither stable nor consistent. Reasons for instability are explored in chapter two.

[6] We must acknowledge, however, that the interest rate and exchange rate are highly interdependent in complex ways.

peterian credit-investment-income mechanism which suggests that difficulties in credit creation impede the investment and creative destruction process. This points to the problem originating in the private financial sector. With the effects of the currency hierarchy rationing credit. Moreover, the preference to hold assets denominated in stronger currencies adds to exchange rate pressure, further feeding back into difficulties of credit. The weakness of credit and investment manifests itself in a weak income creation process which at best stagnates the underdeveloped economy.[7] Thus underdeveloped economies with weak currencies face a vicious credit creation-asset allocation cycle that results in both fragility and more costly credit.

While the following chapters follow a similar framework of a monetary theory of underdevelopment, there are two substantial differences from (Herr and Nettekoven 2022). First, the approach presented in the following chapter predicates the strength of a currency on its means of payment function, and not its role as asset protection. The means of payment function of money focuses on the structural (balance sheet) determinants of a currency's value determination. It permits a formulation of the hierarchy on the quantity of debt denominated in that currency. The higher the quantity of debt, the more stable the demand for that currency to eliminate liabilities, and thus the more stable the value. This allows us to overlook the cyclical and speculative factors that influence the volatility of exchange rates and thus add noise to the currency hierarchy. It also allows us to compare currencies across the fixed-flexible spectrum more accurately as different central banks may prefer different degrees of exchange rate volatility to changes in their stocks of reserves and interest rates. Moreover, the means of storage function literature, takes the currency hierarchy as given and cannot answer the question of how the currencies with the most stable value attained this quality to begin with. The second difference involves moving away from the aforementioned Schumpeterian mechanism which focuses on the cost of credit (and credit rationing) as being the primary impediment to domestic investment. Building on chapter seventeen of *The General Theory*, we understand the importance of the cost of finance but prefer to give weight to expectations (namely, liquidity preference). The following chapters will explain investment as being impeded both by the cost of finance and the negative expectations implied by the existence of currency hierarchy.

[7] To make this point clearer we should elaborate the multiplier relationship between investment and income.

The liquidity approach to underdevelopment adds to the Schumpeterian credit-investment-income channel. We add an initial step, liquidity premium on money (USD); liquidity premium-credit-investment-income. This allows us to highlight two factors. First, the additional borrower's or increasing risk faced by the investors in emerging economies with weak currencies, i.e. the impact of the currency hierarchy on the investment decision. The liquidity preference of the investor determines the willingness of the investor to denominate their liabilities (initial finance/loan) in the domestic currency. This liquidity preference is also a function of the ability of the investor to fund[8] their initial finance (borrowing/loan) in the domestic currency. If the investor is not confident about these decisions then they will either not invest or will borrow in a foreign currency. This would result either in no investment (and structural change) or the use of foreign currency, and the emergence of future commitments denominated in foreign currency. The latter would imply some loss in monetary sovereignty, since there would be a need to acquire foreign currency. This could imply constraints on policy autonomy. Second, this highlights is the importance of government intervention in development financing. The government is the institution which can subsidize the cost of credit and ensure the creation of liabilities in its own currencies, since it does not need to concern itself with domestic liquidity and short-term profitability (Liang 2021). This is because it has a lower default risk relative to the private sector, since it issues its own-currency and cannot default in its own currency.[9]

Thus the impediment of investment, in the following chapters, does not come only from reluctant bankers but a mismatch of expectations between bankers, capitalists, and capital markets (Minsky 2008b). The adverse impact of the currency hierarchy carries itself to the investment decision function instead of the credit creation function. Thus the recessive impact of the currency hierarchy is primarily subsumed by expectations, and more specifically a higher borrower's risk which discourages investment. The lender's risk and the effect of the currency hierarchy on the lending decision works through the interest rate channel, thus suggesting the existence of only price rationing on credit and not quantity rationing.

8 Manage the liability structure, for example floating off shares.

9 Although balance of payment constraints could present an issue.

1.3 Structure of the Thesis

The first (this) chapter introduces the reader to the broad framework and arguments put forward in following chapters. The chapter explained how, in abstract terms, we expect the currency hierarchy to discourage investment and structural change, and invade policy space. The second chapter will trace the origins of the currency hierarchy to the uncovered interest rate parity (UIP). This chapter will explain the implication of a deviation from the UIP on the currency hierarchy. The UIP and the deviation from the UIP are explained to be necessary conditions to the formulation of the currency hierarchy. The UIP provides an interdependence between policy decisions and behavior of macroeconomic variables across countries. The deviation from the UIP provides space for the construction of a hierarchy predicated on a liquidity preference. To understand further the nature of the impacts of the currency hierarchy on the macro economy, the thesis will review the Cambist approach to the deviation and explain how Cambists tend to belittle the influence of the currency hierarchy on the macroeconomy. This will be followed by an alternate explanation of the deviation from UIP, one predicated on chapter seventeen of the General Theory - as the third chapter. This explanation will untangle the various mechanisms through which the currency hierarchy impedes macroeconomic activity. Chapters two and three will reveal three avenues to compensate for a weak currency hierarchy; higher interest rates, higher international reserves, and lower exchange rates. These will serve as the foundation for the next two chapters. The fourth chapter will formulate novel behavioral equations; an international reserves function and a subordinated interest rate function. These functions will attempt to capture the aforementioned 'various mechanisms that result in the currency hierarchy's influence on the macro economy. The fifth chapter will create a stock-flow model predicated on a new transactions-flow matrix. The structure of the model will depict the monetary and balance-sheet asymmetries implied by the currency hierarchy, and center-periphery relations. The novel behavioral equations and relevant shocks will be applied to the model to illustrate and simulate the mechanisms through which the currency hierarchy subordinates the domestic macroeconomy, in chapter six. The shocks will illustrate the transmission of external and international financial shocks on the domestic economy and illustrate the implications of domestic fiscal expansion. The simulation will highlight how the structure and size of the domestic economy has to adapt (often negatively) to decisions that were

not taken by them or for them. The asymmetry lies in the fact that the emerging economy, even when consciously attempting to expand using public spending is unable to do so. These exercises can be described as an exaggeration, as the model only highlights certain mechanisms explained in the following chapters. We admit that in reality there may exist other channels that could offset the highlighted recessive channels implied by the existence of the currency hierarchy. The seventh chapter advances policy recommendations and describes the many limitations of this model. In addition, to the usually advocated reforms of the international financial system, we introduce one new policy recommendation which suggests that if currency dealers behave a certain way, as the Cambists assume they do, the negative implications of the currency hierarchy could be offset.

2 THEORETICAL ORIGINS OF THE CURRENCY HIERARCHY

2.1 The Interest Rate Parity

The interest rate parity is crucial to understand the currency hierarchy. This condition suggests that the interest rates[10] set by different central banks bear some relationship to each other. The relations derived from a modification of the interest rate parity, to account for empirically observed deviations from parity, can provide insight into how liquidity influences the currency hierarchy from a quantitative perspective. Thereby advancing the qualitative money[11]/currency hierarchy-taxonomy that exists in current literature (Bell 2001; Mehrling 2012; Andrade and Prates 2013; Conti et al. 2013; Kaltenbrunner 2015). The interest rate parity, under conditions of free capital mobility, perfect substitutability, and free information, presents an argument that suggests that either interest rates have to be set uniformly or exchange rates between currencies have to change to compensate for interest rate differentials. This argument is predicated on the existence of arbitrageurs who would swoop in and transact if there is a difference in interest rates without an appropriate difference in exchange rates. Thus the flow gains (interest receipts) through an increase in the rate of return of a currency (or asset) are offset by a capital loss on its holding because of the interest rate parity. The following example will clarify.

Let us assume that the exchange rate is stated between two currencies, \$ (dollar) and *Rs* (rupees). The \$ is the foreign (key) currency while *Rs* is the domestic currency. Let us further assume that exchange rates are measured in terms of how much foreign currency (\$) is required to attain one unit of the domestic currency (*Rs*). This would mean that an increase in the exchange rate ($\frac{Rs}{\$}$) implies a depreciation of the foreign currency and an appreciation of the domestic currency. If the domestic interest rate is increased relative to the foreign interest rate, then carry traders borrow in the foreign currency and lend in the domestic currency, after exchanging the foreign currency for the domestic currency at the currency exchange, to make an arbitrage profit. This results in an excess demand for the domestic currency in exchange for the foreign currency that was borrowed

[10] It is crucial to understand the interest rate as Keynes (1964) does. The price paid in the future to acquire money now. Or simply, the forward premium (discount) on money.

[11] The money hierarchy functions on identical principles to the currency hierarchy, except that we assume a closed economy and compare various different assets instead of simply currencies. All assets are also denominated in a common unit of account.

at the lower rate, to lend in the domestic country at higher interest rates. In turn, this results in an appreciation of the domestic currency. Since in this example, the lenders are repaid in the domestic currency, when they exchange the domestic currency for the foreign currency to repay their initial borrowings to perform the carry trade, the appreciation of the domestic currency works against them, offsetting interest gains with capital losses. This would hold true even if the carry trader used their own funds, since ultimately, they would prefer to convert proceeds to their own currency, at which time they have to bear the capital loss. The uncovered interest rate parity is formalized below;

$$\Delta xr = r_d - r_f \tag{1}$$

Note that the uncovered interest rate parity is when we compare the future expected spot and the current spot as explained in the footnote below. Where the subscripts denote domestic and foreign, r denotes the interest rate, Δxr denotes the change in the spot exchange rate of the foreign currency in terms of the domestic currency.[12] In conclusion, the interest rate parity equation suggests that if the domestic interest rate is relatively higher an appreciation of the domestic currency will ensue since the exchange rate ($\frac{Rs}{\$}$) will rise.

The following subsection explains why the interest rate parity and an interdependence between interest rates of different central banks would exist irrespective of the exchange rate regime. The argument emphasized below is that if the government does not intentionally intervene, the private sector will prevent the volatility of exchange rates which would harm them (Davidson 1982). The second subsection will explain the significance of the empirically observed deviation of the interest rate parity to the formulation of the currency hierarchy. It is this deviation that allows for the emergence of liquidity. The second section of this chapter will introduce the reader to an alternate explanation of the deviation from the parity, the Cambist approach, and criticize it from a liquidity

[12] Lavoie (2022) expresses the change in the exchange rate as the difference between the future spot and the current spot exchange rate; $\Delta xr = s_{t+1} - s_t = r_d - r_f$. Where s denotes the spot exchange rate and the subscript denotes time.

approach to explain its inconsistency with the emphasis of the impact of the currency hierarchy on the macro economy.

2.1.1 *Exchange Rate Regimes and Policy Autonomy*

On the face of it, the loss of policy autonomy may seem to be valid only in the context of a fixed exchange rate economy.[13] Since only in a fixed exchange rate system would the central bank have to worry about attracting sufficient reserves to maintain the exchange rate peg. Davidson (1982), who advocated fixed exchange rates, explains why even flexible exchange rate economies would experience a loss of policy autonomy. His argument hinges on the fact that there may not exist a stable vector of prices (exchange rates) to clear the market. In a flexible exchange rate regime, speculation causes exchange rates to explode rather than converge. For this reason, to prevent catastrophe, explosion, and non-convergence authorities or some sector in the domestic economy is forced to intervene in currency markets.

> As long as the exchange rate system is perceived to be one of fixity, changes in portfolio composition tend to correct weaknesses due to 'temporary' trade payment imbalances. If exchange rates are perceived not to be fixed, however, individuals are no longer indifferent to the proportions of the various currencies they hold either as running or reserve assets(...). In the absence of financial institutions and well-established practices whose explicit function is to severely limit the time rate of change in the spot exchange rate, expectations can readily become elastic so that any current unexpected changes in the exchange rate, whether ephemeral or permanent, can induce destabilizing views about the future(...)Yet defenders of freely flexible exchange rates implicitly assume that such unconstrained systems must possess an equilibrium price vector that clears all markets simultaneously and that any observed change in exchange rates would be stabilizing rather than destabilizing(...) (Davidson 1982, 114)

The compiled extracts above explain that flexible exchange rates are not superior to fixed exchange

[13] Being unable to pursue autonomous monetary policy. i.e. change interest rates

rates for the reason that they cannot provide more policy autonomy.[14] This is because flexible exchange rates are likely to have a disequilibrium tendency created by speculators who do not perceive ceilings and floors on the currency's value. This would imply that exchange rates would not stabilize in a purely flexible regime. There are also clear disadvantages to the volatility of exchange rates and depreciation. Taylor (1998) explains how depreciation is likely to have negative implications on effective demand via the promotion of a skewed distribution of income, and unfavorable pass-through effects on the price of export goods due to imports becoming more expensive - leading to reduced international trade competitiveness. We can also observe from Latin American countries, how rapid depreciation of currency results in a depreciation-inflation-wage-price spiral that results in the domestic currency losing its place as a store of value and means of payment – sometimes even domestically. We can logically arrive at this result when we put together the works of Diamand (1978) and Kaltenbrunner (2015). More conventionally, depreciation in response to a rise in international interest rates would be a problem if the Marshall-Lerner condition does not hold. From a financial and balance-sheet perception, Minsky (1979) and Arestis (2002) explain how depreciation can cause balance-sheet weakening and make more units ponzi through no fault of the unit's. Thus every flexible exchange rate requires some norm of a floor and a ceiling to guarantee coherent functioning. This in turn implies a loss of policy autonomy.

> Governments still found that despite the greater flexibility of exchange rates, money supplies among countries remained interrelated, and the promised absolute control over the domestic money supply remained elusive. Many economists are perplexed as to why the exchange rate of some countries should depreciate significantly more than indicated by simple rules such as purchasing power parity or relative rates of monetary growth (Davidson 1982, 119).

Davidson (1982) also methodically explains that international reserves are held irrespective of whether the economy faces a fixed or flexible exchange rate (Davidson 1982, 113-118). The primary difference lies in who holds these international reserves. In the case of a fixed exchange

[14] This is not to say that the exchange rate regime decision is insignificant. This means there is no theoretical reason to pick one over the other, and the choice must be made case-by-case.

rate, it is the central bank that holds the international reserves, since it bears the responsibility of not allowing exchange rates to change and explode. Private balance sheets do not hold reserves since the central bank guarantees perfect sustainability between the different currencies.[15] They can get the foreign currency for a (near) certain rate of exchange at any moment. Thus they will not desire to hold international reserves and will hold domestic currency even if they have cash commitments in foreign currency. This relieves the need for foreign currency for Keynes (1964)'s precautionary and transactions-liquidity motives, as the domestic currency is a perfect substitute.

> By actively intervening in the exchange market to maintain a fixed price, the Central Bank makes foreign money a fully liquid asset, i.e. 'an asset that is perfectly substitutable for the domestic currency in meeting the liquidity needs of the domestic residents. In a fixed exchange rate system, therefore, an individual in country A should be completely indifferent between holding his own country's money or foreign money for meeting his contractual obligations as they come due in the future, as long as he is completely confident in the Central Bank's ability to maintain a fixed exchange rate (Davidson 1982, 111).

In the case of flexible exchange rates, the absence of a dealer (the central bank) willing to provide unlimited liquidity to the domestic currency in terms of the foreign currency results in imperfect substitutability between currencies. This 'imperfect substitutability' can be thought to arise from exchange rate risk. The imperfect substitutability suggests that irrespective of changes in interest rates, private portfolio choice will demand foreign currency (Lavoie 2022). They would demand foreign currency for at least the transactions and precautionary motives, especially if they have cash commitments denominated in foreign currency. Additionally, it would also be likely that domestic and foreign private portfolios would also demand other currencies for speculation (or hedge against said currency). Thus the fragmented cumulation of international reserves results in the private sector behaving like a decentralized dealer that tries to influence the exchange rate. However, the decentralization aspect results in increased chaos and speculation, and possibly the

[15] This would typically be the case unless the private sector perceives a significant default risk (insufficient reserves) from the side of the domestic central bank which would result in them being unable to maintain the peg.

need to hold more reserves than if the dealer was the central bank (Davidson 1982). This connects back to the aforementioned point of Davidson's, that speculation is likely to cause exchange rates to explode in a flexible exchange rate regime.

> Private sector foreign exchange market makers will therefore need more liquid assets as reserves to maintain 'long run equilibrium' (if there is such a thing!) in the face of short-term payment ebbs and flows than Central Bankers would require under a fixed exchange system (Davidson 1982, 115).

As already mentioned above, Davidson (1982) also suggests that the demand for international reserves from the private sector is likely to be higher than what would have been demanded by central banks. Thus reducing further the control the domestic central bank has over monetary policy, and increasing costs since reserves are costly (Rodrik 2006). The loss of control comes from the inability to sterilize exchange rates, since foreign portfolios prefer to hold some level of foreign reserves irrespective of how attractive terms are on the currency exchange. This once again ties back to the imperfect substitutability point.

> In sum, if expectations grow that domestic money will be less stable compared to foreign money in terms of purchasing power over producible goods, then the public will shift their liquidity preferences towards foreign money holdings. This increased demand for foreign currency as liquidity time machines will cause pressure on the exchange rate and the potential for a loss of export markets for foreigners unless the foreign Central Bank expands its money supply to mop up these additional liquidity demands. Consequently, as long as organized exchange markets are freely available to the general public and Central Banks feel a responsibility to alleviate liquidity pressures that can depress economic activity, the Monetarist view that under a regime of flexible exchange rates, each nation can pursue its independent monetary policy is not valid (Davidson 1982, 121).

Similarly Kregel (2007) explains how the rise in global private liquidity has paradoxically increased the desire for international reserves in spite of a flexible exchange rate system.

> Thus, while in theory, the shift to flexible rates should have reduced global liquidity requirements, paradoxically, the increase in private global liquidity due to the increase in private financing created a substantial increase in the demand for official liquidity to ensure exchange rate stability under the revised Article IV (Kregel 2007, 3)

However, we are not convinced by Davidson's argument that fixed exchange rates are superior to flexible exchange rates on the grounds of exchange rate explosion in the latter case. This thesis maintains the position that the choice of exchange rate regimes is not central to the creation of a healthy international financial system. The important question is how imbalances can be dealt with in a non-recessive manner. The relative insignificance of exchange rate regimes is elaborated in Rey (2015) celebrated paper on the policy 'dilemma' not 'trilemma'. What is required is not a change in the exchange rate regime but a much more radical change in the international payments system (Davidson 1992; Kregel 2021a).

The reason why this thesis rejects Davidson's argument is because of this flawed view of perfect substitutability between currencies in a fixed exchange rate regime. This conclusion of perfect substitutability is reached based on comparing currencies as stores of values rather than means of payment.[16] Within the world of the currency hierarchy, there is plenty of debate that the strength of the currency should be measured in terms of how well it serves as a means of payment and not a store of value.[17] The means of payment function stresses the importance of holding a foreign currency for precautionary and transactions motives. However, if these motives were more fully considered in Davidson's defense of fixed exchange rates, he would have seen default and liquidity risk, in addition to exchange rate risk, as a source of the creation of a hierarchy between different currencies. A currency can only be defended till the country runs out of reserves. With vulture

[16] In several passages Davidson does pull out the functions of currencies as a means of payment but with respect to this argument chooses to overlook his points.

[17] See Kaltenbrunner (2015) for the currency as a means of payment and (Andrade and Prates 2013) for the currency as a store of value. Both present arguments for why one view is better than the other.

dealers, default (and liquidity) risk is a real possibility that impedes the 'perfect substitutability' between currencies even in a fixed exchange rate regime. Meaning that the key advantage of fixed exchange rates a la Davidson, i.e. perfect substitutability and stability of currencies could not hold, and a hierarchy could persist. While it may remain true that fixed exchange rates provide stability to one price, the price of the domestic currency, it could create instability of other prices such as interest rates and asset prices.

2.1.2 *Deviations from UIP*

Empirical evidence suggests that the uncovered interest rate parity does not hold (Lavoie 2022). There have been several explanations for this failure. This is because all three assumptions behind the uncovered interest rate parity (UIP) are questionable. Two interdependent questions must be discussed in light of such empirical evidence. Why does the UIP not hold and what implications does this have for the influence of the currency hierarchy over the macroeconomy and policy autonomy? These two questions will be addressed in more depth in the following chapter. Recall that without a deviation, the UIP in itself does not have a role for liquidity or a hierarchy. All the UIP tells us is that there is an interdependence between the interest rates set by different central banks. It is the deviation from the UIP which allowed Keynes to point out the existence of a hierarchy between currencies/assets, which would later form the basis of the creation of money and currency hierarchies. The UIP configures a situation in which agents are indifferent between different currencies but it explains the interdependencies which allow the existence of this situation.

Mainstream literature may use micro-foundations and imperfections regarding asymmetric information and credit rationing to explain deviations from the UIP. This thesis will not engage with micro-founded literature and will instead focus on theories that engage with these deviations from a macroeconomic viewpoint. This is primarily because this thesis identifies itself in the post-Keynesian macro-founded tradition, and chooses to build a macro-simulation. Macro-simulations focus on structural behavior rather than frictions.

Perhaps the most coherent explanation of the deviation comes from the Cambist view (Lavoie 2022). The following subsection will discuss the Cambist view, and provide a financial post-

Keynesian criticism of this view. The thesis then puts forward another explanation that is logically derived from chapter 17 of The General Theory (Keynes 1964; Kregel 2010). The latter approach will lay the foundations for the behavioral equations that follow to illustrate the challenges imparted by the currency hierarchy on weaker currencies. Chapter seventeen approach will be used to question the Cambist view.

The Cambist approach is not necessarily consistent with the influence of the currency hierarchy over countries with less liquid currencies. The Cambist view could logically be extended to argue that credit/currency hierarchies and policy autonomy are not serious issues because the forward premium is dependent only on interest rate differentials. Moreover, the forward premium is the price that adjusts in the presence of changes in the perception of uncertainty and liquidity, or changes in the interest rates of countries with stronger currencies. This means that interest rates (or other quantity variables such as reserves) need not compensate for varying degrees of liquidity to ensure that the spot exchange rate is under control. The spot exchange rate is not the one that adjusts to changes in global liquidity[18] or global interest rates, it is the forward premium.

2.2 The Cambist View

The Cambist view originates with the empirically verified observation that the covered interest rate parity (CIP) holds while the UIP does not. The Cambist view presents the real interest rate parity, which is an inflation-adjusted measure of the above-discussed UIP, as a logical impossibility. Lavoie (2022) does so by decomposing the real interest rate parity into the CIP, the unbiased efficiency hypothesis (UEH), and the purchasing power parity (PPP). By providing logical and empirical evidence as a refutation of the PPP, UIP, and UEH - they disprove the real interest rate parity. The existence of the CIP and the defiance of UIP logically imply the defiance of the UEH (Lavoie 2022, 520). This critique will be discussed further in this section, along with a critique of the Cambists.

Central to the Cambist view is that the dealer institutionally sets the forward premium to equal

[18] The impact of the desired margin of safety will be revealed in later chapters, for not the interest rate parity only emphasizes differentials of global interest rates.

the interest rate differential. Dealers do not speculate. They hedge balance sheets. Due to this monetary policy autonomy exists[19], and changes in monetary policy will only affect the forward premiums and not the spot exchange rates. This extension of the theory seems to be at odds with the currency hierarchy literature which suggests that there are price (exchange rate/interest rate) or quantity (international reserves) consequences to an inferior position on the hierarchy. The Cambists overcome the effect of the currency hierarchy (or at least do not experience it as seriously) because, in their theory, the forward premium on currencies adjusts instead of the spot exchange rate. This would mean that the central bank would not need to intervene to have a handle over the spot exchange rate for the reasons of changes in global interest rates and global liquidity preference. What we discussed as the disadvantages of flexible exchange rates at the start of the chapter does not hold because the spot exchange rate does not move in response to changes in interest rates or other considerations (such as a liquidity premium).

The difference between the CIP and the UIP is that the former suggests that the difference between the forward exchange rate and the spot exchange compensates for the interest rate differential. In other words, the forward premium adjusts instead of the exchange rate, in response to changes in relative interest rates.

$$f_t - s_t = r_d - r_f \tag{2}$$

Where f_t is the forward exchange rate, and other terms are as defined previously. Thus reserves need not be depleted to defend against spot depreciation. UIP, on the other hand, suggests that the spot exchange rate will change over time to accommodate the interest rate differential. The difference lies in the CIP's assumption that all traders hedge to control for the results of the UIP - the aforementioned offset, and that dealers price the other side of the hedge in a specific way such that the spot exchange rate is not affected.[20] Below is an example to further understand the CIP and the Cambist approach.

[19] At least to a relatively higher degree, in comparison to the non-Cambist case.

[20] This abstracts from speculation which will be introduced in a later paragraph in this section.

Following the example we used for the UIP, the carry trader now covers their borrowing in the lower interest rate currency, as they foresee the offsetting capital loss involved in repayment. They do so by purchasing a contract to exchange the domestic currency with the currency they require to repay at today's exchange rate. The increase in demand for forwards raises the forward premium relative to the current spot exchange rate, in line with the change in the interest rate. The currency dealer, however, sees that carry traders would attempt to pass on the capital loss to them and would react by pricing the forwards at the interest rate differential which imply that the carry-traders cannot escape the capital loss. If the future spot exchange rate equals the forward exchange rate then both CIP and UIP are synonymous, and this case is called the UEH. This occurs when the (expected) future spot exchange rate coincides with the forward exchange rate, implying perfect foresight and efficient markets.

$$f_t = s_{t+1} \tag{3}$$

Through a substitution of equation three in equation two, we can see the equality between the UIP and CIP if the UEH holds in comparison with equation one. However, the UEH cannot be concluded to be true since the UIP does not empirically hold while the CIP empirically holds (Lavoie 2022).

The Cambist view theorizes that the CIP is held, empirically, by definition and is not a result of an arbitrage – as the case was in the explanation of the UIP. The suggestion makes its way through the UEH. Cambists, as their title suggests, center their theory around the behavior of foreign exchange dealers. They claim the dealers charge a markup over the spot equal to the interest rate differential to cover their losses, foreseeing the action of the aforementioned carry trader. If the forward premium equals the interest rate differential, then as explained above the increase in the interest rate is offset by a change in the value of the currency. Dealers are thus hedged, the forward equals the spot plus the interest rate differential, and the forward premium equals the interest rate differential. Thus implying that the covered interest rate parity holds by definition since it is the behavior of dealers which allows this to be so. Lavoie (2022) recognizes that dealers are far from

non-profit entities, and suggests that they profit from a bid-ask spread on transactions but not from speculation and by setting the trend of the forward premium which would result in them taking a position in some currency. This logic allows the forward premium to equal the interest rate differential.

$$f_t = s_t + (r_d - r_f) \tag{4}$$

This equation implies that a change in the interest rate differential is the markup charged by dealers over the spot exchange rate.

An evident flaw of this approach is that the Cambists assume that dealers do not take positions, and have hedged balance sheets which may be difficult to believe. Moreover, the Cambist would suggest that the CIP is simply a norm and it has little consequence to exchange rates or flow of funds (Lavoie 2022). Implying that there is no necessary relation between the interest rates of central banks.

> Since only uncovered forward operations have an impact on the spot exchange rate and hence on the amount of official reserves that a central bank would hold in a fixed exchange rate regime, a well-determined central bank, which does not face an exchange rate crisis in a world of turbulence, could thus impose low real rates of interest if it so desires(...)the post-Keynesian view of the foreign exchange market, sustains the notion that central banks can set real rates of interest that are lower (or higher) than those ruling on average in the rest of the world. This result does not necessarily rely on some risk premium or discount...(Lavoie 2022, 532)

Lavoie (2022) reconciles the Cambist behavior to the cost-plus markup approach pricing of post-Keynesians, where it is suggested that prices are costs with market power rather than being determined by the forces of supply and demand. Thus suggesting that supply and demand do little to

determine the forward premium in the case of currency exchange as well. The spot exchange rate on the other hand is left to be determined by other factors, and not the interest rate differential. This would mean that the central bank need not subordinate its policy power to have a grip over the spot exchange rate. Once again, to reiterate, in the Cambist view (without speculation), interest rates and spot exchange rates would neither affect each other nor would be affected by a liquidity premium. The understanding of a cost-markup relationship between the spot and the forward price is difficult to reconcile with a financial (fundamentalist) post-Keynesian position. The relationship between these two prices need not be reliant only on speculation either, as suggested by Smithin (Lavoie, 2022). Lavoie (2022) can reconcile speculation with sufficient convection into the Cambist view. This would be the only exception wherein spot exchange rates can be affected. Making speculation the only avenue through which a currency hierarchy can function, and central bank policy autonomy can be compromised.

Lavoie (2022) suggests that the cost-plus-markup approach of the dealer holds even when speculation (between spots and forwards) rules the market. Let us discuss the logic behind this claim, as portrayed by Lavoie (2022), with an example. If the domestic country decides to reduce its interest rate, then the forward premium falls. This results in the forward exchange rate falling relative to the spot. From our interpretation of the exchange rate ($\frac{Rs}{\$}$), this means that the domestic currency is more valuable in the spot market relative to the forward. Thus, the domestic currency is sold forward for the foreign currency. This is because less *Rs* is required to purchase \$ in the forward market. This implies that the dealer must take cover by acquiring the foreign currency spot. This results in spot deprecation of the exchange rate. Thus changes the relative price of forwards and spots, until the forward equals the expected spot. This will however not harm the Cambist equation since the forward premium still equals the interest rate differential since it is the spot that does the adjusting to accommodate the speculative relation between the forward and the expected spot. This would imply that exchange rates adjust to allow monetary policy autonomy.[21] Thus even during periods of speculation, when the expected future spot does not equal the forward, the Cambist equation (equation 4) holds. All adjustments due to speculation are reflected in the spot exchange rate and not the forward premium. So through speculation, there is an avenue through which there

[21] Unless of course the domestic central bank intervenes to hold the exchange rate.

is some loss of monetary policy autonomy. However, this situation could arise independently of changes in the interest rate and speculation.

The Cambist presumptions are suspect. It is difficult to be convinced that the dealer, who is the harbinger of speculative information, does not use this information to their benefit. While this thesis does not investigate any empiric, logically its position is the dealers take positions both defensive and offensive. In other words, they must take a position to protect themselves and to expand since they are profit motive entities. They will try to make profits however they can. They are not so noble to only profit from operations and the bid-ask spread. An extract from Davidson (1982) would also contribute to the refutation of this 'noble' role of currency dealers in the Cambist view, especially in the case of flexible exchange rate where private dealers are a significant chunk of the market (Davidson, 1982).

> If private bankers are therefore to be entrusted with the 'making' of foreign exchange markets while they are motivated by profit opportunities, they will find it easier to achieve success by swimming in the lead of the tide of public opinion rather than trying to buck the short-term currents (Davidson 1982, 116).

This extract and several others suggest that dealers will try to create the path for exchange rates (spot and forward) which benefit their own balance sheets with capital gains. If they created the path, they would be the entities with the most information, and in a financial market information (conventional or fundamental) and volume is what results in gains (Keynes, 1964). It may be empirically true that dealers operate such that the forward premium equals the interest rate differential.[22]

[22] This may be true for a sample of advanced economies that function with the strongest currencies as changes in liquidity would affect these countries least. Thus allowing the interest rate differential to be the dominant factor. This need not be true for other countries. In addition, suspicion arises from the attempts of empiricists to find the 'right' exchange rate or 'right' interest rate to show that the CIP holds. Since this involves circular reasoning and philosophy Cambism has already been accepted as the truth.

2.3 Keynes' GT Chapter Seventeen Review of the Cambist

While the Cambist view is internally coherent and offers empirical consistency (Lavoie, 2022), it is difficult to reconcile with financial post-Keynesians like Paul Davidson, Hyman Minsky, and Jan Kregel. In addition to the critiques offered above, the financial Keynesian position offers another theoretical critique. Kregel (1998) reveals a congruence between forward prices and Minsky's demand price, and spot prices and Minsky's supply price. Pursuing this route, we can question the Cambist markup (forward premium) being determined only by an interest rate differential. Since such an approach would altogether leave out the implications of fundamental uncertainty and liquidity on prices and exchange rates. As explained in the first chapter, the Cambist would be ignoring default and liquidity risk and would be including, at best, exchange rate risk with the consideration of speculation. The only avenue of imperfect substitutability between currencies would be speculation and exchange rate risk, akin to the section that explained Davidson's view of fixed exchange rates.

In addition to explicit cash flows[23], Keynes had the liquidity premium, and Minsky had the margin of safety that was included in the calculation of prices to account for fundamental uncertainty. This is something that is missing from the Cambist's constant cost-plus markup approach to forward pricing. Dealers also face uncertainties which they may wish to consider while setting the forward premium, especially if they deal in weaker currencies. Fundamental uncertainty could imply that a perfectly hedged book is not the most risk-averse configuration due to the different probability weights and margins of safety attached to different assets and currencies that are intrinsically imperfect substitutes for deeper reasons than speculation (Minsky 2008a). For structural and balance sheet related reasons. We also have to remember that fundamental uncertainty is highest with financial institutions, who borrow, lend and trade financial assets. Meaning that the price determinants of these institutions are most likely to require the Keynesian-Minskian elements to reflect higher degrees of fundamental uncertainty.

Minsky's two-price system provides a financial theory of investment, and more broadly a financial

[23] Explicit in this context meaning explicit cash flow receipt consideration. This word is used in the same sense by Minsky (2008a,b)

theory of asset ownership. It does so by incorporating the principle of increasing risk, via liability structures. Through rising external debt-income ratios and changing margins of safety, Minsky was able to explain that assets get less attractive due to rising borrowers' and lenders' risk which decreases the demand price relative to the supply price. This position would not agree with the Cambist view that spot and forward prices (or demand and supply prices) are determined independently of each other (except for speculation). The determinants of Minsky's demand price are expected future cash inflows from sales capitalized with a discount rate that adjusts for liquidity and other implicit returns, and a probability weight to denote the margin of safety or state of confidence (Minsky 2008a). The supply price, on the other hand, is determined using a Kaleckian cost plus markup approach (Minsky 2008b).

The relation between these two prices is the lender's and borrower's risk which is a principle of increasing risk predicated on changing external debt ratios and changing margins of safety.[24] Thus there must exist a variable and complex relationship between the spot and forward (future expected spot) prices which could even seem, on the face of it, be independent of interest rate differentials to account for liquidity in the guise of borrower's and lender's risk.[25] The forward premium, thus, depends on both the interest differential and the impact of borrower's and lender's risk which impacts these dealers, forcing them to take positions. This is the primary, theoretical reason why this thesis rejects the Cambist view. The rejection of the Cambist view leads to the rejection of its implication that monetary policy sovereignty exists and that there is no currency hierarchy or liquidity.

Davidson (1972) explains the relationship between spots and forwards from a speculative perspective. This concern, however, has been addressed by Lavoie (2022) owing to a discussion with

[24] Strictly speaking, there would also exist a validation-based relationship between the supply and demand price of physical capital assets. This is because the higher the demand price is, the higher the initial finance for investment and thus the higher the injections (wage bill of investment sector workers) relative to the wage bill of consumption good workers. This through the Kalecki equation would push up supply prices if demand prices are high and productivity is constant. However, in this case we are dealing with currencies that do not require labor for production and cannot be valued in the same way that consumption goods are valued Kregel (1985).

[25] Strictly speaking I believe that Minsky's demand price reflects more accurately the future expected spot price and not the forward price as suggested by Kregel (2010). I would like to acknowledge Pavlina Tcherneva, since this recognition came in a discussion with her.

Smithin. The result was the conclusion that speculation is the exception for which spot exchange rates are sensitive to changes in the interest rate. This thesis does not discuss this point in detail. Refer to the previous section for a more detailed discussion. In addition, this thesis suggests that liquidity plays a significant role in the determination of the spot exchange rate and the relationship between the spot and the forward exchange rate. This means that we need not even rely on a change in the interest rate to cause problems, but a change in the global liquidity cycle (Rey 2015), liquidity preference (Ramos 2019) or risk perception (Toporowski 2021) is sufficient. The incorporation of liquidity into currencies that are seen as financial instruments would imply that the currency hierarchy does affect international prices (interest rates and exchange rates) and/or quantities (international reserves).

The next section puts together Keynes' General Theory chapter seventeen view of how we can understand a currency and more generally a credit/liquidity hierarchy as the reason for a divergence from the interest rate parity. While Lavoie (2022) does not dismiss the currency hierarchy, at least not explicitly, this section provided a logical extension of the Cambist view which may suggest an inconsistency with the currency hierarchy and its implications on the macroeconomy. This subsection thus puts forward a theoretical reason for why liquidity and hierarchies predicated on liquidity are important. Suggesting its importance in the calculation of prices, and decisions to take positions by dealers.

3 CREDIT HIERARCHIES AND EXCHANGE RATES

The currency hierarchy arose from Minsky's money/liquidity hierarchy (Andrade and Prates 2013; Kaltenbrunner 2015). The Minskian/chapter seventeen approach to understanding the currency hierarchy provides an insight into how the international financial system influences economic activity in the emerging economy, through changes in exchange rates, interest rates, and the balance sheet structure. This section will elaborate on the money hierarchy as presented by Bell (2001) and Mehrling (2012). Following which the theory of the money hierarchy will be connected with the currency hierarchy. The representation of the hierarchy is often in the form of a pyramid (or more accurately a triangle) depicting different classes of assets in order of their liquidity. Unlike former pieces, this text prefers to think of the hierarchy or asset classes as being determined by the institutions that create them, rather than the instruments (assets) themselves. This is because some properties can be more easily attributed to balance sheets than assets themselves, as will be explained below. This is akin to how Minsky (2008a), in his two-price theory, made the investment decision depend on the balance sheet structure of an entity and not just the properties of an individual asset. He did so to incorporate the effects of the liability structure and carrying costs on investment (borrower's and lender's risk). In a similar vein, we can understand the liquidity of an instrument more accurately if we examine the balance sheet that produced it rather than the asset itself in isolation. Liquidity is everywhere a systemic phenomenon that has little to do with the intrinsic qualities of the instrument itself and more to do with institutional structure, the state of markets, and balance sheets.

As explained in the previous chapter, the UIP and the deviation from the UIP are the central reasons for the existence of the liquidity premium and the asset/currency hierarchy. The UIP indicates a relationship between the (explicit) rates of returns on different assets. The deviation from the UIP is what accommodates a role for implicit returns such as liquidity, and suggests a hierarchy between assets and currencies.

At the apex of the pyramid lies the instrument of the superior institution. This institution decides the unit of account and dictates what corresponds to the description of the means of settlement

which can extinguish debits other institutions may have towards it. The power to make these decisions derives from the existence of widespread debits that exist on this institution's account book (Kregel 2022). The debits may be a result of the functioning of markets and clearing houses (Rochon and Vernango 2003; Kregel 2021b) or they may have risen because of the legislative power the institution may have over others to create debits on its system (Bell 2001; Tcherneva 2016; Wray 2012). In either case, the institution at the apex cannot face a solvency or liquidity problem.[26] Since the negative net worth of the "apex-money" issuing institution means nothing as long as there exists demand for its credits. The credits of this institution are the definition/benchmark of liquidity. The power to decide the 'dictionary' is what gives that instrument of that institution a superior quality and liquidity (Keynes 1978). This institution is typically cited to be the government (Bell 2001; Mehrling 2012; Tcherneva 2016).

The connection with lower layers of the pyramid emerges through swaps of liabilities between institutions. This connection arises because the superior institution typically plays the role of the clearinghouse for the inferior institution. When the inferior institution as a whole is in debt to the superior institution, the superior institution must accommodate this debt through the creation of additional credits in the system in exchange for the IOUs of the inferior institution.[27] If a superior institution does not accommodate, then the payments system below it collapses. At every level down, institutions typically require to acquire an instrument created by the superior institution to clear debts it may have and that may need to be repaid in the superior instrument.

The institutions down the pyramid typically have less flexibility to edit the dictionary regarding the means of settlement they accept. They may be allowed to accept means of payment created by institutions below their position but cannot demand a means of payment above their position. This is because this would imply that the credits of the institutions lose value as they are not valid means of payment to extinguish the debits on their own books (Kregel 2022). The typical hierarchy of the pyramid is depicted in the following order; the government is followed by the

[26] Using a closed economy assumption.

[27] Such a situation may arise even when there exist enough credits in the system to repay the debts but some institutions prefer to hold surpluses and are unwilling to lend out surpluses to their horizontal counterparts which hold deficits.

Figure 1: Currency Hierarchy Pyramid

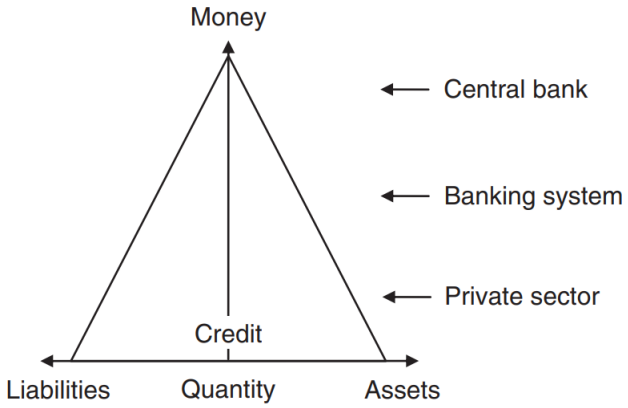

Figure 21.2 The hierarchy of money and credit.

banking sector followed by the private sector (Mehrling 2012). The government is at the top (the special institution) is consistent with Keynes' observation in the Treatise regarding the government being the creator and editor of the dictionary of money (Keynes, 1978; Bell, 2001). Even Modern Money Theory suggests that governments have this special place (Wray 2012). The figure below is adopted from Mehrling (2012).

The government, because of their legal right to impose liabilities on other institutions, typically in the form of taxes. Thus generating a demand for the government's credits (IOUs) to eliminate the widespread debits imposed through legislative action. Banks are below the government since they usually use the liabilities of the government (central bank) to clear payments between themselves and the government. The private sector usually uses the deposits of banks to transact between themselves and banks, thus giving them last place.[28]

In figure 1, which represents the currency hierarchy, the x-axis (base of the pyramid) denotes the quantity of the instrument created. The left to the center denotes how much of the instrument is held as a liability and the right denotes how much is held as an asset. Due to accounting rules, these two values must be equal and the pyramid must be symmetric through the x-axis (the triangle must

[28] We could make the hierarchy more specific, for instance by dividing the private sector into financial and non-financial firms but this would not add anything to the present analysis.

be isosceles). The wider the base, the more that instrument is created as a liability and held as an asset in balance sheets. It can also be thought of as an expansion of the IOU creating institution's balance sheet.

The y-axis (height) denotes the degree of liquidity possessed by the item in question. The higher the asset/liability class, the more liquid it is. The vertical distance between these instruments on the hierarchy reflects the preference to hold the more liquid assets. Liquidity refers to the extent to which the instrument is accepted as a means of payment. Its acceptability depends on different factors. The primary determinant of acceptability is the widespread presence of debits in the system which calls forth the particular means of settlement to eliminate said debit (Kregel 2022). This creates a stable demand for the credits issued by the institution in question. This is the factor that determines the position of the means of settlement on the hierarchy.

As we move beyond a simple qualitative hierarchy, we find that there exist other institutional and market factors that change the liquidity of means of settlement, i.e. the exact height of the pyramid. Or in other words, the exact vertical distance between two instruments on the pyramid. The institutional determinant could be the presence of a dealer of last resort that creates liquidity for the instrument by creating a floor price. The market determinant could be the price that the market sets to exchange that instrument for an instrument of a different level in the hierarchy, or more simply an exchange rate between instruments, given the perceived level of liquidity of the instrument. The perceived level of liquidity is determined by several factors, but perhaps the most important of them is the balance sheet structure of the issuing institution.

Typically, the liquidity of an instrument is inversely proportional to its explicit return (Keynes 1964). The lower the liquidity the higher the rate of return required to induce ownership. This is because the ownership or production of assets come with several risks and uncertainties. The ability to sell these assets at volumes without considerable losses is an automatic hedge against uncertainty to some extent, thus requiring a lower rate of return to compensate for these uncertainties. Liquidity to some extent allows a hedge against default risk. The approach of this chapter suggests that institutions to a large extent determine the liquidity of their instruments. We recognize that

there may be other factors in addition to the rate of interest which compensate for low liquidity. The higher these factors are, the less the rate of interest needs to be to induce ownership. We can refer to this broader quantitative measure of comparison between instruments as the exchange rate.

A digression into some history of economic theory will help us understand this concept and the terminology of 'exchange rate' generalized to all instruments of credit. Kregel (2010) points out that Keynes' interest parity approach was a predecessor of the own-rate (liquidity preference) approach. The own-rates approach is described as a revised version of the interest rate parity between currencies extended to commodities and all assets, as a theory of prices and at the same time a theory of changes in the level of output. In simplified terms[29] the relative price of currencies must adjust to equalize the difference between interest rates on different currencies. We can formalize this simplification as below;[30]

$$\Delta xr^{*} = (r^{d} - r^{f}) \tag{5}$$

Where Δxr refers to the change in the exchange rate, subscripts d and f refer to domestic and foreign countries, and r refers to the rate of return on lending (or holding) that currency. The star denotes that the variable works under the equilibrium conditions of the parity. In the same fashion this parity can be carried over to asset prices, wherein, we replace the exchange rate with the price of an asset $(p*)$ and the rate of interest with the rate of profit (π). With this we get a theory of changes in prices.

$$\Delta p_{d}^{*} = (\pi_{d} - pi_{f}) \tag{6}$$

Equation six would tell us the price of asset d relative to asset f. To find the change in price of asset d relative to money, we would require to find the difference between the rate of profit (explicit return) on asset d and the explicit return on money – the money rate of interest. The parity itself, of course, assumed free capital mobility, perfect substitutability between assets, and perfect information. The second and third assumption however contradict the concept of a money hierarchy, currency hierarchy, and the existence of liquidity and uncertainty in general. We could in fact argue that liquidity is the essential property of money that makes money non-neutral. This

[29] Usually the parity uses spot and forward prices but we can simplify, as Keynes (1964) did in the General Theory

[30] This is identical to equation 1.

allows the money rate of interest to affect price, not through a quantity theory equation but by altering the prices of assets. In other words, by allowing another determinant to asset prices in addition to explicitly calculated profit rates.

Keynes recognized the existence of such a hierarchy which is why he came up with the concept of liquidity preference to explain a shifting equilibrium divergence from the parity. Due to the uncertainty surrounding the ownership of heterogeneous assets and liabilities, arbitrageurs cannot and will not swoop in and ensure that the parity condition holds. For this reason, the change in the price of assets need not reflect changes in their rates of returns differential as accurately as the interest rate parity condition suggests. The extent of divergence is called the liquidity premium which is described as an implicit return - not an actual cash flow receipt. For this reason, the relative price of a means of settlement (relative to the apex) is referred to as an exchange rate by this text. This divergence may be affected by several different factors, namely the balance sheet structure of the institution issuing said instrument. Some of these factors will be discussed below, to understand more deeply the terms of exchange between different means of settlement. We can however revise the formulations above to reflect a liquidity preference.[31]

$$\Delta xr = (r^d - r^f) + (l^d - l^f) \tag{7}$$

$$\Delta p = (\pi_d - pi_f) + (l^d - l^f) \tag{8}$$

Or alternately to see liquidity as a residual we can ascertain the liquidity premium as the difference between the exchange rate/price at interest rate parity and in reality.

$$(\Delta xr - \Delta xr^*) - (r^d - r^f) = (l^d - l^f) \tag{9}$$

$$(\Delta p_d - \Delta p_d^*) - (\pi_d - pi_f) = (l^d - l^f) \tag{10}$$

[31] Note that the appreciation component of the own-rates is ignored. This is because this section chooses to narrow its focus to liquidity. The carrying costs are subsumed into the r and l.

On this note, we may conceive of some other bridges between different levels of the hierarchy in addition to the interest rate (exchange rate between means of payments). Recall that the decision to allocate savings into an asset does not only depend on its explicit returns but also implicit returns. A key implicit return provided by an asset is the liquidity it possesses. Instruments with a high degree of liquidity are less affected by uncertainty, as they can be sold at large volumes without significant losses of value, directly reducing other forms of risk such as default and price risk. The liquidity an instrument possesses does not just depend on its idiosyncrasies but on the perceived liquidity and solvency of its issuer. There are two elements that are seen in the previous sentence; perception and liquidity. Liquidity itself can be measured by ratios from the balance sheet. The perception of liquidity tells us the domain of these ratios that are deemed acceptable. These domains are determined cyclically.[32] The most coherent cyclical understanding derives from Kregel (1997) who explains these cycles are changing margins of safety. These margins of safety are determined by the standard deviation between expected results and realized results. During the boom, expected results converge to real results, reducing the standard deviation and the margin of safety. This in turn would increase the domain of acceptable liquidity ratios. This point will be applied in the next chapter when the thesis formalizes behavioral equations. We can refer to this cyclical element as liquidity preference, which is distinct from the liquidity premium (Ramos 2019).

The instrument sold by an institution that has a high net worth or significant quantities of liquid reserves may be floated at a higher price and may require to pay a smaller rate of return than an identical intuition with lower reserves of liquid assets. Thus structural factors such as the balance sheet structure, to a large extent influence the price/exchange rates of means of settlement via a higher liquidity premium or more broadly by providing a lower (default) risk perception. In more Minskian terms, the less the external debt or the higher the liquidity of the institution, the lower the curvature of the borrowers and lenders for its liabilities. Higher liquidity implies that there would be a higher demand for its liabilities at a higher price (lower interest rate). There may also be other institutional factors such as the central bank acting as a dealer of last resort with private sector

[32] In the long run, they could also be structural, but for simplicity this possibility is omitted. For instance, when capitalism shifted institutionally from the managerial to the money manager capitalism it is unlikely that what was perceived as acceptable did not change (Minsky, 2008b).

debt, that reduces the required rate of interest to be charged on lending to the private sector (or a smaller price for the swap between private sector IOUs and bank IOUs or simply just swap lines). The government's intervention in the aforementioned dictionary reference may also play a role, if private non-bank IOUs are accepted to extinguish tax liabilities, this would decrease the exchange rate between bank and private IOUs. Thus the vertical distance between asset (institution-liability) classes depends on several factors, market, and non-market. We must keep this in mind during our extension of the money hierarchy onto the currency hierarchy, and for the behavioral equations which will follow later on.

Since the previous paragraph already brought up the vertical flexibility of the pyramid, the literature does point out the existence of such flexibility. Bell (2001) notes that the pyramid is flexible but does not specify the dimensions of flexibility. Mehrling (2012) explains the pyramid to be mutable in the length of the base. The endogenous increase in demand for money or credit results in an increase in the slope of the pyramid or an increase in the angle of the tip of the triangle and a decrease in the angle of its legs. This in turn increases the length of the base of the pyramid. This expansionary mechanism is described as elasticity. While its contractionary counterpart is described as a discipline. The height of the pyramid may also change. The change in height denotes a change in risk perception and an increase in the quality of instruments. Figure one and two offer the visualization and dynamic visualization adopted by Mehrling (2012).

However, none of these approaches explain the nature behind a quantitative determination of exchange rates between these instruments in terms of the liquidity preference approach of chapter seventeen of Keynes (1964)'s General Theory, as extended by Kregel (2010) (Kregel 1982, 1996). The association of these exchange rates with the interest rate parity theorem is important to understand the nature of the endogeneity of deviations of these exchange rates from parity. It also provides us with other structural dimensions through which the hierarchy may be compensated for. This structural dimension is essential to move past the condition of interest rate parity and to recognize the heterogeneous nature of money (IOUs). In this section, we formally derived how the interest rate parity evolved into Keynes' liquidity preference approach, and how both these theorems can be transformed, formally, into a theory of prices and exchange rates.

Figure 2: Currency Hierarchy Elasticity

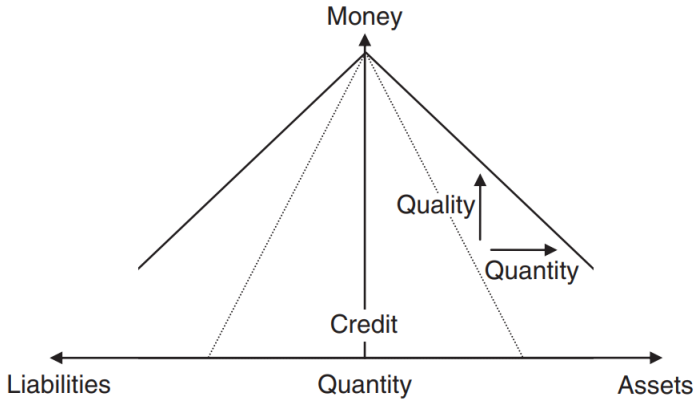

Figure 21.3 Expansion mode.

3.1 Summarizing The Currency Hierarchy

Some arguments may be more straightforward in the case of the currency hierarchy since the interest rate parity is traditionally designed to explain changes in the exchange rate between two currencies (Kregel 2010). The parity condition states that the exchange rate between two currencies must adjust to compensate for differential rates of returns.[33] However as explained in the previous section, we showed that this parity need not be the case due to the existence of a changing implicit return on assets, called the liquidity premium. This implicit return in the case of currencies can be referred to as the currency premium.[34] The currency premium is the reason why the changes in the exchange rate do not accurately mimic the interest rate differentials between different currencies. As it was explained in the previous section, changes in this implicit return is to a large extent determined by structural factors such as the balance sheet structure, in this case of the sovereign as a whole. While institutional structure does impact the currency premium, in similar ways discussed in the previous section, changes in institutional structure are not as frequent as changes in the balance sheet structure. Another factor that may provide liquidity to the currency is an inelastic demand for real resources from a country. However this factor too, is unlikely to change cyclically. Thus it would be reasonable to assume that changes in the exchange rate are caused by changes in

[33] Keynes, more accurately, described the parity as reflecting a preference for holding a currency given the interest rate differential and exchange rate.

[34] Note that it is impossible to actually separate the currency and liquidity premium since they are co-determined.

the balance sheet structure after considering the institutional details to be given. For this purpose, central to the behavioral equations introduced in the following chapters are ratios regarding the liquidity of different sectors. The primary ratio which will be utilized to determine liquidity will be the ratio of foreign claims the rest of the world holds against the domestic economy divided by the international reserves that the domestic currency holds.

This premium, a liquidity premium, is predicated on the stability of demand for a currency (Kaltenbrunner, 2015). This premium, with respect to currencies can henceforth be referred to as a currency premium. The primary source of stability of a currency derives from the existence of debt denominated in that currency in foreign portfolios.[35] The existence of debt guarantees demand for the currency and assets denominated in that currency, for repayments. Thus providing a relatively superior level of stability (control) to said currency's value. In this manner, the determination of the exchange rate is consistent with a capital flow approach to currency value determination and takes into consideration corporate finance and balance sheet structures of the sovereign.

The currency hierarchy can be nullified through the inferior currency country having a higher policy rate, the country of the less liquid currency holding higher levels of international reserves, or by the inferior currency flexibly adjusting in value. These are the three options that are highlighted in this chapter bridging the gap between the hierarchy. These are the key take-always for the following chapter which formulates behavioral equations. The quantitative relation that nullifies the effect of the currency hierarchy is complex and is determined endogenously by global liquidity considerations and other dynamics of the system. The actual domestic situation of the country itself has a smaller weight in the argument (Griffith-Jones and Ocampo 2009). The process is a virtuous cycle since each of the three aforementioned variables are interdependent. For example, reducing international reserve balances may hurt the risk perception of the countries' assets and may result in a requirement for higher spreads or increased devaluation to ensure that the capital account clears the current account given the change in the stock of reserves. Devaluation results in capital losses for those who hold assets denominated in that currency, which would imply that

[35] I stress on the creation of debt in foreign portfolios, since if debt was confined to domestic portfolios it would not have a role as an international means of payment.

investors would desire the country to increase its reserve balances to offset rising risks and may require a higher return on assets denominated in that currency to compensate for price, liquidity, and default risk. Most importantly, the hypothesis indicates that an increase in perception of risk or other reasons that result in the need to bridge some gap created by the currency hierarchy could have negative impacts on the economic activity of the country that creates the inferior unit of account. Thus implying that these adjustments to compensate for the currency hierarchy may be intrinsically recessive. Thus the effect of the currency premium compensation on the investment function is an important one to capture. Exact channels will be hypothesized and realized from the following three chapters, which introduce new behavioral equations, set-up a stock-flow consistent model and simulate it, respectively.

This goes against the arguments which suggest that flexible exchange rates, increased international reserve balances, or increased interest rates could solve the recessive bias created by the current international monetary configuration. Thus highlighting the perspective that the existence of a currency hierarchy is a sufficient condition to bias an international monetary system to recessive mechanics. This points us toward the need for a more radical solution, which involves a reformulation of the international financial system, such that the currency hierarchy is eliminated or cannot discourage economic activity in underdeveloped regions. The argument presented in this piece tries to illustrate that the regular workings of the international financial system are sufficient to hurt emerging economies even without targeted structural adjustment programs and austerity forced by third-party organizations or “exogenous” real and financial shocks.

4 NOVEL BEHAVIORAL EQUATIONS

4.1 International Reserves Function

This section focuses on how changes in stocks of the international reserve compensate for a weak currency. Every country is assumed to desire to hold some level of international reserves as a margin of safety against capital flight. In specific, we focus on the capital flight that would result in pressure to the exchange rate. This would refer to those who demand the domestic economy's assets purely for speculative purposes and have no use for the currency for transactions or precautions. Foreign holders of domestic assets, from the key currency economy would best fit this profile. Chapters two and three pointed out how the possession of international reserves can relax the pressure on exchange rates and interest rates by improving the liquidity of the sovereign's balance sheet structure. Thus presenting one way for weak currency nations to compensate for the currency hierarchy. However the holding of international reserves comes at a cost. The same cost which Keynes (1964) associated with the holding of money and liquidity. The existence of liquidity is the flipside of the existence of unused capacity.

In the specific case of international reserves, if the economy does not even earn a current account surplus, then the economy must borrow to finance its position in international reserves. This would add pressure to the exchange rate because of foreign cash commitments (Herr and Nettekoven, 2022). In addition, typically the cash commitments of loans are higher than receipts through international reserves. The difference between the interest rate on loans and the interest rate on the international reserves would present the 'cost' of holding reserves. Alternatively, even if the economy had a current account surplus, international reserves are a cost since wealth could have instead been stored in higher yielding assets. In this case the cost would be equal to the interest rate differential between the international reserves and the foreign bonds. This cost would operate through the suppression of disposable income which in turn suppresses consumption, income and then investment which further suppresses income.[36]

[36] This chain of causation will be explained in more detail when the model is presented, in the next chapter, as it draws from other behavioral equations included in the model.

As explained previously, this accumulation of reserves is independent of the exchange rate regime, and may have even been exacerbated in post-Bretton Woods with the shift to flexible exchange rates and private finance.

> Under the new system, larger accumulated deficits meant larger liquidity support required to allow countries to avoid default and initiate adjustment. The amount of support to ensure exchange rate stability in the face of such a reversal in confidence by lenders would require, at a minimum, the value of creditors' outstanding short-term foreign claims, plus funds sufficient to see off any foreign speculators and domestic capital flight. That is, sums several orders of magnitude greater than were required under fixed exchange rates with official financing (Kregel 2007, 5).

In the model, international reserves are held in the form of bonds issued by the key currency country by 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 channel the international reserves function attempts to depict. We assume, in line with what was reasoned in chapter two, that 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. 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 as;

$$B^R_{CB} = (FA^R - p_{mos}(\frac{1}{r^S_B})Y^f) \tag{11}$$

$$FA^R = B^S_R + E^S_R + L^N$$

$$Y^f = x + r_B^N B^N$$

Where FA^R is the total claims that the rest of the world (north) has over the domestic economy. This is equivalent to the sum of domestic bonds held abroad (B_S^R), the domestic equity held abroad (E_S^R), and the foreign loans lent to the domestic economy (L^N). The parameter $p_m os$ 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 Minskian fashion. In the international context, this would mean that it is highly dependent on the global liquidity cycle. The more often expectations are realized, the smaller the margin of safety becomes (Kregel 1997). As a reflection of which the level of the probability weight ($p_m os$) 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 Minskian style. Wherein the discount rate is multiplied by a probability weight (this term is the capitalization factor). The equation 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 debt. The higher the certainty of its earnings and the higher the volume of its earnings, the smaller the margin of safety it requires. 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. However this approach is not pursued in this piece but would be an interesting task for another project.

As a caveat we must note the existence of an argument that the rise in international reserve holdings is a result of an attempt to prevent the appreciation of the currency, to favor the tradable sector. In other words, keep the exchange rate devalued so that the export sector can remain competitive. If true, this would imply that our assumption that reserves are held as a precaution is wrong. However, it has been argued that reserve accumulation has taken place in several countries which do not strongly compete in international trade, suggesting that the precautionary motive is the right determinant (Rodrik, 2006). Rodrik (2006) also cites empirical evidence that suggests that it is the precautionary motive that has driven up the stock of foreign exchange reserves in emerging economies.

We must also note that the international reserves function is far from perfected. During the simulations, we note that the function is fragile. Relatively larger changes in the probability weight can result in the domestic central bank holding negative levels of reserves for short periods of time, even though the steady state convergence value would be a positive value. Even larger changes in the probability weight could result in large changes to the steady state value of international reserves. Thus this function has to be designed to be more stable in the future. However, it is expected that a Minskian formulation would display instability, but we need to make sacrifices to have realistic results in a complex stock-flow consistent framework. Another interesting modification of this function for the future would be to use the foreign interest rate as the discount rate. This would give the foreign interest rate an additional avenue to impact the domestic economy. A hike in the foreign interest rate would increase the holding of international reserves, since it would reduce the capitalized value of gross foreign receipts. The use of the foreign interest rate is also probably more relevant, since in a world-system liquidity preference framework, it is the rate of return that rules the roost.

4.2 The Domestic Interest Rate Function

This section emphasizes the role of the interest rate in nullifying the presence of the currency hierarchy. Chapters two and three explained how the inducement to hold an asset/currency depends not only on the interest rate differential but also the liquidity premium. In light of the theory presented there, we could imagine proactive central banks from weak currency nations choosing to subordinate their monetary policy to ensure that its currency and asset prices have some stability. The mechanism through which rising interest rates have a stabilizing effect on currency and asset prices can be seen from equations seven and eight in chapter three. There is also an indirect stabilizing effect through increase in interest rates attracting more foreign reserves and thus increasing the liquidity of the sovereign balance sheet. This in turn reduces the liquidity premium on superior currencies, thus reducing changes in prices (refer equation seven and eight). Note that this is a policy choice. The subordination of monetary policy is a choice and in practice any central bank can pursue the interest rate they desire. However this does not mean that any interest rate is compatible with the smooth functioning of the economy. This section presents an equation that depicts the monetary policy choice of central banks' degree of subordination (or not) to the key currency nation's monetary policy.

$$r_B^S = r_{B-1}^S + \alpha(\Delta r_B^N + mos(l^S)) \tag{12}$$

$$l^S = \frac{B_R^S + E_R^S + xr(L^N)}{xr(B^N)} \tag{13}$$

Where r_B^S is the interest rate on domestic bonds in the current period and $B-1$ refers to the last period. The policy choice is depicted by α. If alpha is zero, the interest rate on bonds is exogenously determined by the central bank. The higher the value of α the more subordinated the interest rate on domestic bonds is to global financial conditions. These global financial conditions are captured not only by changes in the interest rate in the key currency economy (Δr_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*). The specification of the liquidity premium is presented in equation thirteen. The liquidity premium states the excess over the interest rate parity that the domestic economy has to offer in order to compensate for liquidity risk. The higher the quantity of liabilities of the sovereign that can lead to capital flight (which will be exchanged for other currencies) relative to international reserves, the higher the returns the sovereign has to offer to induce ownership of its debt.

The choice of subordination of monetary policy, as suggested above, has implications on the stability of currency and asset prices. This stability, ceteris paribus, allows external imbalances to be stable. However monetary policy, changing domestic interest rates could have negative effects on the domestic balances of the economy which could in turn cause changes in the external balance. The rise in domestic exchange rates could make the cost of finance more expensive, thus discouraging new investment and increasing the debt burden on old investment. The rise in interest rates could also result in the triggering of financial fragility among financial institutions. Additionally, tight monetary policy has been criticized to skew income distribution in favor of capitalists.[37] Thus raising interest rates could increase external stability at the cost of internal stability. However, since external and internal stability are interdependent through the Godley three balances, instability in one sector must be reflected in another. This means that the policy choice to attain stability in one over the other could be self-defeating, if instability is induced in the other.

[37] The monetary policy institute blog dedicates nearly all its entries to these issues.

5 THE CURRENCY HIERARCHY IN A STOCK-FLOW CONSISTENT MODEL

5.1 Why Stock-Flow Consistent Modelling

A Stock-flow consistent model is a monetary 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. An SFC model, thus, allows one to test their theory in the presence of the only certain and invariant real-world rule - the rules of accounting. The SFC allows the theorist to learn more about the dynamics of their theory, by allowing their theory to interact with fundamental economic dynamics. An SFC, being a complex system, does not always reveal the results that one has in mind or would expect. Results can be full of surprises, that may allow the researcher to better understand the theory they propose. It would also allow the researcher to understand if the assumptions behind the theory (calibration) is 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 lie. The creation of the model is about the process of learning rather than a binary test.

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 emerges 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 effect 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.

Chapters two, three, and four emphasized the role of assets, liabilities, and the balance sheet structure in the currency hierarchy. It was 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. This is because the balance sheet structure was explained to influence the extent to which a non-key currency economy would desire to hold international reserves, and the extent to which it would have to change its domestic interest rates. For this purpose, 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 understand which assets and liabilities have to 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. The centrality of finance and the balance sheet to this theory implies that we cannot afford to ignore the dynamics that are implied by the accounting consistency. 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 failure to recognize that holding of higher levels of international reserves requires either an equivalent reduction of assets or increase in liabilities could ignore the effects of the decline in assets or increase in liabilities on transaction flows in future periods. It would also give a wrong picture of the balance-sheet structure of the unit. For these reasons, this work does not see any substitute to SFC modeling. Any theory which emphasizes balance-sheet structure must operate in a SFC framework.

The most fundamental piece of an SFC model is its transaction flow matrix (TFM). The TFM defines the level of aggregation of the model, i.e. which sectors the model chooses to focus on. It also indicates the assets and liabilities which are of interest to the researcher. The TFM provides a platform to create interactions between sectors through different transactions of income and expenditure for different purposes. An additional dimension of interaction it captures is how an unbalanced budget (of income and expenditure) between different sectors is resolved - and what

assets and liabilities are created as a consequence. An interesting feature of the SFC model is that sectors' spending are not constrained by their income. Their 'budget constraints' are broader than just their earnings. Spending is dependent on both earnings and the willingness of other sectors to hold liabilities issued by the sector in question. This willingness is often dependent on a profit motive, i.e. liabilities can only be issued if holding the subsequent asset produces income.

After the researcher makes the three choices of the level of aggregation, the assets and liabilities, and the interaction transactions, the sum of rows and columns - which equal zero - provide a series of equations which ensure that the rules of SFC modeling are adhered to. The variables which are not determined by the accounting equations need to either be left exogenous or need to be endogenized using the behavioral equations of the researcher's choice. Unlike the accounting equations, exogenous values and behavioral equations are not truths. They are tainted by the perception of the researcher. To some extent it can be argued that exogenous values, imported from real life data, are truths. However, ambiguities with data do not guarantee this. Behavioral equations can at best be verified empirically. However, as we know, econometric verification comes with its own caveats. Since testing is in the presence of so many channels of causation, we cannot say for certain the we captured or verified only the right channels. For this purpose, behavioral equations are best verified logically, making them topics of intense debate. The logical verification of the behavioral equations proposed by us is presented in chapter four. Moreover, behavioral equations change as the behavior of economic units change to adapt to the evolution of the economy.

The next sections of this chapter explain the structure of the SFC model used by us, the implied accounting equations, the behavioral equations borrowed from the literature, and the sequence of shocks that are applied to the model.

5.2 Structure, Asymmetric Matrices and Asset Hierarchies

The SFC predicated modeling culture was popularized by 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 SFC literature lie primarily in the extension and

modification of the benchmark structure of the models present in this book. However there are only two open-economy models in this book. Both models presume countries which are of an equal level of development, with equally powerful currencies. Thus not emphasizing any significant differences or asymmetries in the portfolios or flows of the two nations.

For this reason, we create a SFC model, more specifically a TFM from scratch. Our TFM emphasizes the balance-sheet asymmetries between the center, which is the key currency issuer (the foreign sector), and the periphery which has a weaker currency that is not used internationally. The former 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 to purchase physical or financial resources from the periphery but the periphery cannot do the same. The periphery to acquire the international means of payment, it must either compromise its portfolio through the creation of costly liabilities or compromise its economic structure to earn the means of payment (commonly referred to as the Dutch disease).

The first feature of the TFM is that it assumes a small open economy. The rest-of-the-world (center/foreign) sectors' 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. Thus only other countries would 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 since we want to focus on structural factors, and not speculative ones. It could, however, be easily 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 with 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 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 claims of the foreign sector over the domestic economy.[38] Future models could address this by further dis-aggregating the foreign sector or by adding additional countries. The addition of additional countries could also be essential to illustrate the dynamics of a currency hierarchy, rather than just a 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.

Table 1: Balance Sheet Matrix

Source: Author's own calculations

	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^S_H			-B^S	+B^S_{CB}		+B^S_{ROW}		0
Equity	+E_H	-E					+E_{ROW}		0
RoW Bonds	+B^{ROW}_H				+B^{ROW}_{CB}	xr		-B^{ROW}	0
RoW Loans		-L^{ROW}_F	-L^{ROW}_B			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

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/liability can be found on the first column of the balance sheet matrix. The plus indicates that the entry is an asset while the minus indicates that the entry is

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

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.

Below is the transactions flow table. Like in the case of the balance sheet matrix, the first column states the transaction/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 of 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 of 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 since spending must create income (flow-flow consistency). Columns sum to one since spending has to either come from earnings, borrowings, or proceeds from the sale of assets. As explained previously, using the TFM we can construct the accounting identities. There are thirty accounting constraints in total. An exhaustive list of the accounting equations can be found in appendix A. The next section elaborates the accounting equations. The section following the next elaborates on the behavioral equations. The last section of this chapter explains the shocks applied to the simulation.

As explained previously, using the TFM we can construct the accounting identities. There are thirty accounting constraints in total. An exhaustive list of the accounting equations can be found in appendix A.

Table 2: Transactions Flow Matrix

Source: Author's own calculations

	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

5.3 Accounting Equations

This section explains the construction of the thirty accounting equations from the TFM illustrated above. This will give the reader a more detailed insight into the construction of a SFC model after the formulation of the two matrices (TFM and balance sheet). We navigate the accounting equations by sector. The fundamental idea behind the construction of the accounting identities is to provide an exhaustive list of equations representing all rows and columns of the TFM. The horizontal equations in the upper half of the TFM, which sum to zero, denote that every flow must originate from some sector and make its way to another sector. Flows cannot disappear into a blackhole or come from nowhere. The horizontal constraint in the bottom half of the TFM denotes that the change in the quantity of a stock of one sector must be compensated by the change in

the quantity of stock in another sector. This means that stocks cannot disappear or appear in one sector without a counterpart in another sector. The vertical constraint implies that a money flow transaction between two sectors must cause a counterpart change in the stocks of the two sectors engaged in the money flow transaction. This ties the top and the bottom of the TFM, and implies that every transaction must have a reflection/implication on the balance sheet. In this manner, we capture the aforementioned quadruple entry system.

5.3.1 *Production Sector*

This sector's equations are the most intuitive and commonly seen, even in models that do not implement stock-flow consistent restrictions. The first equation is the open economy GDP equation calculated from the expenditure side, followed by the profits which are a rearrangement of the GDP equation from the income side. These are vertical constraints. The production sector does not have any stocks since it transfers all its income to the firm sector.

Profits - GDP Income Side

$$\pi = Y - W - Dep \tag{14}$$

GDP - Expenditure Side

$$Y = C + I + G - M + X \tag{15}$$

In the above equations Y denotes income, π denotes profits, W denotes wages, Dep denotes depreciation, C denotes consumption, I denotes investment, G denotes government expenditure, M denotes imports, and X denotes exports. Equation one tells us that profits are what are left over after paying out wages and deducting depreciation. The second equation tells us that income is the sum of consumption, investment, government spending and the difference between the imports and exports of the economy.

5.3.2 *Household Sector*

This section discusses the accounting identities associated with the household sector. The first two equations explain the calculator of disposable income and the computation of the net worth of the household sector.

Disposable Income

$$YD_R = W + R_D^S D_{H-1}^S + R_B^S B_{H-1}^S + (xr) R_B^{ROW} B_{H-1}^{ROW} + \pi_F^S + \pi_B - T \tag{16}$$

Household Wealth

$$V_H = V_{H-1} + YD - C \tag{17}$$

Equation three describes disposable income (YD_R) to be the sum of wages, the interest payments on deposits to households ($R_D^S D_{H-1}^S$), the interest payment on domestic bonds to households ($R_B^S B_{H-1}^S$), the interest payment on foreign bonds to households ($R_B^{ROW} B_{H-1}^{ROW}$), and the profits transferred from firms (π_F^S) and banks (π_B) minus income taxes paid by the households. Equation four describes the wealth of the household (V_H) to equal the difference between disposable income and consumption (C) plus the opening stock of wealth held by households at the start of the year. Thus the expenditures that are not accounted for by incomes must make a changes to the wealth and the stocks (assets and liabilities) of households.

Household Deposits

$$D_H^S = V_H - (xr) B_H^{ROW} - E_H^S - B_H^S \tag{18}$$

Equation five explains the balance of deposits held by households (D_H^S) to be a residual of theory total wealth less their choice to purchase other assets. The other assets they purchase are foreign bonds (B_H^{ROW}), domestic equity (E_H^S), and domestic bonds (B_H^S).

5.3.3 *Firms Sector*

This section discusses the accounting identities associated with the firm sector. The equation below explains the accounting of physical capital stock.

Stock of Capital

$$K = K_{-1} + I - Dep \tag{19}$$

This equation states that the closing capital stock equals the difference between the investment in the current period and the depreciation of capital stock added to the previous periods capital stock. This equation has to do with the capital account of the firm sector, observable in the TFM. The

next equation explains the accounting of the net profits of the firm.

Domestic Firm Net Profits

$$\pi_F = \pi - R_L^S L_{F-1}^S - (xr) R_L^{ROW} L_{F-1}^{ROW} \tag{20}$$

Equation seven tells us the that net profits of firms (π_F) equals the difference between the profits transferred to it from the production process (π) less their interest payments on domestic and foreign loans ($R_L^S L_{F-1}^S + (xr) R_L^{ROW} L_{F-1}^{ROW}$). The next equations explains the distribution of the firms net profit to sectors that hold the firms equity.

Distribution of Firm Profits to Domestic Economy

$$\pi_F^S = (\frac{E_{H-1}^S}{E_{-1}^S}) \pi_F \tag{21}$$

Distribution of Firm Profits to Foreign Economy

$$\pi_F^{ROW} = \pi_F - \pi_F^S \tag{22}$$

Equation eight tells us that the household's share of the firm's net profits (π_F^S) equal the share of equity they own ($\frac{E_{H-1}^S}{E_{-1}^S}$) multiplied by the net profits of the firm in that period. Equation nine tells us that the firm's net profits distributed to the foreign sector (π_F^{ROW}) equals the residual from the deduction of equation eight from total net profits of the firms. The two equations that follow explain the decision to borrow of firms.

Firm Loans

$$L_F = K - E^S \tag{23}$$

Loan Composition

$$L_F^S = L_F - xr(L_F^{ROW}) \tag{24}$$

Equation ten tells us that firm's outstanding borrowings equal the difference between the value of physical capital stock and the money raised from equity. Thus the quantity of loans equal the initial

finance which could not be funded through the issue of equity. Since firms must always borrow first using loans (to invest), and loans outstanding equal what cannot be funded through earnings and the sale of alternate liabilities (Graziani 2003). Equation eleven tells us that the firm's outstanding domestic loans equal the part of total loans that were chosen to not be raised using foreign loans. Once again, we stress that the initial finance happens in domestic loans and this initial finance is funded through the issue of equity and through borrowing from other sources such as abroad that may be cheaper. The changes in the composition between these three liabilities of firms constitute the liability management of firms. Liability management (corporate finance) offers an alternate way to maximize net profits through the economizing of interest payments. The next equation explains the distribution of the issue of equity by the firms. **Equity Supply**

$$E^S = E^S_H + E^S_{ROW} \tag{25}$$

The issue of equity by firms (E^S) depends on the sum of the demand for equity from households (E^S_H) and demand for equity from the rest of the world (E^S_{ROW}).

5.3.4 *Domestic Commercial Bank Sector*

This section discusses the accounting constraints associated with the commercial banking sector. The equation below explains the determination of the profits of the commercial banks.

Commercial Bank Profits

$$\pi_B = R^S_L L^S_{-1} - xr(R^{ROW}_L L^{ROW}_{B-1}) + R^S_{Res} Res_{-1} - R^S_D D^S_{-1} \tag{26}$$

The profit of the commercial banks (π_B) is a function of its interest receipts and interest payments. The commercial banks profit off of their liquidity creation function. They lend dear and fund their lending relatively cheaply through deposits and foreign banks. They receive interest payments on the loans they lend to firms ($R^S_L L^S_{-1}$), and receive interest payments on their reserve balances at the central bank ($R^S_{Res} Res_{-1}$). They pay interest on deposits ($R^S_D D^S_{-1}$) and interest on foreign loans ($R^{ROW}_L L^{ROW}_{B-1}$). The following equations explain the calculation of interest rates of the liabilities and assets of commercial banks.

Interest on Deposit

$$Int_D^S = R_D^S D_{H-1}^S \tag{27}$$

Interest on Domestic Loans

$$Int_L^S = R_L^S L_F^S \tag{28}$$

Interest on Domestic Bank Reserves

$$Int_{Res}^S = R_{Res}^S Res_B^S \tag{29}$$

These are simply the product of the relevant interest rate and the relevant stock (asset/liability). The following equation describes the determination of foreign borrowings of the domestic central bank.

Domestic Bank Demand for Foreign Loans

$$L_B^{ROW} = L^{ROW} - L_F^{ROW} \tag{30}$$

The foreign borrowing of the central bank (L_B^{ROW}) is the residual of the total foreign loans issued (L^{ROW}) less the foreign borrowings of the domestic firms (L_F^{ROW}). This implies that the firms liability management choice determines the liability management choice of commercial banks in the domestic economy.

5.3.5 *Government Sector*

This section describes the accounting equations of the government sector. The government sector consists of the domestic central bank and the treasury. The following equation explains the net wealth of the government sector.

Government Wealth

$$V_G = V_{G-1} + T + \pi_{CB} - G - R_B^S B_{-1}^S \tag{31}$$

The net wealth of the government sector (V_G) equals the opening balance of the sectors wealth (V_{G-1}) plus the net deficit it incurs in every period. The net deficit or net lending of the government sector is calculated as the difference between the expenditure and income of the government. The income of the government is the sum of profits that are transferred to the treasury from the central bank (π_{CB}) plus income tax revenue (T). The expenditure of the government is equal to the sum of interest payments on treasury bonds ($R_B^S B_{-1}^S$) and government spending (G). The following equation explains the calculation of the profits of the central bank which are transferred to the treasure at the end of the accounting period.

Domestic Central Bank Profits

$$\pi_{CB} = R_B^S B_{CB-1}^S + (xr) R_B^{ROW} B_{CB-1}^{ROW} - R_{Res}^S Res_{-1} \tag{32}$$

The profits of the central bank (π_{CB}) equal the difference between its interest receipts and interest payments. The central bank receives interest payments on treasury bonds ($R_B^S B_{CB-1}^S$) and foreign bonds ($R_B^{ROW} B_{CB-1}^{ROW}$) while it pays interest on the reserve holdings of commercial banks ($R_{Res}^S Res_{-1}$). The next equation explains the interest payment on domestic bonds.

Interest on Domestic Bonds

$$Int_B^S = R_B^S B_{H-1}^S + R_B^S B_{CB-1}^S + R_B^S B_{ROW-1}^S \tag{33}$$

The interest on domestic bonds (Int_B^S) equals the sum of interest payments to bond holders. This constitutes households ($R_B^S B_{H-1}^S$), the central bank ($R_B^S B_{CB-1}^S$), and the foreign sector ($R_B^S B_{ROW-1}^S$). The following equation explains the issue of treasury bonds to be equal to the negative of the net wealth of the government sector. This is because treasury bonds are the only liability of the treasury.

Domestic Bonds Issue

$$B^S = -V_G \tag{34}$$

The central bank's issue of reserves to commercial banks (Res) equal the sum of commercial bank deposits (D_H^S) and foreign loans of commercial banks (L_B^N) less the foreign borrowings of domestic firms (L_F^S).

Central Bank Reserves

$$Res = D_H^S + xr(L_B^N) - L_F^S \tag{35}$$

The missing equation of the model is illustrated below. This equation also provides an estimate of central bank reserves. Equation 22 and the equation below must output the same level of central bank reserves. This is a necessity to ensure stock-flow consistency.

MISSING EQUATION: Central Bank Reserves

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

The equation tells us the reserves must equal the sum of treasury bonds and foreign bonds. The next equation explains the demand for treasury bonds by the central banks.

Central Bank Demand for Domestic Bonds

$$B_{CB}^S = B^S - B_{ROW}^S - B_H^S \tag{36}$$

This equation tells us the central bank clears the treasury bonds market. It purchases the residual treasuries that are not purchased by the external (B_{ROW}^S) or household sector (B_H^S).

5.3.6 *Foreign Sector*

The foreign sector consists of the foreign financial and foreign non-financial sector. This section will discuss the accounting identities associated with the foreign sector. The equation below accounts for the net wealth of the foreign sector.

Foreign Wealth Against Domestic Economy

$$V_{ROW} = V_{ROW-1} + M - X + R_B^S B_{ROW-1}^S + \pi_F^{ROW} + \pi_B^{ROW} \tag{37}$$

The net wealth of the foreign sector (V_{ROW}) equals the sum of the opening balance of the sectors net wealth and its net lending. The net lending of the foreign sector is the result of its incomes and expenditures. The incomes of the foreign sector are the receipts from the imports of the domestic country (M), its interest receipts on its treasury bond holdings ($R_B^S B_{ROW-1}^S$), the profits transferred

to it from domestic firms (π_F^{ROW}), and the profits transferred to it from the foreign financial sector (π_B^{ROW}). The expenditures of the foreign sector only constitute the exports of the domestic sector which are purchased by the foreign sector (M). The following equation presents the calculation of the profits of the foreign financial sector.

Foreign Financial Sector Profits

$$\pi_B^{ROW} = R_L^{ROW} L_{-1}^{ROW} - R_B^{ROW} B_{-1}^{ROW} \tag{38}$$

The foreign financial sectors profits (π_B^{ROW}) equal the difference between the interest receipts on foreign loans issued to the domestic sector ($R_L^{ROW} L_{-1}^{ROW}$) and the interest payments on foreign bonds ($R_B^{ROW} B_{-1}^{ROW}$). The next equation explains the distribution of interest payments on foreign bonds.

Interest on Foreign Bonds

$$Int_B^{ROW} = (xr) R_B^{ROW} B_{CB-1}^{ROW} + (xr) R_B^{ROW} B_{H-1}^{ROW} \tag{39}$$

The total interest payments by the foreign financial sector equations the sum of interests paid to the holders of foreign bonds. In this model, only the domestic central bank ($R_B^{ROW} B_{CB-1}^{ROW}$) and the household sector hold foreign bonds ($R_B^{ROW} B_{H-1}^{ROW}$). The next equation explains the receipt of interest on foreign loans issued to the domestic sector.

Interest on Foreign Loans

$$Int_L^{ROW} = xr(R_L^{ROW} L_{B-1}^{ROW}) + xr(R_L^{ROW} L_{F-1}^{ROW}) \tag{40}$$

Interest payments are made by domestic firms ($R_L^{ROW} L_{B-1}^{ROW}$) and the domestic central bank ($R_L^{ROW} L_{F-1}^{ROW}$) to the foreign financial sector to service debt. The next equation explains the issue of foreign loans.

Foreign Loans Issue

$$L^{ROW} = xr(B^{ROW}) \tag{41}$$

The issue of foreign loans (L^{ROW}) are determined by the demand for foreign bonds (B^{ROW}). This makes sense since the international liquidity to purchase foreign bonds has to come from somewhere. This implies that some sector, in this case the domestic commercial bank, takes a position

in the foreign currency so that other domestic sectors can purchase foreign bonds using foreign currency proceeds supplied by the domestic commercial bank. The next equation explains the demand for domestic bonds by the foreign sector (B^S_{ROW}) as the difference between the net wealth of the foreign sector less the demand for equity (E^S_{ROW}). Since there are only so many assets which can be used to store wealth one asset must always play the role of the residual.

Foreign Demand for Domestic Bonds

$$B^S_{ROW} = V_{R_W} - E^S_{ROW} \tag{42}$$

The final accounting equation of the model describes the distribution of supply of foreign bonds.

Foreign Bond Supply

$$B^{ROW} = xr(B^{ROW}_H + B^{ROW}_{CB} \tag{43}$$

The issue of foreign bonds depends on the demand for foreign bonds from the household and domestic central bank sectors. This completes the thirty accounting equation implied by the TFM and stock-flow consistence is guaranteed.

5.4 Behavioral Equations

We adopt twenty-one equations in addition to the thirty accounting equations that ensure stock-flow consistency. Not all of these twenty-one are behavioral equations; some of them may be intermediate steps. There are fifteen behavioral equations of which thirteen are adopted from the existing literature. The two new equations introduced in this thesis are explained in chapter four. The behavioral equations are; the consumption function, imports and exports function, income tax function, depreciation function, the investment function, the target capital-stock function, the wages function, the portfolio choice functions of the household and the foreign sector, the international reserves function, and the domestic interest rate function. This equation will explains the nineteen remaining equations that have not been discussed elsewhere. These equations have been adopted from existing literature, mostly from the benchmark models of Godley and Lavoie (2012), with the exception of a handful of newer contributions.

5.4.1 *Household Behavior*

First we begin with the behavioral equations associated with household sector. All the behavioral equations of the household sector are identical to the ones used by Godley and Lavoie (2012). To model consumption we use the standard equation provided by Godley and Lavoie (2012) where consumption is a function of the 'regular' disposable income of the previous period and household wealth.

Consumption Function

$$C = \alpha_1 YD_{R-1} + \alpha_2 V_{H-1} \tag{44}$$

We the proceed to the income tax equation, which suggests that income tax is a fraction of disposable income from the previous period.

Income Tax

$$T = \theta YD_{R-1} \tag{45}$$

Wages are expressed as a fraction of the last period's national income. In this model, we assume that workers are able to maintain a constant wage share of income equal to ν.

Wages Function

$$W = \nu Y_{-1} \tag{46}$$

Household portfolio choice employs the standard Tobin-Godley formulation that is used throughout the literature. Some other interesting approaches such as Dafermos (2012) have been taken to endogenize the coefficients of the portfolio choice, which indicate the wealth elasticity of each asset. However, this model sticks to the standard presentation of exogenous portfolio choice.

$$\begin{bmatrix} D_H^S \\ B_H^S \\ B_H^{ROW} \\ E_H^S \end{bmatrix} = \begin{bmatrix} \lambda_{10} \\ \lambda_{20} \\ \lambda_{30} \\ \lambda_{40} \end{bmatrix} V_{H-1} + \begin{bmatrix} \lambda_{11} & \lambda_{12} & \lambda_{13} & \lambda_{14} \\ \lambda_{21} & \lambda_{22} & \lambda_{23} & \lambda_{24} \\ \lambda_{31} & \lambda_{32} & \lambda_{33} & \lambda_{34} \\ \lambda_{41} & \lambda_{42} & \lambda_{43} & \lambda_{44} \end{bmatrix} \begin{bmatrix} r_D^S \\ r_B^S \\ Er_B^{ROW} \\ Er_E^S \end{bmatrix} V_{H-1} + \begin{bmatrix} \lambda_{15} \\ \lambda_{25} \\ \lambda_{35} \\ \lambda_{45} \end{bmatrix} YD_{R-1} \tag{47}$$

The matrix-form equation above provides us with four individual equations which can be found in their scalar form in the appendix. Note however that the coefficients of the portfolio choice are such

that the demand for deposits which are the residual from equation five. The first set of lambdas can be thought as a liquidity preference, as it denotes an exogenous share of wealth that is to be held in the respective asset. It can also be thought as a measure of imperfect asset substitutability. The second set of lambdas explain the reaction of demand for every asset to a change in returns of other assets and itself. This can be thought of as the speculative demand for assets, as it demonstrates agents The last set of lambdas denote the transactions demand for the asset, i.e. the effect of rising disposable income on the demand for each asset.

Recall that the sum of demands for assets must sum up to the total wealth of the household, it cannot exceed the current wealth of the household. This is ensured by assuming certain constraints on the lambdas. The first set of lambdas must sum to one, meaning that the initial values of assets must sum to the total wealth of the household sector. The sum of each column of the second set of lambdas must equal zero. The second matrix must also be symmetric. These constraints ensure that the loss in demand for one asset, for speculative reasons, is compensated by a gain in demand for other assets. The final constraint is that the last set of lambdas must sum to zero as well, meaning that the loss of demand for one asset ,for transactions purposes, must be compensated by the gain in demand of other assets. These constraints are explained in more detail by Godley and Lavoie (2012). The vector beside the second set of lambdas signify the rate of return on each of the four assets. The calculation of the first two elements are determined outside. The last two, returns on foreign bonds (Er_B^{ROW}) and domestic equity (Er_E^S) are computed using the equations below;

Return on Foreign Bonds

$$Er_B^{ROW} = R_{B-1}^{ROW} + \Delta xr \tag{48}$$

Return on Equity

$$Er_E^S = \frac{\pi_F}{E^S} \tag{49}$$

The returns on foreign bonds is the sum of the rate of interest on foreign bonds (R_{B-1}^{ROW}) and the change in the exchange rate (Δxr), note that the second element is redundant because we are operating in a fixed exchange rate. The returns on equity (Er_E^S) is computed as the rate of return on equities, i.e. the net profit of firms over the total issue of equity.

The two equations below explain the behavior of imports and exports. They are simple functions of the respective incomes of the countries times respective import propensities.

Imports

$$M = \mu^{S} Y_{-1} \tag{50}$$

Exports

$$X = \mu^{ROW} Y^{ROW} \tag{51}$$

5.4.2 *Firm Behavior*

This section describes the behavior of firms. The primary role of the firm is to invest and determine the level of income and employment in the economy. Since we operate independent of the loanable funds market, investment determines the borrowing of firms and the investment decision drives the economy. The investment decision also leaves behind a liability structure that has implications on the economy. We once again use the standard specifications that are used by Godley and Lavoie (2012). However the firm behavior prescribed by Godley and Lavoie (2012) is susceptible to the Kregel (1985) '*Hamlet Without the Prince*' critique suggests that post-Keynesian investment functions have failed to emphasize the role of finance and thus take into account uncertainty. The equation below explains the investment decision;

Investment Function

$$I = \gamma(K^{T} - K_{-1}) + dep \tag{52}$$

Target Capital Stock Function

$$K^{T} = \kappa Y_{-1} \tag{53}$$

Equation 40 explains investment as a function of the deviation of the last period's stock of capital (K_{-1}) from the desired stock of capital (K^{T}) and depreciation. This is a Kaleckian investment function that takes into account the negative effects of having excess capacity, and the positive

effects of having inadequate capacity. The investment function also takes into account the cost incurred as replacement cost, i.e. depreciation. As long as the excess capacity is lower than the quantity of depreciation, investment is positive. Equation forty-one explains how the desired level of capital stock is determined. The desired level of capital stock is a multiple (κ) of the previous period's income. The higher the level of income in the previous period, the higher the desired capacity of the firms.

The equation below explains the calculation of depreciation which is a function of the valuation of capital in the previous period.

Depreciation

$$Dep = \delta K_{-1} \tag{54}$$

We must note, however, that the investment function is not as strong of a characterized as envisioned by Keynes (1964) and Minsky (2008a). The changes in the decision to invest is primarily dependent on the previous periods income which is dependent on consumption and government spending. Thus analytically thinking about it investment is not the driver of the economy. Autonomous expenditures are the drivers. The development of a more powerful investment function to reflect the insights of Minsky (2008a) and Keynes (1964) is a topic for another day.

The equation below is reflects the choice of firms to fund domestic loans with foreign borrowing. This is one of the few behavioral equations which have been borrowed from a source that is not Godley and Lavoie (2012). Raza et al. (2019) develops an interesting, yet simple, behavioral equation for the firm's liability choice. We must also mention Nalin and Yajima (2022) as presenting an interesting alternate behavioral equation that describes the liability management of firms with respect to the composition of loans; domestic versus foreign.

Firm Loan Choice

$$\begin{bmatrix} L_F^S \\ L_F^{ROW} \end{bmatrix} = L_F \begin{bmatrix} \psi_{10} \\ \psi_{20} \end{bmatrix} + L_F \begin{bmatrix} \psi_{11} & \psi_{12} \\ \psi_{21} & \psi_{22} \end{bmatrix} \begin{bmatrix} r_L^S \\ r_L^{ROW} + \Delta xr \end{bmatrix} \tag{55}$$

The construction of the loan/liability structure choice does remind us a little of the portfolio choice equation's principles. The constant terms, i.e. the first set (vector) of ψ's indicate the initial composition of the loan composition. The second set (matrix) of ψ's indicates the interest rate sensitivity of the decision to borrow from one source. The design is such that the choice of one also depends on the change in cost of the other, similar to the portfolio choice design. We can also note that in principle, the decision to fund also depends on the change in the exchange rate. This, however, is redundant for our purposes since we adopt a fixed exchange rate regime in out model. Also recall that only one of these loans are actively and behaviorally determined since the sum of loans from foreign and domestic sources must sum to the total quantity of loans determined by the system. Thus similar to the case of the portfolio choice equations, the first vector of ψ's must add up to one. The second ψ matrix must by symmetric and the sum of each column must be zero.

5.4.3 *Foreign Portfolio Choice*

Since we adopt a small-open economy assumption, there exists only one behavior we assign to the foreign sector. Other variables are, for the most part, exogenous. The only behavior that will be explained in this sector is the portfolio choice of the foreign sector. This equation is structurally identical to equation 34.

$$\begin{bmatrix} B^S_{ROW} \\ E^S_{ROW} \end{bmatrix} = \begin{bmatrix} \lambda_{50} \\ \lambda_{60} \end{bmatrix} V_{ROW-1} + \begin{bmatrix} \lambda_{51} & \lambda_{52} \\ \lambda_{61} & \lambda_{62} \end{bmatrix} \begin{bmatrix} r^S_B - \Delta xr \\ Er^S_E - \Delta xr \end{bmatrix} \tag{56}$$

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6 SIMULATION SCENARIOS AND RESULTS

6.1 Proposed Scenarios

The scenarios of this model attempt to illustrate how an emerging peripheral economy is vulnerable to external shocks which are out of their control. Toporowski (2021) categorizes external shocks into three.

The first considers the effect of the center's GDP on the periphery. This may come from austerity in the center, trade controls, or crisis in the center. Financial fragility and the fall of incomes in the center is transmitted to the periphery. This is through a fall in expenditure for the periphery's trade and a fall in demand for the periphery's liabilities caused by the contraction of income in the center. This could result in the periphery being unable to service its debt, since its cash inflows (in the foreign currency) depend on its proceeds from the center through trade and on its ability to borrow from the center at affordable rates.

The second considers the effect of a an increase in interest rates in the center. The rise in interest rates in the center could have an effect on the periphery through the aforementioned channel, by inducing an austerity in the center. More importantly, the rise in interest rates in the center could also force the periphery to react by increasing its own interest rates, allowing its exchange rate to depreciate, or build up its stock of international reserves. They are forced to take these actions to prevent capital flight. These actions, as explained in previous chapters, come with recessive and fragility implications of their own. We simulate two scenarios in this case. One where the domestic economy does not respond, and the next where the domestic economy responds with a change in its own-interest rate.

The third channel which will not be simulated in this thesis, considers changes in the level of global liquidity preference. If we were simulating this scenario, we would do this by changing the probability weight of the capitalization factor from the international reserves function proposed in chapter four. However, we do not do this due to the fragility the comes with the international reserves function. This fragility requires us to re-calibrate other parameters when we make a

significant changes to the probability weight of the international reserves function. In addition to these scenarios, we also simulate the extent and conditions under which which the government can stimulate its own economy through spending in the presence of the constraining relations imposed by the currency hierarchy. We first simulate the effect of a rise in government expenditure. We then simulate the rise in government expenditure complemented by a fall in the import propensity, either caused by trade/capital controls or by structural change induced by the government spending.

In this manner we simulate how relationships implied by the existence of the currency hierarchy not only allow shocks of an international nature to effect the peripheral economy with a weak currency, we also demonstrate that the peripheral economy's government would have to take additional efforts to stimulate its economy. We also observe that the type of stimulus is very important.

6.1.1 *Foreign Austerity*

The first scenario reduces the foreign income by 6.25 percent. This could be a result of austerity or fiscal discipline imposed by the center on its own economy. This decision would influence other peripheral economies, since it would reduce the foreign income accrued to the periphery. We would expect this to increase the fragility of the peripheral economy, as its foreign cash inflows would fall relative to its foreign cash commitments - since its exports are a function of the foreign sector's income. This could also increase the cost incurred by the economy, to hold international reserves. We can visualize this effect through a reference to the international reserves function, illustrated in chapter four. Given the claims the foreign economy has over the domestic economy, a fall in the receipt of foreign income causes a rise in the gap between the value of claims and the capitalized receipts of foreign income. Thus implying that the central bank increases its demand for international reserves. There is also the more direct channel through which the periphery's income is affected, with the quantity of export demand falling, thus causing the total income of the periphery to fall.

6.1.2 *Domestic Fiscal Expansion*

The second scenario of the model increases the government spending in the peripheral country. This could be in response to a slump or simply a desire to expand the peripheral economy. In a typical model, it is almost certain that a rise in government spending will results in a permanent rise in the steady state level of income.[39] However, the set up of the SFC model in this chapter does highlight some negative channels of government expenditure. Primarily through the international reserves function. Given the set-up of the model, we would expect that there is a possibility that government spending could have a negative effect on the peripheral economies' income. This is because the rise in government spending not only results in a balance of payment strain, through the imports channel but also through a financial flows channel. This is because the rise in wealth and the creation of domestic bonds results in an increase in the foreign claims of the center on the periphery. Through the international reserves function, this implies that a higher quantity of wealth of the peripheral economy needs to be set aside to maintain international reserves. As discussed in chapter four international reserves (and liquidity) pose a cost to the economy. The disadvantage of highlighting this channel so explicitly is that other channels may not be present to offset this channel. Thus we must not right at the outset that the claim of this model is not that this channel dominates and that government spending must always result in a fall in income. The goal is simply to highlight an overlooked channel, the cost of international liquidity. The government spending is increased by 17 percent in this scenario.

6.1.3 *Domestic Fiscal Expansion with Import Substitution*

As explained in the previous section, we acknowledge the possibility of a rise in government spending to have a negative effects on the GDP of the emerging economy. This was explained to be initiated primary through a balance of payments constraint. In concert with this, we try to complement government spending with a change in the import propensity of the emerging economy. This rise in import propensity could be a result of either controls on trade or capital flows. It may also be a consequence of strategic government spending that stimulates not only the GDP but also structural change, which reduces the demand for importing. We would expect that govern-

[39] All the models from the handbook of SFC models by Godley and Lavoie (2012) derive this result.

ment spending complemented by a falling import propensity has a positive effect on the GDP. For this purpose in addition to the 17 percent rise in government spending, we also shock the import propensity. The import propensity is calibrated to decline by 3 percent from 30 percent of GDP to 27 percent of GDP.

6.1.4 *Foreign Monetary Tightening*

The third scenario of the model considers the case of monetary tightening, i.e. increase of interest rates in the center. This is a contemporary phenomenon, and historically was also responsible for the 'lost decade' in Latin America. The center usually decides to tighten its monetary policy in response to inflation pressures that persist within its economy. Rising interest rates have historically and theoretically been proven to have at best an ambiguous effect on inflation Papadimitriou and Wray (2021). Even if higher interest rates do succeed, it is usually through a 'real' and 'financial' sabotage of the economy. Leaving aside the impact of the hike on the center's domestic economy, the rise in interest rates often causes capital flight from the periphery to the center. This results in a fall in their exchange rates, a rise in their desire to hold international reserves in response to expected capital flight, and/or may force them to hike their own interest rates. All these actions could result in the contraction of the peripheral economy. The interest rate on foreign bonds is raised by 0.3 percent in this scenario.

6.1.5 *Domestic Monetary Subordination*

The fourth scenario follows from the third. The model disallows changes in the exchange rate, since we operate on a fixed exchange rate assumption. The changes in demand for international reserves are endogenous. However the subordination of the peripheral economies' interest rate is a policy choice, as explained in chapter four. In this scenario, we allow the peripheral central bank to respond (to a defined extent) to changes in the interest rate in the center. The peripheral economy reacts by 20 percent to the change in the interest rate of the center. So if the center changes interest rates by 1 percent, the periphery would change its interest rate by 0.2 percent. We would expect this to have a negative effect on the domestic economy, since the rise of interest rates typically slows the economy down, through real and financial channels (Papadimitriou and Wray 2021).

6.2 Simulations

In this section, we simulate and apply the aforementioned shocks of our model. Using the trends of different stock and flow variables, we evaluate if our hypothesis about the shocks holds true. A stock-flow consistent model is a complex system, and there is no reason to believe that our ceteris-paribus hypotheses that do not take into account accounting constraints will hold true. The SFC model gives us a chance to examine additional channels in addition to the proposed theory that are a consequence of the interaction of behavioral and accounting equations. All graphs are presented in relative terms instead of absolute terms. This is because the initial values and calibration of the model are purely theoretical, and absolute values have little meaning. What we study is the change in behavior due to the shocks. For this reason, it may be reasonable to present all observations and quantities relative to the baseline. In this case we can obtain the percentage change of quantities relative to the baseline. The first graph below proves that the model converges to a steady state level of income (in absolute terms). This would imply that the relative income of following scenarios converging, indicate the convergence in those cases as well. Since the baseline is, for the most part, constant. The graph below may seem volatile but looking at how small the scale of the y-axis is, we can see that volatility is negligible, and there is convergence. Convergence of income in an SFC model implies the convergence of all stocks and flows as well. This denotes a long-term steady state, barring any changes in parameters.

Figure 3: Baseline Income Convergence

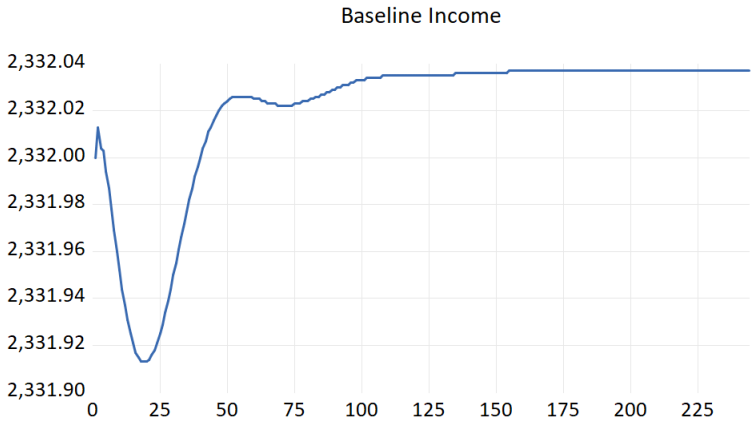
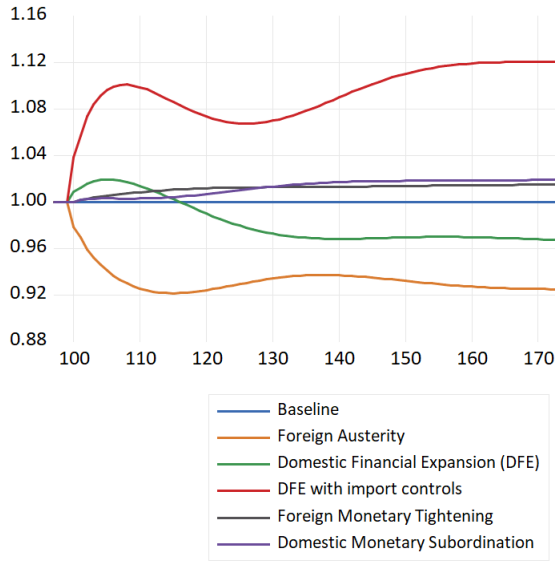


Figure four below illustrates the impact of the five scenarios and shocks on the income of the domestic peripheral economy. The shocks were applied at the 100^{th} time period. The dynamics of changes in the level of income, relative to the steady state baseline level of income, is not very complex and fairly straight forward. We do not experience any complex cyclical dynamics. The shocks result in a convergence of income to a steady state level.

Figure 4: Impact of Shocks on Domestic Income



In figure four we observe that not all of our aforementioned expectations were met. The two scenarios that completely contradicted our prediction were scenarios four and five. The rise in the foreign interest rate, and the rise in the domestic interest rate in response to the rise in foreign interest rates, both, resulted in a rise in income, almost monotonically. The previous section explained the channel through which we expected income to fall in response to scenarios three and four. This does not contradict the theory explained above. Rather it implies that we have to uncover the other channels that prevent the observation of this channel.

As hypothesized in the previous section, with a rise in government spending, in initial periods income rises before it converges to a level lower than the baseline. The only scenario that strictly follows the expectations presented in the previous section is the foreign austerity scenario, which

displays a falling trend in domestic income right from the start. We also see that a decline in the import propensity allows government spending to positively impact the periphery's GDP.

The shocks are not comparable in magnitude. However we can observe that the scenario of foreign austerity experiences the largest fall in income by around 8 percent. This is because both channels, directly though the GDP calculation (via a fall in net exports) and indirectly through the international reserves function act in a recessive manner. We see that a rise in government spending complemented by a decline in the propensity to consume results in a 12 percent rise in GDP. We need to examine some additional graphs to confirm and hypothesize the exact channels through which income changes in each of the scenarios were realized. The following sections analyze each scenario individually. Attached below are a series of common graphs which will be analyzed in the following sections. Please note that we adopt the legend from figure four, unless stated otherwise.

Figure 5: Central Bank International Reserve Holdings

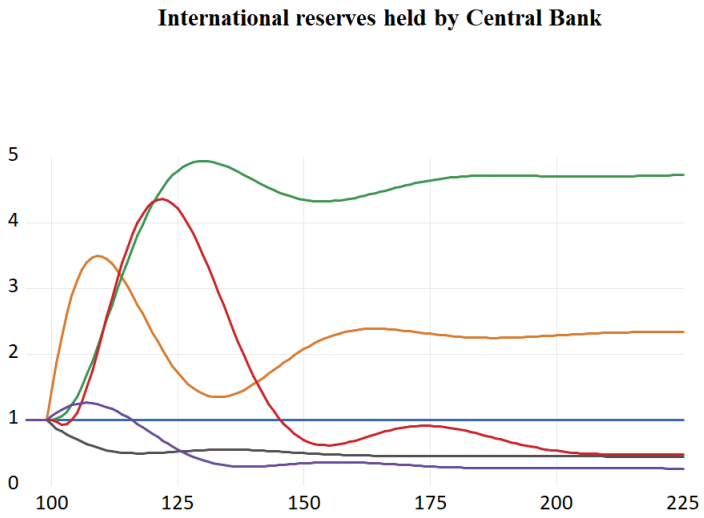


Figure 6: Foreign Claims on Domestic Economy

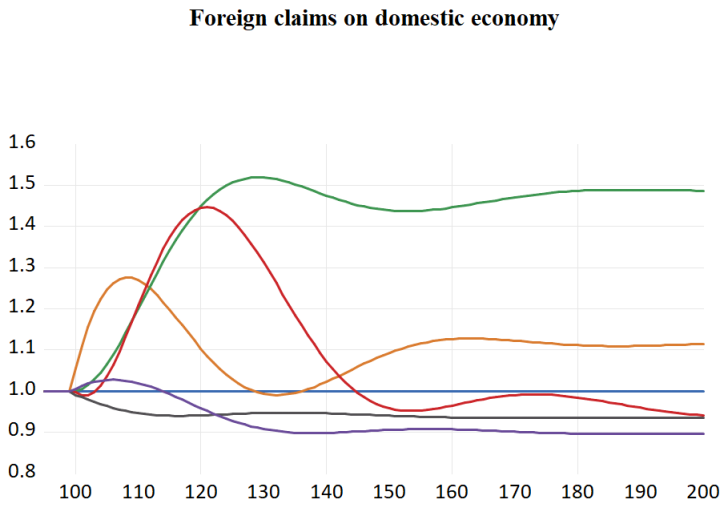


Figure 7: Domestic Disposable Income

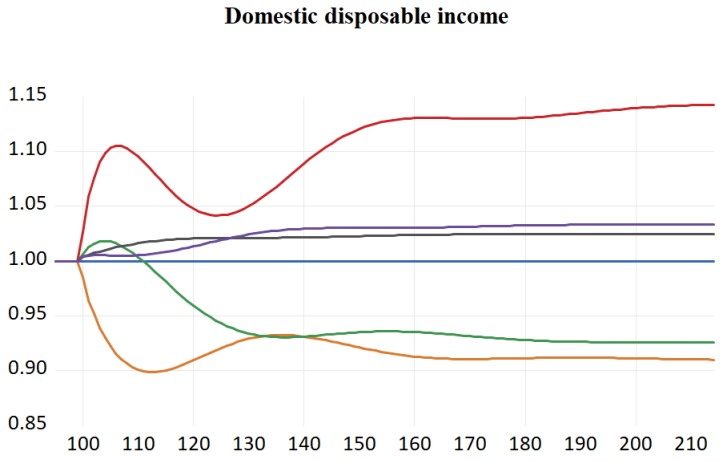


Figure 8: Gross Foreign Receipts

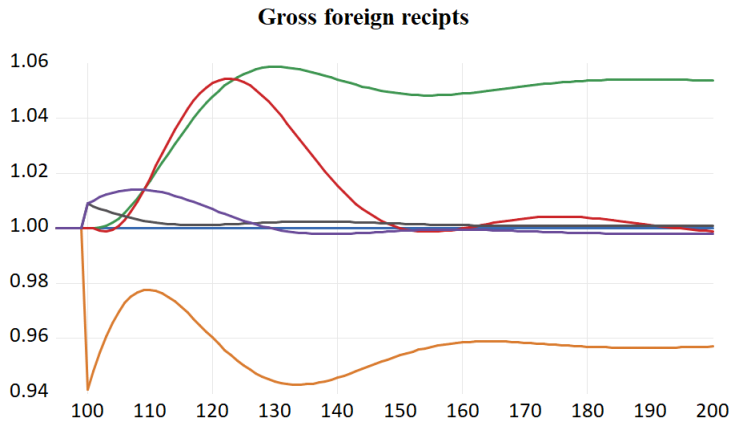


Figure 9: Current Account Balance

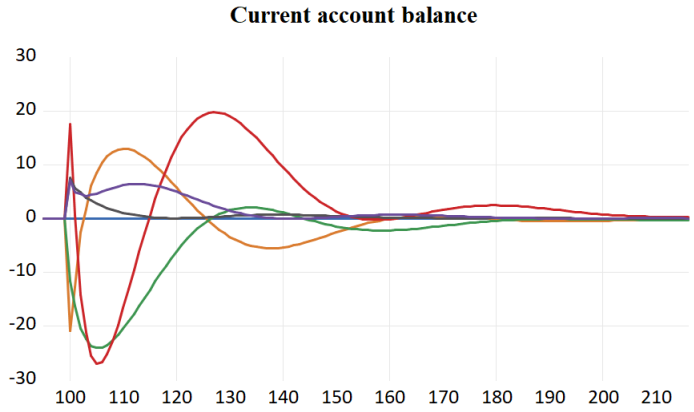


Figure 10: Household Wealth

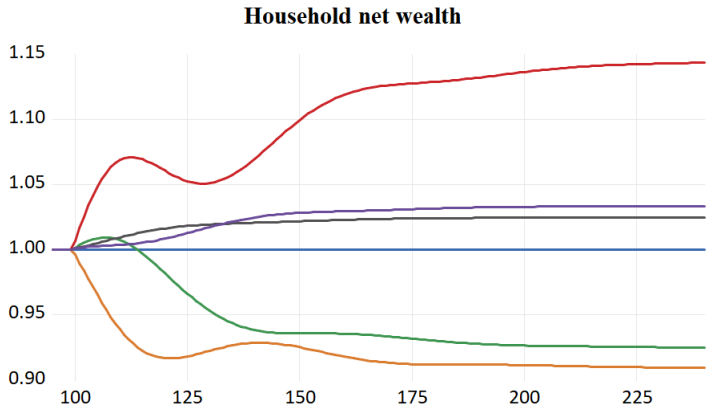


Figure 11: Government Wealth

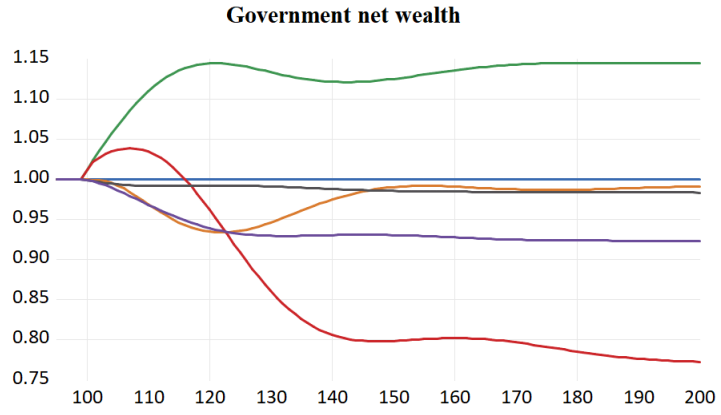
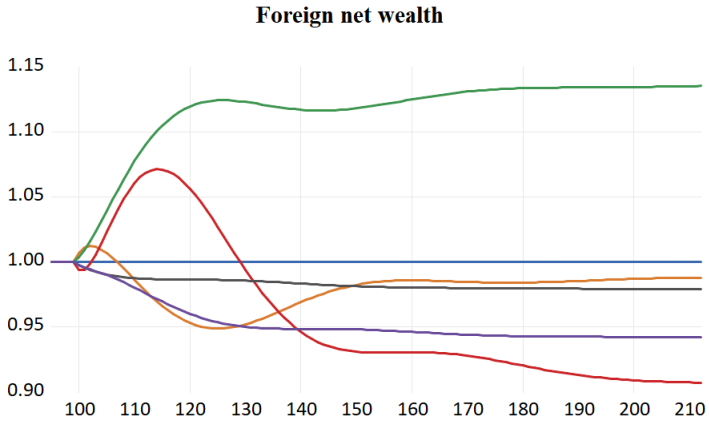


Figure 12: Foreign Wealth



6.2.1 *Scenario 1: Foreign Austerity*

As discussed previously, in this first scenario, the foreign GDP is shocked to reduce by 6.25 percent. From figure four, we see that this shock hurts the peripheral economy the most by reducing its income by almost 8 percent. The two channels hypothesized above were a direct and an indirect one. The direct channel reduces GDP through a reduction in exports, since the imports of the foreign economy is a function of its income. The indirect channel works through the fall in the capitalized value of foreign receipts relative to the claims of the foreign economy, which increases the demand for international reserves (foreign bonds). The increase in demand for international reserves imposes a cost on the domestic economy (Rodrik 2006). In all of the above figures, orange denotes this scenario as indicated by the legend of figure 4.

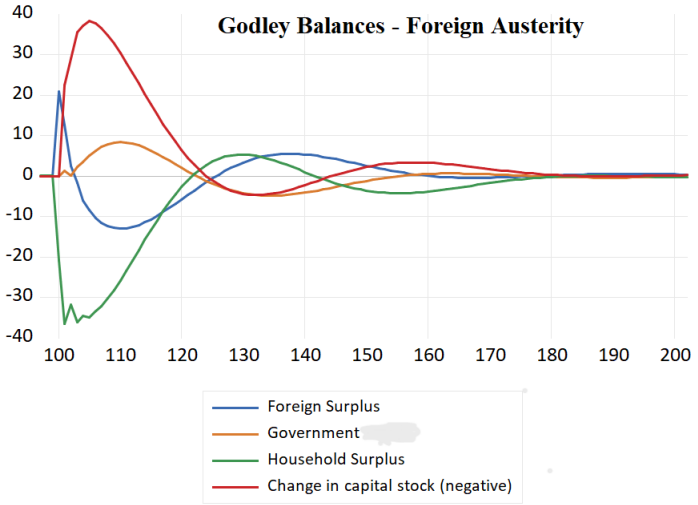
We can see from figure 5 that the quantity of international reserves, at steady state, held by the domestic central bank rose a little over two times what was held in the baseline. We can also observe from figure 6 that the claims that the foreign economy had over the domestic economy rose by 10 percent, initially increasing by almost 30 percent. This presumably increased the outflow of interest payments on financial assets from the domestic-peripheral economy into the foreign economy. This would have resulted in a fall in disposable income by reducing the profits and increasing the interest payments of each sector. This fall in disposable income (Figure 7) 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 fall 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 in the middle of this 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 interest payments accrued on the rise in holding of foreign bonds fail to offset this negative effect on disposable income because of the interest rate spread between the assets of the domestic and peripheral economy, i.e. the cost of holding international reserves. As we can

see the government wealth reduces (Figure 11), implying that more domestic bonds were issued, presumably to finance the increase in purchase of international reserves.

We see that there is initially a sharp drop in the gross receipts of foreign income (Figure 8). This is caused by the fall in exports. The temporary recovery of foreign income is driven by increase in holdings of international reserves which generate some interest payments. This declines as the holding of international reserves declines and the foreign claims over the domestic economy rise (Figure 6). We also observe similar trends in the current account balance (Figure 9), 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 rise in foreign claims that the foreign sector holds over the domestic economy (Figure 6).

Figure 13: Godley Balances - Scenario One



We can also see from the Godley balances that the foreign austerity, which initially causes a foreign surplus results in unsustainable processes of a household deficit (Godley 2012). The recessive impact of foreign austerity also results in a rising government deficit, due to the fall in tax revenue. 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 (Figure 10,11,12) suggests that the 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 decline significantly before rebounding and converging at a steady state lower than the baseline. Household wealth fell by about 10 percent while the wealth of government and foreign sector fell by much less, indicating that the private domestic sector (household) took the hardest hit. The fall 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 6. 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.

6.2.2 *Scenario 2: Domestic Fiscal Expansion*

In this second scenario, the domestic government decides to raise government spending by almost 17 percent. We observe that the rise in government spending initially increases the level of income for the first twenty periods (Figure 4). Income hits its peak at a 2 percent increase from the baseline. However, after twenty periods, there is a steady fall in the level of income until the new level of income converges to a value that is almost 4 percent less than the baseline. To typical literature this is a very surprising effect, since one would typically expect that the rise in government spending increases income. However, as explained in the previous section, we suspected this as a possibility on account of the introduction of the international reserves function. This scenario is marked using the color green in the graphs, as shown in the legend of figure 4.

As we can see from the accounting identities, the 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 9). The rising current account

deficit is because of the rising trade deficit and the rising financial flow deficit.

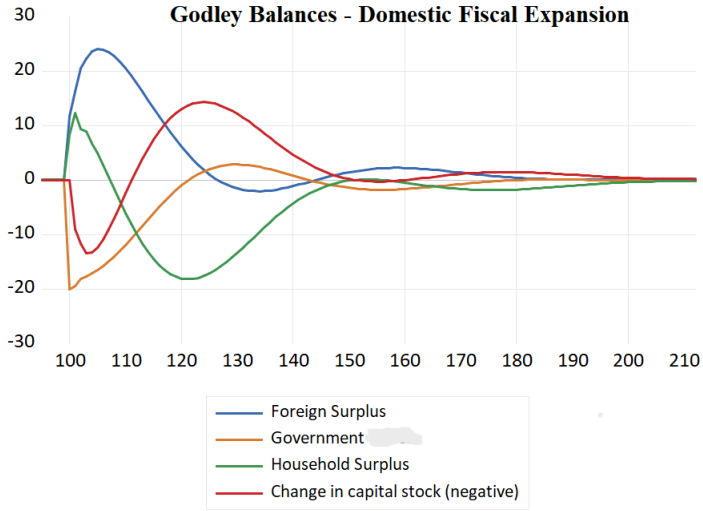
We can observe a sharp rise in the holdings of international reserves by the domestic central bank (Figure 5). This sharp rise saw international reserves increasing almost five-fold in the first thirty periods and stabilizing at around that value. This rise in demand for international reserves is driven by the sharp increase in foreign claims over the domestic economy - an almost 50 percent rise. This was followed by only a 6 percent increase in gross income receipts from abroad, driven by the rise in holdings of international reserves. Thus the rising 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 12). While the household sector's wealth falls by almost 8 percent (Figure 10). The government wealth also falls by around 15 percent (Figure 11). This implies that even from a long run perspective, the domestic economy is worse off, and government spending primarily benefited the foreign economy. With the government wealth, physical capital (which is a scalar times income) and household wealth all being adversely affected.

We also observe that the disposable income falls after about twenty periods. This is because of the fall 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 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 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 in the middle of this wages, which are a function of income, also fall due to the fall of income which in turn further depresses disposable income.

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;

> If France or Italy decided to expand domestic demand, it would be quickly drained out of the country — it would no longer show up in the German balance of payments surplus and an Italian deficit as before EMU, but now appear as increased expenditure flows from Italy to Germany, with the Italian fiscal deficit deteriorating, and credit risks on Italian securities increasing (Kregel 1999, 40).

Figure 14: Godley Balances - Scenario Two



On analyzing the Godley balances, we see that government spending, or the rise in the government deficit initially benefits the household surplus and the foreign surplus at the same rate until a little before the 110^{th} period. After this point, the household surplus falls sharply. The government deficit in this case, seems to be behaving 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. Capital stock, after increasing initially falls, albeit slower than the household surplus. The foreign sector's deficit barely turns negative. 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 the developed and the underdeveloped countries. This leaves us with a very unsatisfying result, that government spending encourages the divergence of income and wealth inequality between the developed and underdeveloped countries.

6.2.3 *Scenario 3: Domestic Fiscal Expansion with Import Substitution*

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. This is not the intention of the thesis. Rather we question how government spending can be complemented so that the benefits of government spending can also be accrued to the domestic economy. A straightforward solution to this is finding a wage to reduce the import propensity of the domestic economy. This rise in import propensity could be induced by structural change that resulted from the government spending or through controls, more broadly import substitution strategy. In this scenario, we reduce the import propensity by 3 percent, from 30 percent to 27 percent in addition to increasing the government spending by 17 percent. This scenario is denoted by the color red, as shown in the legend of figure 4. We see that even this small change in the import propensity can make a significant difference to the results. From figure four, we can see that the rise in government spending complemented by import substitution increases income significantly, by almost 12 percent more than the baseline (Figure 4).

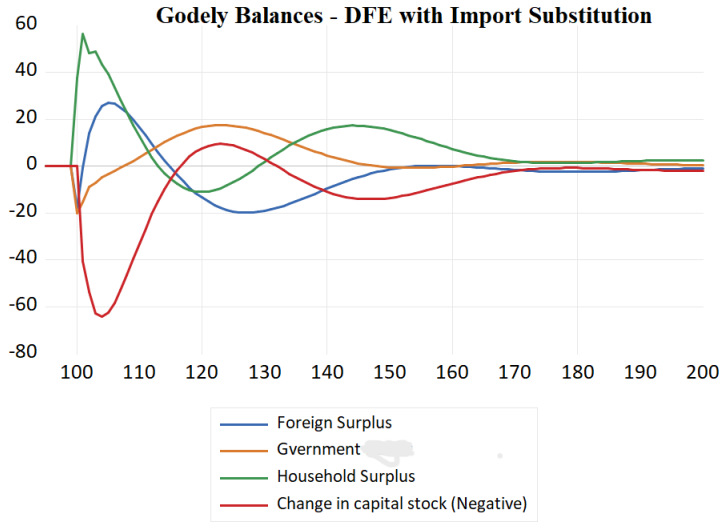
An initial fall in the rate of increase of income is caused by the initial rise in the net wealth of the foreign sector (Figure 12). This rise in net wealth is driven by the initial current account deficit[40] driven by a rise in financial and trade flows. The rise in financial and trade flows are driven by the same factors 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, as explained previously. The fall in import propensity allows leakages to be slow enough so 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 increasing financial inflows into the domestic

[40] After a very brief current account surplus.

economy (since the domestic sector hold 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 the 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 see that in scenario two, 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.

Figure 15: Godley Balances - Scenario Three



We see that 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). We also see that the government deficit rises as the household surplus falls, displaying counter-cyclicality. Thus we

can conclude that import substitution is what is required for the emerging economy to successfully stimulate its economy, and reap the benefits of this stimulation both in the short and the long run. In this case, the benefits do not simply flow out to the developed economy, as it did in the previous scenario.

6.2.4 *Scenario 4: Foreign Monetary Tightening*

In this scenario, we simulate the effects of a rise in interest rates on foreign bonds. The hike is by 0.3 percent. As explained in chapter five, we would expect an interest rate hike to adversely impact emerging economies. However, the simulation reveals counter-intuitive results. We see that the foreign interest rate hike results in a monotonic rise in domestic income, with domestic income converging at almost 2 percent higher than the baseline. In this section we need to understand why the rise in the center's interest rates did not have a negative impact on the domestic economy. These exercises could help identify some essential missing channels which prevent the model from reflecting the stylized fact of interest rate hikes and international instability (Pettis 2001; Arestis 2002). This scenario is marked by the color gray, as seen in the legend of figure 4.

The first two things we can notice from the graphs 7 and 8 are an initial increase in receipts in the foreign currency and the rise in disposable income of the domestic economy. We also see that the current account balance turns briefly positive and does not go into a deficit. The rise in disposable income implies the opposite of the disposable income recession channel. It stimulates consumption which increases income, which in turn increases the capital target level. This in turn increases investment expenditure and then income. The rise in gross receipts from the foreign sector implies that the demand for international reserves fall, via the international reserves function. We can observe this in the graph that depicts international reserves. The rise in disposable income and the stimulation of the economy results in a rise in domestic wealth, which in turn results in an increase in the share of domestic assets held by the domestic sector. The rise in domestic income also reduces the government's negative wealth. Coupled with the rise in household wealth, the wealth of the foreign sector, or the claims of the foreign sector on the domestic economy falls. This is also a channel through which the quantity of international reserve holding falls. For these reasons we see that a hike in the foreign interest rate results in a rise in domestic income, contrary

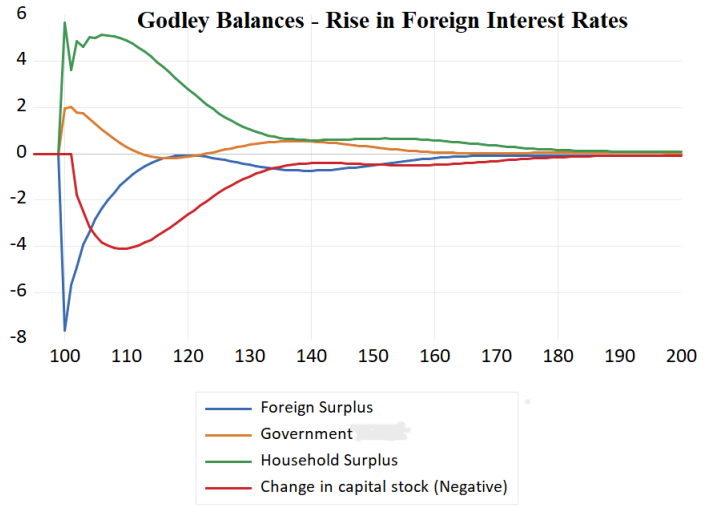
to expectations. However, the fall in foreign wealth and foreign claims on the domestic economy could be interpreted as capital flight which would be the expected response to a hike in the foreign interest rates. Perhaps we would have been able to observe a fall in domestic wealth if the foreign sector could purchase liabilities issued by other nations.

We also observe that the rise in interest rate causes a decline in the government's negative net wealth, and a rise in household wealth. This is stimulated by the rise in tax revenues caused by the rise in income. Thus here too we observe a marginal "good deficit".

The primary reason for this counter-intuitive result is the absence of an autonomous theory of investment. The investment function in the model is similar to an accelerator function which only takes into account changes in income. If we used a financial theory of investment, where investment depends on asset prices, then we would be able to observe more clearly the negative effects of a foreign interest rate hike (Minsky 1979, 1983, 2008b; Wray 2006). A rise in interest rates reduces the valuation of asset prices which in turn would reduce investment. If this effect were bigger than the positive effect on disposable income and consumption expenditure, the economy would shrink. Another major missing channel is changes in exchange rates and the absence of an endogenous term structure of interest rates. If exchange rates were allowed to vary, as hypothesized in chapter three, a hike in the interest rate would cause a deprecation of the domestic currency. This would in turn increase the debt burden on foreign debt and fragility of the firm (Minsky, 1979). Which would in turn discourage investment. If we had the term-structure of interest rates endogenized, then the hike of the interest rate in foreign economies would also (most likely) cause an increase in the interest rate on foreign loans. This would result in an increase in debt burden once again and discourage investment. In addition, the rise in interest rates from the center are highly likely to result in capital flight which would depreciate the currency and cause capital losses on domestically created liabilities. Causing a vicious cycle between exchange rates, interest rates, and asset prices. Arestis (2002) refers to this vicious cycle as putting emerging economies at risk of super speculation. The rise in fragility is also likely to cause a rise in the margin of safety of central banks which in turn would result in a desire to hold additional international reserves as both a precaution against capital flight and as a defense against the exchange rate. This could, through

the international reserves function, also raise the holding of international reserves. Which would impose an additional strain on the economy, as liquidity is a cost. Presented below is the evolution of the Godley balances

Figure 16: Godley Balances - Scenario Four

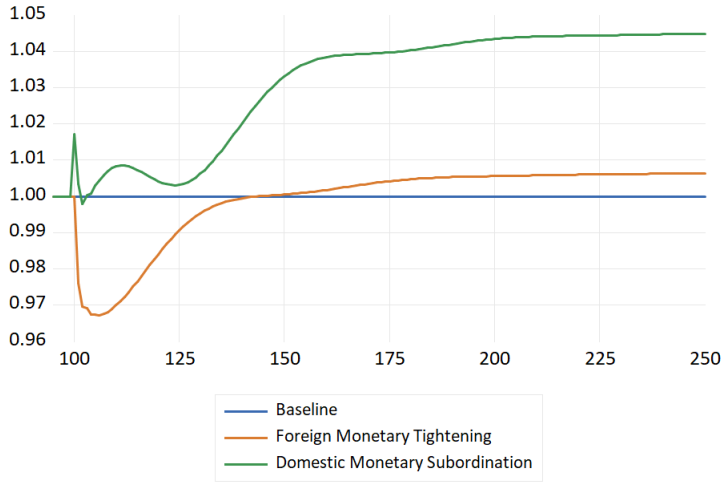


6.2.5 *Scenario 5: Domestic Monetary Subordination*

In this scenario, which is a continuation of scenario three, the domestic central bank decides to react to the hike in the foreign sector's interest rates. The domestic central bank subordinates its monetary policy to match the interest rate hike in the center to a magnitude of 20 percent. This reaction causes the interest rate on domestic bonds to rise by 0.06 percent. We once again observe counter-intuitive results in this case. Likely for very similar reasons to the previous scenario. We see that income monotonically rise, slower than in scenario three, when the domestic central bank did not respond to a hike in foreign interest rates. Income converges to a level higher than the previous scenario and a little higher then 2 percent relative to the baseline. Since the unexpected rise in income in response to a rise in foreign and domestic interest rates seems to be explained by the same factors explained in the previous section, this section will try to understand why domestic income rose more but slower relative to the previous scenario. This scenario is marked in the color purple, as shown in the legend in figure 4.

We observe that the rise in disposable income is slower in this scenario relative to the previous scenario. This already provides an avenue to understand the slower rise in domestic GDP through the consumption-income-target capital investment channel that was illustrated in the above section. Thus the question we should address is why disposable income rises slower albeit converges to a higher level in this scenario. We can do this by investigating the components of the disposable income identity; interest on domestic bonds, interest on foreign bonds, profits from firms, and profits from domestic banks.[41] Below are the graphs that compare changes in the components of disposable income between the baseline, scenario three and scenario four.

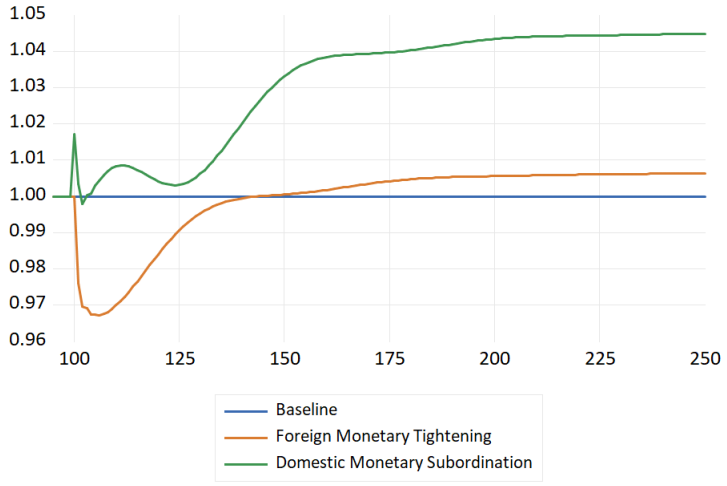
Figure 17: Household Interest Receipts on Domestic Bonds



We can see from the graphs that in this scenario, the interest payments on domestic bonds are the highest and rose the fastest. When the domestic central bank increased its interest rate, the interest payments to households rose by almost 5 percent in comparison to the baseline and the previous scenario. This is because of a quantity and returns effect. The rise in interest rates on domestic bonds induced an increased quantity of ownership of domestic bonds through the portfolio choice process. In addition, the rise in interest rates meant increased returns from each domestic bond. On the other hand, both of these effects were absent from the previous scenario where the interest rate of foreign bonds rose but the interest on domestic bonds did not. This scenario also saw a rise in interest payments on foreign bonds by 4 percent in comparison to the baseline and the previous

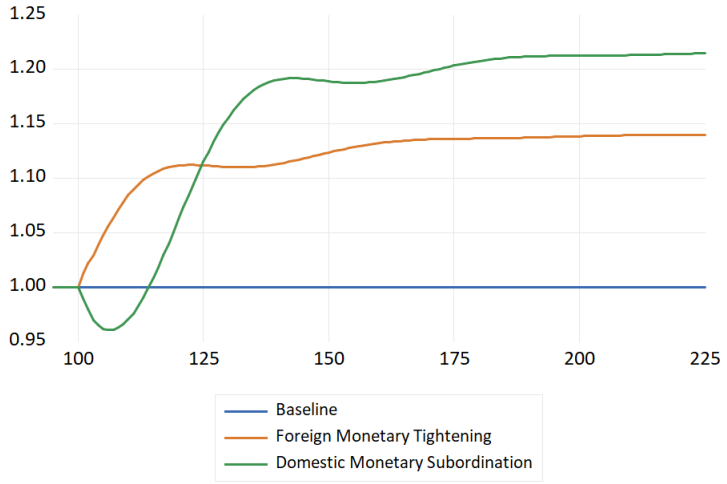
[41] Taxes are not considered since they are an effect, i.e. determined by lagged income. Interest on deposits are not considered since interest on deposits is assumed to be zero.

Figure 18: Household Interest Receipts on Foreign Bonds



scenario. However this does not answer why disposable income grew slower in this scenario. In fact it seems to suggest it should have grown faster. We must turn to profits on firms and profits on banks to understand why disposable income grew slower but converged to a higher level, thus allowing a similar trend with domestic GDP.

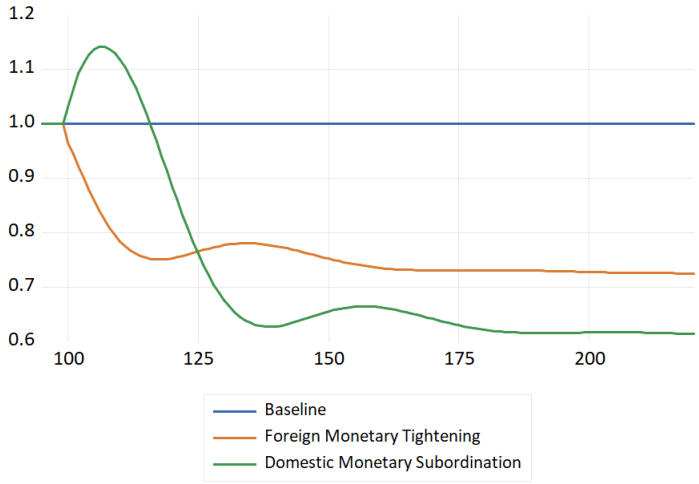
Figure 19: Bank Profits



We observe that the profits graphs perform more poorly in comparison to scenario three. We see that bank profits fall below the baseline by almost 5 percent in the initial periods before rising above the baseline. It takes about twenty five periods for scenario four's bank profits to catch up

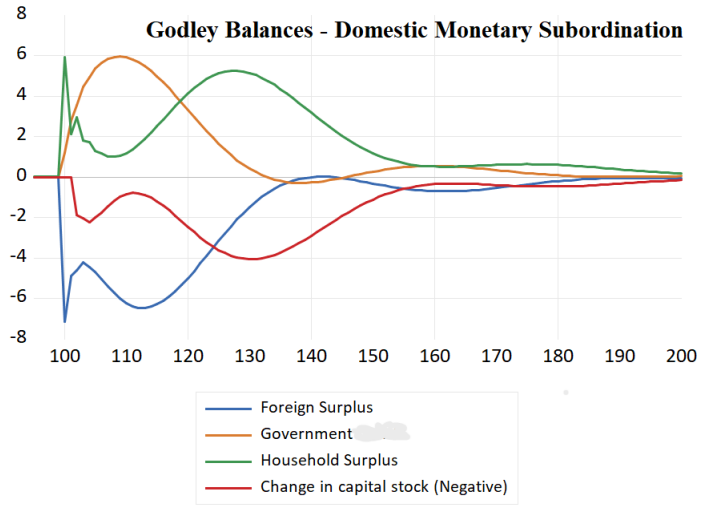
with scenario 3. However after the twenty fifth period we see that the profits of banks in scenario three increase by about 10 percent more than scenario three and 20 percent more than the baseline. Thus providing a rationale to the slower but higher convergence of disposable income and GDP in this scenario. We must still ask why bank profits behaved this way. For this we must examine the accounting determinants of bank profits. These include the interest received on lending to domestic firms, the interest paid on borrowing from foreign banks, and the interest received on reserves held in the central bank.

Figure 20: Interest Paid by Domestic Banks on Foreign Loans



After analyzing the components we can single out the interest paid on foreign loans to be the cause of the initial decline and the slower rise in bank profits. We can see in the figure above that the interest paid on foreign loans increased by over 15 percent of the baseline (and around 30 percent in comparison to the previous scenario) before declining to 40 percent less than the baseline and almost 20 percent less than the previous scenario. Only after twenty five periods did the interest on borrowing from abroad for domestic banks converge for this and the previous scenario. Similarly we can also observe that firm profits are more unstable in this scenario, and actually converge to a lower value. The reason for the initial rise in foreign loan borrowings of domestic banks is firstly because of the rise in issue of foreign loans stimulated by the rise in issue of foreign bonds (equated by accounting). The rise in demand for bonds is stimulated by the rise in their interest rates. In this scenario with investment expenditure and the accumulation of capital being slower (due to the

Figure 21: Godley Balances - Scenario Five



disposable income channel), the demand for foreign loans from firms is slower. Thus the banks, being the residual borrowers (refer accounting equation) have to initially take on a higher quantity of foreign loans. However, as investment and capital accumulation pick up, firms borrow more to invest more and thus the profits or banks pick up. We can see this from the marginal fall in the profits of firms in the graph in the appendix.

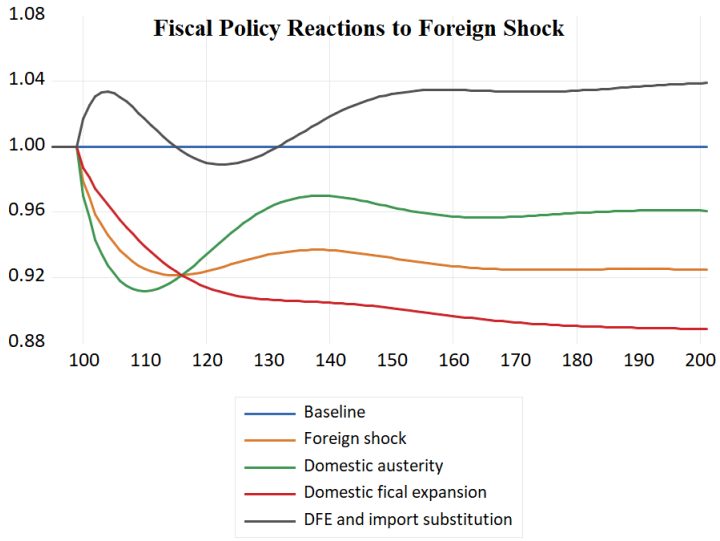
We also observe in this case a similar dynamic (to scenario three) of the holding of international reserves falling relative to the baseline. However we see an initial marginal increase in the holding of international reserves. This is because of the rise in demand for domestic bonds from the foreign sector in response to the increase in its interest rate. Thus increasing the financial claims that the foreign sector holds over the domestic economy. This can be observed in the relevant graph in the appendix. However, in the long-run this increase in interest rate effect on the holding of international reserves by the domestic central bank is offset by the fall in foreign wealth which in turn results in a subdued demand for domestic assets and a fall in the foreign claims over the domestic economy. An initial marginal current account surplus is driven by the initial capital outflow from the domestic economy, in response to the rise in the interest rate on foreign bonds. It is also driven by the initial increase in firm profits and the initial rise in interest on foreign loans.

However, as explained in the previous section, the structure of this model captures the positive effects of interest rate hikes without focusing sufficiently on other aspects such as the influence on the rise in interest rates on investment. Refer to the previous section for a more detailed description of the limitations of this model with respect to this scenario. Since we get counter-intuitive results with respect to change in the level of income and change in the level of wealth across sectors. Presented below are the evolution of the Godley balances.

6.3 Policy Responses To Foreign Shocks

In this section, we explore what policy to recommend to the underdeveloped domestic economy when the foreign developed country's income falls by 6.25 percent. We explore four options. First, we see what happens if the government does nothing. This is identical to scenario one. Second, we see what happens if the government follows austerity policy by reducing government spending. The fall in government spending is equivalent to the rise applied in scenario two. 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 22: Policy Responses to Foreign Shock



In response to the foreign shock, the best response was to raise government spending comple-

mented 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 a level of income 4 percent higher than the baseline. The next best choice was foreign austerity which resulted in income fluctuating between 10 percent and 3 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 do 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 document the negative effects of income volatility on investment better, 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 worse policy performance was to increase 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 POLICY SUGGESTIONS AND CONCLUSIONS

7.1 Limitations of the Model

As the quote on the first page of this thesis suggests, *all models are wrong but some models are useful*. This model is also wrong and incomplete for several reasons. The process and purpose of creating a model only reaches fruition when the creator of the model can explain more about the limitations of their model than their the model itself. In the previous chapters, several limitations of the model were suggested. This section will attempt to summarize these limitations, 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 message of the model more robust.

Coming from a Minskian 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. This results in the simulation of counter-intuitive results, namely scenario four and five. We see that rises in foreign and domestic interest rates cause a rise in income, this is because the rise in interest payments stimulate the economy, and the behavioral equations do not take into account the recessive effects of the rise in the interest rate, such as fragility and a possible decrease in investment. This model also fails to capture changes in asset prices and changes in the exchange rate, which are both important channels to understand 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, even though we employ a fixed exchange rate[42]. 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

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

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 three from chapter three.

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 and not allowing the foreign economy to purchase its own liabilities impedes capital flight.

7.2 Policy Conclusions

The thesis undertook an analysis of the currency hierarchy which 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, to improve sovereign balance sheet structure and the relationship between domestic and foreign interest 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 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, benefit 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 wealth of one economy implies future cash inflows implied by 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 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' Bancor (or Davidson's ICMU) 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 which 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 to 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 to ensure that no other currency arises as a hegemony. We would also require a non-partisan board of academics to decide thresholds of tolerance of 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 exist. 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 all of them would 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 - could relax balance of payment constraints. Advocating 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; Kregel 2018) is that of multiple exchange rates. Multiple exchange rates 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 alternate, imported from the second chapter of this thesis, would be financial regulation that ensures that 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 chapter two, passes on differences between interest rates and liquidity to the forward premium instead of the 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 require 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

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

Imports

$$M = \mu^S Y_{-1} \tag{2}$$

Exports

$$X = \mu^N Y^N \tag{3}$$

Income Tax

$$T = \theta YD_{R-1} \tag{4}$$

Depreciation

$$Dep = \delta K_{-1} \tag{5}$$

Investment Function

$$I = \gamma(K^T - K_{-1}) + dep \tag{6}$$

Target Capital Stock Function

$$K^T = \kappa Y_{-1} \tag{7}$$

Wages Function

$$W = \nu Y_{-1} \tag{8}$$

B.2 Portfolio Choice Functions

B.2.1 *Household*

Return on Foreign Bonds

$$Er_{R_B^{ROW}} = R_{B-1}^{ROW} + \Delta xr \tag{9}$$

Return on Equity

$$Er_{E^S} = \frac{\pi_F}{E^S} \tag{10}$$

Disposable Income Wealth Ratio

$$DIWR = \frac{YD_{R-1}}{V_{H-1}} \tag{11}$$

Demand for Domestic Bonds

$$B_H^S = V_{H-1}(\lambda_{20}^S + \lambda_{21}^S R_{D-1}^S + \lambda_{22}^S R_{B-1}^S + \lambda_{23}^S Er_{R_B^{ROW}} + \lambda_{24}^S Er_{E^S} + \lambda_{25}^S DIWR) \tag{12}$$

Demand for North Bonds

$$B_H^{ROW} = V_{H-1}(\lambda_{30}^S + \lambda_{31}^S R_{D-1}^S + \lambda_{32}^S R_{B-1}^S + \lambda_{33}^S Er_{R_B^{ROW}} + \lambda_{34}^S Er_{E^S} + \lambda_{35}^S DIWR) \tag{13}$$

Demand for Equity

$$E_H^S = V_{H-1}(\lambda_{40}^S + \lambda_{41}^S R_{D-1}^S + \lambda_{42}^S R_{B-1}^S + \lambda_{43}^S Er_{R_B^{ROW}} + \lambda_{44}^S Er_{E^S} + \lambda_{45}^S DIWR) \tag{14}$$

B.2.2 *Rest of the World*

$$E_{ROW}^S = V_{ROW}(\lambda_{20}^{ROW} + \lambda_{21}^{ROW}(R_B^S - \Delta xr) + \lambda_{22}^{ROW}(Er_{E^S} - \Delta xr) + \lambda_{23}^{ROW}\frac{Y_{-1}^N}{V_{ROW-1}}) \tag{15}$$

B.3 International Reserves Function

Demand for International Reserves

$$B_{CB}^{R} = (FA^{ROW} - p_{mos}(\frac{1}{R_B^S})Y^f) \tag{16}$$

Gross Financial Claims Against Domestic Economy

$$FA^{ROW} = B_{ROW}^{S} + E_{ROW}^{S} + L^{ROW} \tag{17}$$

Gross Income Receivable in Foreign Exchange

$$Y^f = x + R_B^N B^N \tag{18}$$

B.4 Firm Loan Choice

$$L_F^{ROW} = L_F(\psi_4 + \psi_2 R_L^S + \psi_3 R_L^N) \tag{19}$$

B.5 Domestic Interest Rate Function

$$R_B^S = R_{B-1}^S + \sigma(\Delta R_B^{ROW} + \varepsilon \frac{FA^{ROW}}{B^{ROW}}) \tag{20}$$

B.6 Domestic Current Account

$$CA = (X - M) + R_B^{ROW} B^{ROW} - R_L^{ROW} L^{ROW} - \pi_F^{ROW} - R_B^S B_{ROW}^S \tag{21}$$