Essays on Money, and the Asymmetries of the International Monetary System

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ANGEL GARCIA BANCHS[**]

***Abstract*:** This thesis argues international monetary asymmetries are largely responsible for determining the balance sheet structure, policy decisions, and behavior of all institutional sectors in the economy. That is to say, that whether or not the economy issues an international reserve currency is fundamental to economic theory and practice. Three manuscripts are assembled following the Post Keynesian tradition and the endogenous money approach, which is reviewed in the first chapter. The second develops the core thesis, and presents compelling evidence of the presence of such asymmetries. Finally, the third formalizes the argument by modeling the set of policy choices, and behavior of reserve earning economies. The methodology is based on the Post Keynesian stock-flow consistency approach, and simulations of several experiments that include a fiscal policy response to a global crisis like that of 2009.

Keywords: International Monetary Asymmetries, Stock-Flow Consistency.
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[*] Chapter I (which is introductory) has been published in *Revista Venezolana de Análisis de Coyuntura*, UCV, Venezuela. Chapter II (which develops the main argument of the thesis) has been published in Spanish in *Revista Investigación Económica*, UNAM, Mexico, and is forthcoming in English in the *Journal of Post Keynesian Economics*, USA, the same journal which is currently considering for publication Chapter III (which formalizes the thesis by developing a model of reserve earning economies).

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Preface:

Two fundamental ideas have motivated this thesis. The first one is that money matters because it affects the motives of economic agents (e.g. due to liquidity preference), and the second is that international monetary asymmetries also matter for the same reason (e.g. due to foreign currency liquidity preference).

While Keynes and the Post Keynesians have explained thoroughly the role of uncertainty and liquidity preference (e.g. the preference for money and liquid assets) in determining employment, asset prices, and the balance sheet structure of both creditors and debtors, the thesis here pretends to explain the role of foreign currency liquidity preference and uncertainty within the context of an asymmetric international monetary system.

The same reasoning that applies to Keynes's (and the Post Keynesian) theory applies to the thesis here. In the first case, the generic uncertainty about the future, market outcomes and credit crises, forces economic agents and institutions to hold money and liquid assets (causing unemployment), while here the uncertainty about net foreign currency inflows, the international monetary system, currency crises, and the access to international means of payments, forces institutional sectors to hold in their portfolios liquid assets/liabilities denominated in foreign currency (causing unemployment domestically and abroad).

The argument here, however, is that the presence of international monetary asymmetries is largely responsible for determining policy choices, the balance sheet structure, and behavior of all the institutional sectors in the economy. That is, here it is sustained that whether or not the economy issues an international reserve currency is fundamental to both economic theory and practice (e.g. it affects the motives of economic agents).

Put differently, liquidity preference, balance sheet structures, the exchange rate regime, and the flexibility of monetary and fiscal policies all depend on whether the economy is a reserve issuing (RIE) or a reserve earning economy (REE), as well as on the availability of foreign reserves (i.e. international means of payment).

The entire argument is, therefore, developed following the Post Keynesian tradition and the endogenous theory of money, as only the latter views money as a systemic need or social institution that deals with uncertainty and, hence, affects motives and decisions (money is always non-neutral), its price, the interest rate, being an exogenous variable rather than a market determined outcome. Following this reasoning, the first chapter reviews the closed economy Post Keynesian literature on banking and money, although two basic mainstream theories are briefly discussed at the beginning: the so-called industrial organization approach and the contemporary theory of financial intermediation.

The second chapter develops the main thesis, and explains the quantity and price effects that arise from the presence of international monetary asymmetries. It argues that the current international monetary system is fully asymmetric, as it divides the world among reserve issuing (RIEs) and reserve earning economies (REEs).

The latter implies economic policy is affected by whether or not the central bank issues an international reserve currency, as that largely influences its balance sheet structure, interest rate targeting procedures, the elasticity (flexibility) of monetary policy and the exchange rate regime. The reason is plain: as opposed to RIEs, the central bank in REEs must target a minimum stock of foreign currency assets, as the local currency does not circulate abroad.

The hypothesis of the presence of such asymmetries is confirmed by the findings described in the second chapter regarding the strikingly different balance sheet structures of fifteen central banks from North America, South America, Europe and Asia. Moreover, the chapter explains why the presence of such asymmetries is so relevant to monetary theory and policy, how different monetary practices can be observed and, finally, which economies tend to follow similar patterns or stereotypes.

To finish, the third chapter formalizes the above findings, while extending the argument applied to the central bank to all other institutional sectors, what is done within the context of a reserve earning economy (REE). The model is based on the Post Keynesian stock-flow consistency approach and takes full account of the balance sheet structure, transactions and revaluation processes that describe the behavior of those economies.

Further, the model is built to reflect the relevance of buffer stocks and stock-flow norms affecting the real and financial spheres, and how the availability of foreign reserves determines fiscal and monetary policies, the rate of growth of government expenditures, the issue of foreign and local currency debt, interest rate targeting, exchange rate intervention and switching mechanisms, and compensation instruments. Moreover, several different simulations and experiments are performed to understand the system, including a fiscal policy response to a global crisis similar to that of 2009.

This thesis has taken many years of work; and this is still the beginning. The hope is that the study of reserve issuing and reserve earning economies allows for a better understanding of how the international monetary system actually works, and how it should be transformed so as to guarantee the transition towards global full employment.

My supervisors have followed my thesis with great interest, and have provided invaluable comments on earlier versions of all chapters, which have been published, are forthcoming, or have been recently sent to well known journals in both the English and Spanish language, such as: the *Journal of Post Keynesian Economics* (NY, USA) and *Investigación Económica* from UNAM (México).

The work of Ernesto Screpanti (University of Siena) and his several suggestions and comments have been particularly valuable in understanding private banking and the process of money creation. Further, the contribution of Edward Nell (New School) on Transformational Growth, and his explanations of the evolution of monetary systems in mass production economies have also been fundamental, as have been his explanations with respect to the internal consistency of the Post Keynesian theory regarding the (exogenous) determination of the interest rate and the theory of distribution. Finally, the work of Luís Mata Mollejas (Central University of Venezuela) on financial crises and the Financial Pre-adjustment Theory has been instructive and clarifying, particularly regarding the role played by portfolio adjustments in determining (ex-ante) macroeconomic outcomes (observed ex-post). They have all been supportive and encouraging.

My gratitude goes to all three; to the anonymous referees whose comments contributed to improving the quality of this manuscript; to my wife, Daniela Correa; my parents, Angel R. Garcia G. and Carmen Banchs De Garcia, for their unconditional support; and, finally, to the University of Siena, the New School University (NSSR), as well as the Center for Development Studies of the Central University of Venezuela (UCV) for providing the institutional and financial support. The usual disclaimer applies.

Chapter I

Banking and Endogenous Money: The relevance of Keynesian uncertainty and generic credit risk[*]

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***Abstract*:** This chapter presents an assessment of the relevant literature on banking and the endogenous money theory. The focus is, thus, placed on the Post Keynesian view, although two mainstream approaches are briefly discussed at the beginning. Here, it is argued that the Post Keynesian view and the Circuit approach are capable of explaining the core of banking and the systemic need for money because they reverse the causal link implied by the quantity theory, the saving-investment cycle, and the base-multiplier, while focusing on the asset side of commercial banks' balance sheets. But also because they treat banks as the institutions capable of making the generic credit risk saleable rather than as pure financial intermediaries. They transform risky, illiquid, nonmarketable assets that are based on personal credit into safe, liquid, and marketable bank deposits which are socially perceived as money.

[*] This paper has been published in English in *Revista de Análisis de Coyuntura*, UCV, Venezuela.

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I.1 Introduction

It is well known that there is neither need nor room for money and banks in general or partial equilibrium models that are based on the walrasian and Arrow-Debreu worlds (Hahn, 1981; Davidson, 1988). Thus, usually orthodox models concerned with the study of banking and money require *ad-hoc* assumptions to justify their exogenous presence, involving, therefore, the direction of causality implied by the quantity theory.

For the same reason, it is not surprising that commercial banks are often confused with pure financial intermediaries, their presence being explained by the existence of frictions, private information, and transaction costs. But while financial intermediation might be explained by the need to cope with credit specific risks that are not taken care of by the market mechanism, commercial banking might be explained by the need to deal with generic credit risk, or the so-called Keynesian uncertainty; that is, by the systemic need to monetize personal credit, as risky and illiquid assets that are indispensable to the finance of production and speculative activities get transformed into safe and liquid deposits.

This chapter reviews the literature on banking and the endogenous money supply theory. Topics such as credit rationing, the lender-borrower relationship, optimal contracting and regulation, are not considered due to the vast extent of the space involved. Section 2 deals with the abovementioned traditional approaches to the existence of commercial banks and financial institutions, spelling out the reasons why they are unable to disentangle the core of banking (i.e. the process of money creation) from that of financial intermediation, nor to explain the endogenous (or systemic) need for money.

Section 3 focuses on the study of credit specific risks and generic credit risk. It reflects a Post Keynesian view of both banking and (endogenous) money which is mainly based on the transformation of personal credit (e.g. loans) into socially acceptable bank money (e.g. deposits). Section 4 is concerned with Keynesian uncertainty, liquidity, and precautionary behavior.

Section 5 reviews the literature on the Post Keynesian and Circuit approaches to endogenous money, considering the debate among Structuralists and Horizontalists and their differing views about the degree of interest rate exogeneity (in a chronological way) and, hence, mainly deals with the old Post Keynesian literature. Section 6 reconciles both perspectives in an attempt to rescue the core elements of the Post Keynesian view and, thus, deals with its recent literature. Finally, section 7 provides some final remarks.

I.2 On the orthodox approach to Banks and Financial Institutions

There are two major mainstream theories of banking: the industrial organization approach and the theory of financial intermediation. They are both orthodox in that they originate from the basic walrasian paradigm, a framework within which there is neither need nor room for banks and money in the first place, unless some sort of *ad-hoc* frictions are incorporated in which case the systemic need for money cannot possibly be explained.

Both approaches explain the presence of financial intermediaries, but not necessarily the process of money creation associated with commercial banks. Further, they require the inclusion of *ad-hoc* assumptions regarding the presence of positive transaction costs or informational asymmetries under a framework characterized by contractual (or market) incompleteness.

The first approach stresses the relevance of frictions in transaction technologies, while the second focuses on the existence of informational costs. But both treat banks either as security retailers or as pure financial intermediaries. For this reason, both theories are incapable of explaining the money creation process associated with the banking business and the very nature of private credit money, a point to which I shall return shortly.

Further, in both approaches, deposits always precede loans, money enters exogenously into the economic system, and the orthodox links established by both the quantity theory, the base-multiplier, and the saving-investment cycle are all preserved; precisely the links which are reversed by both the Post Keynesian view and the Circuit approach.

Notice, though, the latter is not the case of the New Consensus approach to macro (NC), which nowadays is more representative of the mainstream theory and, yet, treats the interest rate as an exogenous variable, and money as an endogenous process. Nevertheless, there are several criticisms about the New Consensus approach raised by Post Keynesians, although the latter admit the recent progress of the mainstream theory (see footnote 15 for the criticisms raised by Post Keynesians about the NC).

I.2.1 The industrial organization approach

Under the industrial organization approach to banking, commercial banks are defined as financial intermediaries, whose presence depends on the existence of frictions in transaction technologies, implying economies of scope and scale may arise from the opportunity to save on transactions costs (Freixas and Rochet, 1997).

Regarding scope economies, the latter approach suggests transportation costs explain why safekeeping and deposit services, and international trading and payment services, might have emerged simultaneously (Freixas and Rochet, 1997). But the latter argument does not explain the persistence of intermediaries, as one would expect technological progress would reduce this sort of transaction costs, forcing intermediaries to disappear.

Moreover, the above approach also fails to capture that: (i) banks' financial contracts, both loans and deposits, cannot be easily retailed or marketed due to the fact that the identity of the bank (or holder) matters – non-anonymity; and (ii) that the terms and characteristics of the contracts issued by debtors (or borrowers) are typically different from those required and desired by depositors (or creditors).

The original work of Gurley and Shaw (1960), and that of Benston and Smith (1976) and Fama (1980), deal with the abovementioned complexities. But one of the most influential contributions is Diamond and Dybvig's (1983) work on liquidity insurance, at least regarding scale economies. They show that, by the law of large numbers, a great coalition of individuals is capable of investing in illiquid but more profitable assets, while retaining sufficient liquidity to satisfy individual requirements simultaneously[1].

[1] This implies the market allocation is not Pareto optimal and, hence, can be improved by introducing a deposit contract issued by financial intermediaries. The justification for their result relies on their assumption about the independence of individual liquidity shocks affecting economic agents in an uncorrelated fashion. Under that assumption, complete contingent markets are absent due to two reasons: (i) the state of economy is not observable by anyone because the list of consumers receiving liquidity shocks is unknown, and (ii) the remaining non-contingent financial market (the bond market) is unable to provide sufficient risk-sharing by itself.

I.2.2 The contemporary theory of financial intermediation

The fact that the industrial organization approach to banking generally applies not only to banks but also to mutual funds and insurance firms might have led both New Keynesians and Post Walrasians to consider information asymmetries as the major source of transaction costs, including ex-ante adverse selection problems, interim moral hazard, and ex-post costly state verification.

The work of Leland and Pyle (1977) is the starting point of this literature. It provided a rationale for financial intermediaries which, being able to discover the quality or mean returns of individual projects, become capable of selling claims to primary investors upon a diversified portfolio of assets (Bhattacharya and Thakor, 1993)[2].

In this literature, asymmetric information explains market inefficiencies, in a way similar to Akerlof's (1970) original paper[3]. In the case of financial markets, however, it is the private information on the quality of their projects that borrowers have what makes it possible for the competitive equilibrium to be inefficient. The theory, thus, explains the existence of financial intermediaries as a response to the incapability of the market-based

[2] In the view of Bhattacharya and Thakor (1993), financial intermediaries provide brokerage and qualitative asset transformation services. Economies of scale and scope arise from both services. Regarding brokerage, they argue that brokers develop special skills that allow them interpreting subtle informational signals while being able to profit from cross-sectional – across customers – and intertemporal reusable information. In relation to qualitative asset transformation services, they underline the major modifications of asset attributes such as: maturity, divisibility, liquidity and credit risk transformation.

[3] The original contribution of Akerlof (1970) established the fundamentals of asymmetric information theory. Roughly speaking, his contribution describes how the presence of quality heterogeneity and asymmetric information may lead to market inefficiency, and even to the disappearance of a particular market (e.g. the used car market). When quality is ex-ante undistinguishable for a buyer due to asymmetric information, incentives exist for the seller to offer a low-quality good as if it were a high-quality one. The buyer anticipates this problem, taking into account the uncertainty about the quality of the good. In this framework, only the average quality of the good is considered, implying an adverse selection problem as higher than average quality goods are driven out of the market.

mechanism to efficiently deal with informational problems among creditors and debtors (Bhattacharya and Thakor, 1993).

Diamond (1984) and Ramakrishnan and Thakor (1984) show economies of scale may be present under certain conditions[4]. In accordance to Diamond (1984), increasing returns associated with monitoring activities imply a sort of specialization under which lenders delegate monitoring functions instead of undertaking them by themselves[5].

In the work of Hellwig (1991), monitoring applies in a much ampler sense. It might involve ex-ante screening activity under adverse selection, as in Broecker (1990), and also the prevention of opportunistic behavior during implementation (i.e. moral hazard) as in Holmström and Tirole (1997), or punishing and auditing under some sort of costly state verification as described in Diamond (1984), Gale and Hellwig (1985) and Krasa and Villamil (1992).

[4] Specifically, if firms are able to form coalitions (intermediaries) under the absence of frictions in internal communication, the cost of capital per firm becomes a decreasing function of the number of firms belonging to the coalition. In this setting, diversification reduces monitoring costs. There is, however, a major distinction among Diamond (1984) and Ramakrishnan and Thakor (1984): while the former focuses on depository financial intermediaries, the latter concentrate on non depository financial intermediaries.

[5] In order to trust the information provided by monitors, they must be given the appropriate incentives to perform in the interest of those who delegate. Diamond (1984) argues that whenever investors are able to impose non-pecuniary penalties on those monitors who do not perform well, the optimal deal resembles a deposit contract. Some criticism, however, has been raised regarding Diamond's (1984) assumption of non-pecuniary penalties which are modeled in accordance to the borrower's cash flow reports; this is because more realistic non-pecuniary costs such as loss of reputation, jail, and so on, may be better considered as lump-sum. Regarding diversification of loans, Holmström and Tirole (1997) sustain that outside investors require the involvement of the monitor in the project through its participation in the financing, thereby creating the opportunity for economies of scope between monitoring and lending activities while simultaneously emphasizing the role of banking capital. Their framework captures the substitutability between capital and monitoring. In Holmström and Tirole (1997) banking capital deals with the moral hazard problem at the bank level, without assuming full diversification as in Diamond (1984). The major difference between Diamond's (1984) framework and that of Holmström and Tirole (1997) is that while in latter perfect correlation among projects (financed by banks) is assumed, in the former project returns independence is considered.

The problem with this theory, however, is that, although it is true that banks may have a comparative advantage in monitoring activities[6], in the form of ex-ante screening, prevention of opportunistic behavior, punishing and auditing, it is also true that none of those tasks are specific to banks, as they can also be carried out by individual lenders themselves or by specialized firms such as rating agencies, brokers, security analysts, auditors and so on.

Thus, what is that role specific to commercial banks which explains their existence and permanence? The answer, as shall be explained below, is the monetization of credit which leads to the creation of private money (flows), a task which by no means excludes the possibility of carrying out secondary businesses such as those undertaken by other financial institutions (involving the money stock): it is due to scope economies that, first, banks are confused with financial intermediaries and, second, universal banking has become possible, highly risky and profitable.

The latter is not to say that specific uncertainties arising from credit relations are not part of the real world. Clearly, they must be considered. But, as Post Keynesians correctly emphasize, it is the so-called Keynesian or fundamental uncertainty, or the so-called generic credit risk, which is essential to the existence of commercial banks. Not only because it cannot be accurately estimated at all, but primarily because it represents the greatest disincentive for potential credit activity and the reason why banks and the preference for money have evolved. In short, banks reduce specific risks, but above all

[6] Several assumptions are crucial for the presence of a comparative advantage. Scale economies must be present, implying the bank must finance many projects simultaneously. Divisibility may apply so that each project requires the funds of several investors; and, finally, there must be low costs of delegation, implying the costs of controlling the bank itself must not exceed the gains from scale economies associated with the direct monitoring of the investment projects.

they tolerate and reduce generic (or Keynesian) uncertainty, two different kinds of risk which are considered in the next section.

I.3 Credit Specific Risk versus Credit Generic Risk

The (credit) specific risk is that related to the insolvency risk of a particular debtor. Notice that, in as much as the insolvency risk refers to the actual possibility that the debtor will not be effectively capable of repaying his debt, it should naturally constitute the objective foundation of the credit specific risk (Screpanti, 1993, 1997). Nonetheless, as in practice the latter is frequently reduced to the creditors' subjective evaluation of the debtor's capability to repay, it is common to observe substantial divergences among the different estimations reached by diverse potential creditors.

This divergence among different evaluations of a debtor's insolvency risk complicates the monetization of personal credit and reduces its marketability: one important reason why personal credit lacks moneyness, liquidity, and marketability is because the debtor's ability to generate income is not fully observed due to the presence of hidden or private information on the part of the borrower (e.g. due to asymmetric information).

Notice that, although commercial banks cannot fully remove the specific credit risk associated with a particular borrower, they can greatly contribute to ameliorate informational asymmetries; and, so doing, they can reduce the discrepancies among the different evaluations of risk. Not only are commercial banks endowed with relatively greater proficiency and technical skills for the evaluation of the business of the debtors,

but they are also good at accruing knowledge about the evolution of their cash flow capacity and wealth conditions, precisely by establishing durable relations with them[7].

Yet, bear in mind that the management of specific risks is not the essential task of banks. Indeed, as previously argued, such a task is also conducted by non-bank institutions, implying that as far as the problem is the gathering of information on specific risks and diversifying instruments, there is still no need for banks, though they are very good at it[8]. Moreover, after a great deal of specific risks is removed there prevails in the aggregate a substantial amount of risk which is common to all; the so-called generic credit risk.

The latter is independent of the particular characteristics of the debtor and, hence, responds to causes which are out of his control. In times of tranquility, diversification strategies are able to allow for a major reduction of risk, as the specific risks of borrowers are not strongly correlated. But, as soon as unstable times arrive − e.g. under recessions, crises, prosperity, and booms − two major factors contribute to increasing generic risk: (i) instability itself not only increases the level and co-movement of specific risks but also the level and variability of generic risk, and (ii) above all, instability presents itself under no specific frequency or stable pattern, implying no accurate estimation of it can be obtained (Davidson, 1988).

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[7] In addition, by applying differential interest rates and collaterals, banks are able to enforce truthful revelation of borrowers' information (and type) and, hence, are able to discriminate among different risks. The reason is that, while those borrowers with low-risk projects are interested in revealing information, those with risky projects are interested in hiding it. Furthermore, just as financial intermediaries do, banks can also make use of diversification strategies to reduce the overall credit risk faced by their creditors. Thus, the overall risk bank-creditors take is lower than the sum of risks banks tolerate from debtors.

[8] Recall, the management of asymmetric information and risk diversification problems may also be undertaken (at least partially) by individual lenders themselves, specialized firms such as rating agencies, brokers, security analysts, auditors, and so on.

The fact that generic risk, on top of being high and variable, cannot be accurately estimated represents the greatest disincentive for potential creditors. Indeed, it is only under fundamental uncertainty and non-ergodicity (Davidson, 1988; Dymski, 1993) that banks play a role not only essential but specific to them: "they take upon themselves the generic risk of their debtors and transform it into a bank wealth [insolvency] and liquidity risk…Banks make the generic credit risk saleable" (Screpanti, 1997, p. 571).

But why are creditors willing to accept more liabilities from banks than from banks' debtors? Because banks are capable of transforming risks, as: (i) they hold base money and quasi-money reserves; (ii) they count on deposit insurance, and hedging instruments; (iii) they participate into networks with other banks so as to provide mutual assistance and socialize part of the risks (e.g. interbank markets); (iv) they also belong to a system of banks led by a central authority that plays the role of lender of last resort; and (v) they bear part of the risk by investing their own capital and reserves into the business.

Not surprisingly: (i) banks' insolvency risks are socially perceived as relatively low; (ii) the public is willing to accept private bank money (liabilities); and (iii) banks are capable of benefiting from charging relatively high rates for their risky assets while paying relative low rates for their safe liabilities. The above Post Keynesian approach to banking views the risk transformation process in the opposite way the traditional literature does: commercial banks do not merely transform short maturity deposits into non-marketable loans of a longer maturity, larger amounts and credit risk; rather, they transform risky, illiquid non-marketable assets into safe, liquid and marketable deposits: the core business of banks is that of transforming potential credit into money.

I.4 Keynesian uncertainty: Liquidity and Precautionary Behavior

Keynes (1973, 13, p. 411) had long before argued that money plays an essential role affecting motives and decisions both in the short and the long run, and Post Keynesians have argued that the consciousness about calendar time, the uncertainty about the future, and the fact that production itself is time-consuming, explains the need for liquidity and forward monetary contracts as stable social institutions (Davidson, 1982-1983, 1988).

"Forward nominal contracts for the sale of goods and services are human institutions devised to enforce money wage and price controls over the life of the contracts…" (Davidson, 1988, pp. 154-155). They contribute to the reduction of potential conflicts by guaranteeing both parties that even under uncertainty of future events any lack of compliance with the terms will be penalized[9].

In a monetary production economy, the presence of nominal contracts and means of money allowing for the termination of contractual obligations affect both real production and general decisions and motives of economic agents. In those economies, precautionary behavior is linked to tolerance thresholds, which are usually defined by reservation measures. Examples include the holding of financial assets, quasi-money, and money, as well as fluctuations in inventories and changes in production capacity, all of which work as mechanisms of absorption of perturbations, errors, and uncertainties.

In particular, holdings of money represent an important component of aggregate wealth. For money, besides being unit of account for economic transactions, is characterized by

[9] Nominal price flexibility and the unpredictability of the money wage, two essential characteristics of neoclassical economics, are exactly what firms and households are most averse to and, hence, what they are readily interested to contract in order to reduce (Davidson, 1988).

four major properties: (i) it is a reserve of value like any other asset; (ii) it is marketable like securities and quasi-money are, but certainly personal credit and many other assets are not; (iii) it is liquid as quasi-money is; and, (iv), above all, it is an instrument of credit accepted as means of exchange and means of payment.

Notice, in the process of monetization the banking sector benefits from the existence of increasing returns to scale. Banks' profits derive mainly from the spread among credit and debit rates, and from the composition and size of their assets. Indeed, if it not were for the presence of psychological and institutional factors, rather than technological ones, banks all together, by reducing credit rates, would be able to expand their volume of loans and deposits almost indefinitely in such a way that debit rates would also have to decrease. But in the presence of those factors, of generic risk and fundamental uncertainty, banks and other agents are forced to hold reserves in order to deal with illiquidity risks (Davidson, 1988; Dymski, 1993)[10].

In particular, banks might hold base money as primary reserves (they don't in Canada) and quasi-money as secondary reserves. They hold the latter mainly because loans are non-marketable, and the former because the latter cannot be used for compensation. Primary reserves are monetary, liquid and marketable, are accepted for compensation and yield no income[11], while secondary reserves do yield an interest but must first be monetized to be used for clearing, as they are liquid, marketable but non-monetary.

[10] A bank's illiquidity risk mainly refers to the risk associated with the possibility that net compensations of deposits among banks may lead to an extensive cash deficit for a particular one. In dealing with this type of risk, banks are expected to manage their assets and liabilities in an efficient way. However, it is in the nature of liquidity risk that, not even efficient management of assets and liabilities can guarantee full elimination of it, as generic risk is itself an externality.

[11] The exception is the case of non-compulsory remunerated reserves under the custody of the central bank.

Notice, though, that while the profit motive creates incentives for banks to keep their primary ratio as low as possible, the precaution motive does the opposite: under a low primary ratio, a shortage of secondary reserves forces banks to look for "urgent money", with the risk of facing high interest costs posed by the market or the central bank.

In short, the reserve ratio depends on three major factors: (i) the subjective or psychological preference for money, (ii) the objective rate of return on financial assets, and (iii) the degree of organization of the money market, and the monetary policy of the central bank; for instance, deep money markets and interest rate-smoothing policies contribute to lower reserve ratios, while lower asset returns and opportunity costs contribute to the opposite.

Finally, notice that, while for the public, both households (creditors) and firms (debtors), the major concern is the maturity composition of their assets and liabilities respectively, for commercial banks the major concern is the ratio between (primary and secondary) reserves and deposits. This is true because banks' liabilities mainly consist of liquid obligations (e.g. deposits, interbank loans, etc), being this the reason why reserves provide psychological relief (recall, though, primary reserves do no exist in Canada)[12].

[12] Banks, however, are not only concerned with illiquidity. They are also concerned with the possibility of not being able to recover the whole value of their credit loans. Thus, as a safeguard and fundamental part of their precautionary behavior, banks hold equity capital and pay close attention to the evolution of their debt to assets ratio; banks' capital is both a signal of their ability to generate profits and a buffer against possible losses and insolvencies: a low capital to assets ratio represents a condition of high profitability but as well of high exposure. Thus, regularly, monetary authorities are the ones who impose capital adequacy ratios. However, the effective ratio held by banks varies in accordance to their evaluation regarding customers' solvency and, therefore, is highly associated with the bankers' perception regarding the overall evolution of the economy.

I.5 Credit and the Endogenous Money Supply

The endogenous theory of money, as opposed to the exogenous theory (see footnote 13)[13] sustains monetary authorities (and banks) control the rate of interest rather than the quantity of money, as it assumes interdependent supply and demand curves for liquidity. The theory brings together elements from the contributions of Wicksell (1898), Robertson (1922), and Keynes (1930,1936), although it has been particularly developed by Post Keynesians and Circuitists, such as Arestis (1992), Davidson (1972), Kaldor (1982), Lavoie (1992), Minsky (1957a), Mata (2001), Moore (1988b), Screpanti (1997), Nell (1998), Rochon (2001), and Wray (2004), among many others.

Recently, nonetheless, the endogenous theory has been implicitly accepted by mainstream theorists of the New Consensus (NC) school, such as Woodford (2003) and Weber (2006), although there remain profound differences among the NC account of the theory and the PK approach − see footnote 14 for a summary of the NC and footnote 15 for the main differences between the PK and the NC approach; finally, Table I.1 presents

[13] The exogenous theory of money sustains monetary authorities are able to control the quantity of money; among the quantity theorists are the followers of David Ricardo and the strong classical tradition for whom money is neutral both in the short and the long-run (e.g. most neoclassical economists), but also are the followers of David Hume and the weak classical tradition, like Friedman (1956), Friedman and Schwartz (1963), and Sargent (1986), for whom money is neutral only in the long-run (Fontana, 2006, 2007). The neoclassical account of the theory assumes decreasing returns to capital, a high negative correlation between investment and the rate of interest, as well as automatic adjustments through a price mechanism that leads to full employment and a harmonious distribution of income (in line with marginal productivity). It emphasizes the role of money as means of exchange, but in such a way that it is considered a commodity (or veil) that merely reduces transaction costs; as such, reserves are expected to be physically constrained, while the interest rate is assumed to be endogenously determined within the goods market in line with the principle of scarcity. Moreover, savings are expected to precede investment, so that deposits and reserves are required to extend new loans. The exogenous theory emphasizes the role of monetary policy through the control of some monetary aggregate and undermines that of fiscal policy mainly due to the assumption of Ricardian equivalence and crowding-out effects. Finally, it considers inflation a demand phenomenon that is caused by an "excess supply of money", and accepts the direction of causality which goes from the money supply to nominal income.

a comparison between the exogenous theory of money and the PK and NC endogenous theories.[14,15].

The Post Keynesian endogenous theory is mainly concerned with the study of real world monetary economies. Rather than treating money and banks as an addendum to the economic system, or as a means to reduce transaction costs, it explains their presence as a response to fundamental uncertainty and the systemic need for liquidity.

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[14] The New Consensus framework usually incorporates a production function which, in accordance with supply conditions such as the rate of growth of the labor force and the rate of technical progress, determines the potential or "natural" output of the economy; a vertical long-run Phillips curve that is consistent with the NAIRU or potential output and, hence, implies the absence of a long-run trade-off between inflation and unemployment; an endogenous money supply and exogenous interest rate; a regime of monetary policy based on an inflation target and an interest rate targeting rule (e.g. the Taylor rule) which is long-run neutral (e.g. it cannot affect real variables in the long-run); short-run fluctuations in aggregate demand which, caused by fiscal policy or interest rates different from the natural rate, determine deviations from short-run potential output; inflation-expectation effects that, through the adjustment of the central bank interest rate, can affect real output and employment; and, finally the determination of the natural rate of interest at full-employment in line with marginal productivity and thrift, the so-called natural rate of unemployment (Rochon and Setterfield, 2007).

[15] While the NC accepts the long-run neutrality of money, PKs sustain money is non-neutral both in the short and the long-run; and while for PK money endogeneity is natural to the system, it is a policy choice for the NC − e.g. due to the unreliability of the demand for money − see Seccareccia (1998), Setterfield (2004), Lavoie (2006), Monvoisin and Rochon (2006) and Arestis and Sawyer (2008) for a criticism of the NC. Moreover, the PK endogenous theory of money offers a superior framework of analysis than that offered by the NC in that the former explains in detail the behavior of banks and the systemic need for liquidity in a way that is internally consistent with its own approach to income distribution. Put differently, the NC endogenous theory of money, which relies on Wicksell's two interest rate-analysis, turns out to be internally consistent with the (harmonious) marginal productivity approach only by chance. The latter occurs when inflation pressures are under control, or no imbalance between investment and savings occurs; that is to say, when the loan rate set by banks happens to be equal to the natural rate of interest, the latter being a real rate that is rather unknown to banks as it is determined by the scarcity and marginal productivity of capital, both of which fluctuate over the business cycle (Fontana, 2007). Further, notice that, opposed to the case of the NC, under the PK view wages are negotiated as part of a conflicting process of income distribution, which is essentially determined within the real and socio-political spheres, this being the major influence upon costs of production and inflation. Moreover, opposed to the NC, the PK account tends to focus on a modern mass production monetary economy which is rather characterized by increasing returns to scale and the dependence of investment upon the rate of profit, or the preservation of a "normal" level of capacity utilization. Rather than automatic (or fine-tuning) adjustments that work through a price mechanism that tend to full employment, adjustments are assumed to be incomplete, leading to multiplier (accelerator) effects (Nell, 1998). In the PK view, investment precedes savings as they are just a residual of the system which reduces aggregate demand, while in the view of the NC savings cannot constraint investment, the difference between the two being the cause of inflation (or deflation) as the contractual loan rate might remain below (or above) the fluctuating natural rate. Nevertheless, in both views of the endogenous theory, the value of money has no anchor, monetary reserves face no restriction, and the interest rate is assumed to be exogenously determined by the state and the banks, rather than the market. Loans create deposits, and the availability of reserves does not constraint the expansion of loans.

The theory consistently describes how technology, the distribution of income, the financial and monetary system, and economic policy affect the behavior of the economy. In particular, the theory reverses the causal links that are implied by the quantity theory, the base multiplier, and the saving-investment cycle, while treating the stock of money as endogenously determined by market forces, as in Davidson (1972), Kregel (1973), Eichner (1987), Moore (1988b), Pollin (1991), Arestis (1992), Lavoie (1992), and Shapiro (1977).

Further, with respect to the income generating process, the theory treats the interest rate as exogenous and the supply of credit money as endogenous, as in Hewitson (1995), Lavoie (1996), Pasinetti (1974) and Wray (1995), with money being a continuous credit-driven circular flow which is destroyed through the repayment of loans as in Eichner (1987), Lavoie (1992), Mata (2001) and Parguez (1987).

The theory also captures the role of effective demand, fundamental uncertainty and liquidity preference, as in Keynes (1936) and Davidson (1972), while it focuses on the asset side of commercial bank's balance sheets, as in Kaldor (1982), Arestis (1992), Lavoie (1992), Moore (1983), Nell (1998) and Rochon (2001). Furthermore, often some Post Keynesians (within the Chartalist view) emphasize the presence of a fiat money, whose circulation depends entirely on the state's capacity to impose and collect taxes (Knapp 1905; Wray, 1995, 2004).

Post Keynesians frequently emphasize the presence of constant and increasing returns, the dependence of investment on capacity utilization, the conflicting distribution process, and the effectiveness of fiscal and incomes policies to stabilize output and inflation:

money is an effect and not a cause; yet, it is not neutral both in the short and long-run because it affects motives and decisions; expected output drives the money supply, prices are a mark-up over costs, while inflation is a conflicting claims process (Rochon, 2001).

In the PK view, aggregate demand is not determined but only validated (or financed) by the supply of money, so the direction of causality of the quantity theory gets reversed, running from actual and expected nominal income to the money supply, not the opposite. Money is always demand determined, and the monetary system is flexible so that it accommodates the needs of trade and production. Precisely, production, trade, the payment of wages and inputs create the demand for private credit money, whose supply is secured due to the existence of overdraft facilities that are pre-negotiated with banks. The latter, in turn, set the cost of credit as a mark-up over their costs of funds, but adjust their rates in response to changes in confidence.

Regarding the early contributions to the theory, Post Keynesians usually refer to the works of Minsky (1957a, 1957b) and Kaldor (1958), although a complete account of the theory must consider in detail the original works of Keynes, Kalecki, Robinson, and Kahn, including the contributions to the Radcliffe Committee. Yet, there are considerable differences between the early works of Minsky, Kaldor, and Robinson.

The endogenous money approach entails the denial of the notion of the natural tendency to full-employment as argued by neoclassical theory (Rousseas, 1986, p. 73). The latter, indeed, is inconsistent with the endogenous theory: if one accepts the endogenous theory one cannot accept the marginalist approach to income distribution, and the converse. This is because, under the former, the interest rate is exogenous with respect to the

income generating process, while in the latter the rate of interest is endogenously determined by the full employment level of real factors such as the relative scarcity and marginal productivity of capital: to be internally consistent neoclassical theory must deny the endogeneity of money, as otherwise the price of money, the rate of interest, would not be determined by supply and demand schedules.

Post Keynesian often refer to Keynes' General Theory (Keynes, 1936), but also to two of his most renowned articles on the rate of interest: the "Alternative Theories of the Rate of Interest" (Keynes, EJ, June 1937a) and "The Ex-ante Theory of the Rate of Interest" (Keynes, EJ, December 1937b), both of which introduce the "finance motive".

The latter, opposed to the stocks approach predominant in Keynes' study of the transactional, precautionary, and speculative demand for money balances, is rather understood as a flows approach under which the notion of time is made explicit to capture the idea that firms make some of their investment decisions ex-ante and, therefore, usually generate a "temporary demand for money before [actual investment] is carried out" (Rousseas, 1986).

The finance motive, thus, concerns a planned investment for which provision of funds must be secured before investment itself takes place and, hence, a demand for ex-ante finance which "cannot be met without a rise in the rate of interest unless the banks are ready to lend more cash…at the existing rate…" (Keynes, 1937c, p. 222). It is, precisely, the interpretation of the latter argument which has caused a profound internal debate among Post Keynesians both structuralists and horizontalists (Rousseas, 1986).

For instance, the works of Robinson and Eatwell (1973, pp. 218-219) and Davidson (1972, pp. 246-281) have stressed the relevance of commercial banks' decisions for the investment process and the success of the economy, while according to Rousseas (1986) the works of Kaldor (1982) and Moore (1983) refer to the money supply as a passive demand-driven magnitude so that investment can only be constrained to the extent that the cost of reserves determined by the central bank affects the market rate of interest. However, Rousseas's assertion with respect to Kaldor's and Moore's reference to the money supply as passive is challenged by horizontalism. Next subsection deals with this latter approach. But previous to that, Table I.1 summarizes the main differences between the exogenous theory of money and the PK and NC approaches to endogenous money[16].

[16] Notice that this table presents two views which are diametrically opposed. Of course, some economists may find themselves somewhere in between. But that could only be due to one of the following reasons: either because of an inconsistency problem in their theory or because of a matter of strategy at the time of its formulation. The latter is the case of Keynes who assumed a given stock of money in his General Theory, possibly because of convenience. After making several concessions to neoclassical economics, such as accepting the marginalist theory of distribution, he was able to develop his main point, namely that the preference for liquidity is the primary cause of unemployment in modern capitalist economies subject to fundamental uncertainty. Even though he could have easily formulated his theory of liquidity preference and asset prices based on the assumption of an endogenous money supply, Keynes opted instead for treating the stock of money as given, while leaving the interest rate endogenously determined by monetary rather than real forces. Additionally, some economists such as Wicksell and Schumpeter have treated the money supply as an endogenous process, even though they both had accepted the orthodox approach to distribution. But, in general, the marginalist approach to income distribution is only consistent with the exogenous theory of money. For the endogenous determination of the interest rate, should in principle reflect, at full employment, the marginal productivity and relative scarcity of capital. The opposite holds too; if one accepts the view of the endogenous theory money one cannot accept the marginalist approach to distribution. For, under the former, the interest rate is determined by monetary policy (and political forces) rather than by thrift or productivity. In short, the neoclassical theory of distribution which is based on the relative scarcity of capital and labor is inconsistent with the theory of the endogenous money supply − see Table I.1.

Table I.1. Theoretical Conclusions on the opposed theories of Money

Concept	The Exogenous Theory of Money		The NC and Wicksell's Endogenous Theory of Money		The PK Endogenous Theory of Money	
	Postulate	**Implications**	**Postulate**	**Implications**	**Postulate**	**Implications**
Technology	Decreasing returns to scale. Investment depends largely on the rate of interest.	Automatic adjustments through a price mechanism tending towards full employment of resources.	Idem to exogenous theory	Interest rate fine-tuning policies are required to guarantee the loan rate (r) equals the natural rate (ρ).	Increasing returns to scale. Investment depends on the preservation of a "normal" level of capacity utilization.	Incomplete adjustments through variations in quantities, leading to multiplier/accelerator effects.
Distribution of Income	Labor is a commodity. Salaries are determined by marginal productivity.	The distribution of income is harmonious. Every one gets his marginal contribution.	Idem to exogenous theory but only by chance when $r = \rho$.	Idem to exogenous theory but only by chance when $r = \rho$.	Salaries are negotiated and determined within a conflicting claims process.	*Income distribution is determined exogenously outside the market through political power and policy, and it is the major influence over costs of production and inflation.*
Financial System	Savings constrain investment.	Deposits and reserves are required to extend new loans. Portfolio adjustments are irrelevant.	Savings do not constrain investment, investment does not generate savings, and there can be a gap between the two in nominal terms, although not in real terms.	Loans create deposits, and the availability of reserves does not constraint the expansion of loans. Yet, the excess of investment over savings causes inflation.	Investment generates savings.	Loans create deposits, and the availability of reserves does not constraint the expansion of loans. Savings are just a residual which reduces aggregate demand. Portfolio adjustments are crucial.
Monetary System	Money is a commodity which reduces transaction costs.	The value of money is anchored, reserves are physically restricted, and interest rates reflect scarcity in the market.	Money is credit money.	Idem to PK theory of endogenous money, although money is endogenous by policy choice.	Money is credit money. For some PK money is also a fiat money which circulates due to the state's capacity to collect taxes.	The value of money has no anchor. Monetary reserves face no restriction and interest rates are exogenously determined by the authorities.
Direction of Causality	From the money supply to nominal income.	*Inflation is a demand phenomenon and "excess money" is its cause*	Idem to PK theory of endogenous money.	*Yet. inflation is a demand phenomenon and the "excess of investment over savings" is its cause*	From expected and actual nominal income to the money supply.	Money is an effect and not a cause. Money is demand determined, and aggregate demand is not determined but financed by the money supply.
Economic Policy	Monetary policy is effective in the short-run, but fiscal policy is not, as it leads to "crowding out" effects which reduce investment.	*Monetary authorities must reduce the output gap and inflation by controlling the amount of money.*	Monetary policy is effective in the short-run, but fiscal policy is not because of Ricardian equivalence.	*Monetary authorities must control the output gap and inflation by setting the interest rate equal to the natural rate ($r = \rho$).*	Fiscal policy and incomes policies are effective to stabilize output and inflation, while monetary policy may be activist, or instead focus on income distribution.	*Monetary authorities must accommodate the demand for reserves and set a low and stable interest rate so as to guarantee the well functioning of the payments and financial systems.*

I.5.1 The Post Keynesian Horizontalist Approach

For Kaldor (1982), Lavoie (1992), Moore (1983, 1988a. 1988b), Rochon (2001) and many others, the response of the money supply to changes in the demand for it is seen as

perfectly elastic. That is, the short-run money supply curve is conceived to be horizontal for any given level of the short-term interest rate.

Moore (1983) argues that the central bank seems to tolerate the accommodation of the money stock to increases in the demand for bank credit: whenever money wages increase rapidly: "…the supply of money is horizontal at every going short-term interest rate" (Moore, 1983, p. 555).

Under this view, there can never be an excess supply of money balances, as the quantity of money is always demand-determined. Further, reserves cannot be quantity rationed, central banks can set the short-term interest at which they will provide liquidity, but the overall level of the money stock is out of their control.

It is argued credit-money only comes into existence if it is demanded[17]. Economic agents who receive bank deposits in exchange for real and financial goods and services are indeed selling those goods and services on credit. Horizontalists sustain the fact that this "convenience lending" requires no sacrifice of contemporaneous consumption or investment implies there is no need for an additional interest bribe or "for the supply of credit money to be upward sloping"; although, this is not to say that money endogeneity requires indefinite interest rate pegging or the passivity of the central bank, as the latter

[17] In the view of Moore (1998a), banks are price setters and quantity takers in both their retail loan and their deposit markets; so both loans and deposits are demand driven. The mark-up of the loan rate over the deposit rate must cover costs and targeted profits; and the amount of total loans and deposits demanded must preserve some desired ratio, which at the aggregate level of the banking system should not deviate far from unity. Thus, provided banks' loan collateral standards are met, any increase in the demand for bank credit will simultaneously result in an increase in loans and deposits. As these deposits are spent by borrowers, either in the purchase of financial or real assets, the providers of these goods, including workers, will accept bank money in exchange; so, as long as bank deposits preserve moneyness, bank deposits will always be demanded.

can indirectly affect the rate of money growth by managing the short-term rate of interest (Moore, 1988a, pp. 382-384).

Hewitson (1995, p. 287), Moore (1989, p. 12) and Rochon (2001, p. 293) sustain that bank reserves cannot constrain (or cause) the supply of loans, as banks only look for reserves once loans have been placed and deposits been created. In short, the so-called the full accommodation approach views the money supply as characterized by a given interest rate on bank loans with a horizontal line as its best graphical representation (Kaldor, 1982; Moore, 1988b; Lavoie, 1992; Rochon, 2001).

I.5.2 The Circuit Approach

The Circuit approach is mainly represented by the French-Italian School; and some major contributions are the works of Parguez (1975, 1987), Cencini (1988), Graziani (1989) and Schmitt (1986)[18], although there are enormous differences between these authors. Nevertheless, circuit theorists, inspired by Marx and Keynes, emphasize the primary role of money as the means of payment that makes the circulation of commodities possible: when money is kept idle, it is not considered an instrument of circulation.

The theory of the circuit incorporates: (i) the presence of a token currency such as paper currency; (ii) the acceptance of money as a means of final settlement; and (iii) the condition that money must not provide seignorage privileges to any payee and payments must be made by means of "promises of a third agent", namely banks.

[18] Due to the vast extent of the space involved, a complete account of the Monetary Circuit approach is out of the scope of this paper. The interested reader is invited to follow the references in the text.

Money only comes into existence when a payment is made (Graziani, 1989, p. 4). Money is different than credit: while credit is an ex-ante instrument which allows production to take place, money is an ex-post variable that appears only when credit is used. Indeed, the demand for credit is different and independent of the demand for money, and "…It is, in fact, quite conceivable for the demand for money to be nil, while it is never the case that the demand for credit is nil" (Rochon, 1997, p. 281).

Money is a stock concept while credit is mainly a flows notion. Planned expenditures both on wages, means of production, and investment, start the process leading to a demand for credit loans, followed by the creation of money as credit is used and, finally, to the reimbursement of debt and destruction of money as credit is repaid: credit is used to allow production take place, while savings and collections from sales are used as a way of reimbursing the initial debt; but, to close the circuit, it does not matter if money comes from consumption or from savings (Graziani, 1989).

Finally, instead of interpreting Keynes' finance motive as a fourth reason for holding money which is only meaningful during expansions, the Circuit approach interprets it as a continuously meaningful notion even in the absence of growth: whenever the circuit closes the initial finance has already been used and destroyed so that new credit must be demanded (and used) for a new cycle to start.

I.5.3 The Partial Accommodation Approach

"The links between money and investment occur in two ways. Portfolios hold monetary assets, liabilities of financial institutions, as protection against contingencies, as well as

assets, or claims upon assets, that enter into production. Secondly, investment spending has to be financed" (Minsky, 1991, p. 210).

Rousseas (1986), Palley (1991), Pollin (1991), and several other Post Keynesians, disapprove, what they refer to as, the extreme position pioneered by Kaldor, as they argue it leads to a perfectly elastic money supply curve under the general assumption that the central bank's main responsibility is to guarantee the solvency of the financial system.

Rousseas (1986) argues the theory of endogenous money must incorporate changes in the velocity of circulation. Rousseas suggests a different graphical representation than the horizontal Post Keynesian and the vertical Monetarist approach: changes in velocity in response to higher interest rates are decomposed in demand-caused movements along the velocity curve arising from the activation of idle balances and the economizing of transaction balances, and supply-caused shifts of the curve due to financial innovations taking place during long-lasting expansions or in reaction to tight monetary policies.

Rousseas (1986, p. 82) considers Weintraub's (1978) political argument in support of the full accommodation approach as weak, and Kaldor's emphasis on the lender of last resort as the "Post Keynesian version of the neoclassical fine tuning". Rousseas (1986) argues, in Weintraub (1978), the traditional link between the money supply and income cannot be said to be effectively broken, but just politically broken, as it is assumed the central bank fully accommodates the "needs of trade" only in face of political pressures[19].

[19] Weintraub (1978) argued that, for a given level of real output, any increase in wages over the level of average productivity will give rise to a proportional increase in nominal output and prices. This, in turn, would lead to a higher transactions demand for money which, under a constant velocity of circulation, must be fully accommodated by the central bank if real output is to be kept constant, as any failure to accommodate the money supply would necessarily lead to a higher price level and lower level of output

"In the case of Kaldor, the exogenous interest rate coupled with a lender of last resort function of the central bank severs the Keynesian link between velocity and the rate of interest" (Rousseas, 1986, p. 86). Moreover, he argues Kaldor's acceptance of potential partial accommodation assumes that changes in the stock of money and velocity are perfect substitutes: "...For Kaldor, any shortfall in the increase in the supply of money will be met in full by a rise in velocity to 'make up the difference', i.e., the *adjusted* or *effective* supply of money curve would be perfectly elastic and hence horizontal to the money axis".

He argues: "If, however, money and the income velocity of money are less than perfect substitutes, if, in other words, the velocity increase does not fully 'make up the difference', then the endogeneity of money does not imply a perfectly elastic or horizontal supply curve of money, and the relation of velocity to the rate of interest becomes an important consideration to be taken explicitly in any reformulation of an endogenous theory of the money supply, i.e., the rate of interest is no longer exogenously determined by the central bank and severed from the income velocity of money…" (Rousseas, 1986, p. 86).

(e.g. stagflation). Weintraub's explanation for the endogeneity of money is, thus, a consequence of his wage theory (Rousseas, 1986). In Weintraub's model changes in the price level respond to changes in unit labor costs. The money supply is linked to real output and employment. Thus prices are a function of wages which, in turn, are predetermined by social bargaining; thus monetary policy can only affect prices indirectly whenever the central bank does not fully accommodate the demand for money, as that brings about unemployment leading to a tampering of wage demands. For Weintraub, this is only possible in the case the central bank is able to defy the pressure exercised by political authorities. As argued by Rousseas (1986), Weintraub (1978, p. 193) pulls back from the notion of full accommodation indicating that money supply endogeneity "may not be complete; it has been erratic and only intermittently predictable. Nevertheless it exists, though the relationship is not readily captured in a tidy analytical model". Moreover he argued that the extent of predictability of accommodation would entail information on the "psychological profile of the MA personalities and staff". Just as argued by Rousseas (1986, p. 85) prediction is simply not possible, and the degree of accommodation will change under different circumstances and pressures, and "…with the response of the private financial sector in defiance of the policies pursued by the monetary authorities".

I.6 Post Keynesianism and Reconciliation

In reference to the above Post Keynesian disagreement among Horizontalists and Structuralists, Wray (2004, p. 1) says: "For the most part, I believe this particular debate was at best a result of misunderstanding, and I wish it had died a more timely death": Both accept the view that the money supply should be treated as an endogenous variable, but the latter do not treat the interest rate as exogenous (Wray, 2004)[20].

Wray (2004) identifies four reasons why central banks often accommodate the demand for reserves. The first is the lagged and contemporaneous reserve accounting, which implies that the legally-required level of bank reserves depends on past levels of deposits. The second reason, which is related to the lender of last resort role of the central bank and the preservation of stability within the financial system, is less satisfactory as the latter cannot explain daily horizontal accommodation (Wray, 2004).

The third is associated with the need for maintaining an "orderly payment system" and, hence, is more plausible, as par clearing within the banking system and with the government requires opportune access to reserves. Finally, the last reason concerns the stability of the overnight interest rate, which in absence of accommodation would be highly unstable due to the inelasticity of the supply and demand for reserves.

[20] Wray (2004) discusses on the different meanings of exogeneity. He argues that the common definition adopted by Post Keynesian economists is that related to "the control sense: an exogenous variable is one whose value is set by government policy". A second meaning is that associated with causality; while a strongly exogenous variable must be independent of all other variables in a system, a weakly exogenous variable need only be independent of contemporaneous values of the endogenous variables, but may depend on their lagged values. The third definition of exogeneity he considers is related to the statistical sense; a variable is exogenous when it is independent of all unobserved explanatory variables of the model, and hence when it leads to unbiased estimates.

Regarding the exogeneity of the rate of interest, Wray (2004) argues the overnight rate, the short-term rate and long-term rates on government debt can be considered as exogenous. Further, once risk considerations are taken into account, whether or not rates on loans and deposits ought to be considered as exogenous – in the control sense – depends on the reaction of the mark-up (and mark-down). If the mark-up is independent of changes in monetary policy, the central bank could also affect the loan rate. However, if due to microeconomic or macroeconomic reasons, it is not constant over time, the administration of loan rates becomes unlikely.

He argues: "…Moore does not deny that the mark-up might be variable – and I am sure he will agree that it can vary over the cycle – rising with pessimism and falling with optimism…Moore's horizontal loan supply curve is at a point in time, while theirs is a plot of interest rates over time. Moore's horizontalism is not inconsistent with a rising mark-up over time as risks in the economy increase, and the structuralist concern with innovation and evolution of practice can be incorporated within Moore's framework…the point that Hyman Minsky had tried to make is that over an expansion, and under some conditions, the balance sheets of both borrowers and lenders can become 'stretched' in such a way that loan rates tend to rise; this can be construed as either an upward sloping trend or as shifts due to rising risk"[21].

Screpanti (1997, p. 573) also contributes to reconciling the Horizontalist and Structuralist positions. He derives a rising money supply curve that is mainly based on a reformulation

[21] In addition, Wray (2004) admits that while it is true that households hold credit cards with pre-authorized credit limits and that corporate firms negotiate as well credit lines with their banks, it is also true that in both cases full utilization of the credit limits will certainly affect rates and fees charged on additional borrowing. He attributes this to a "transition to riskier classes". He also acknowledges that commercial and mortgage loans entail individual negotiations and possibly variable rates depending on institutional arrangements, with "loan quantities and uses carefully established at the time interest rates are quoted".

of Kalecki's (1937) increasing risk hypothesis. In such a framework, the limit to the expansion of credit is based neither on rising marginal costs nor institutional constraints; rather he argues: "it is the very effect of credit expansion on the degree of risk that will impose those limitations…[bank's] main concern is to choose the level of activity and the composition of assets and liabilities so as to balance expected profits and perceived risks".

Banks' balance sheets matter both in the determination of loan and price policies, as they bear risks in the form of a liquidity and solvency risk. Even though commercial banks are price setters in both the deposit and credit loan markets, mark-ups are fixed but adjustable in the sense that the link existing between loan rates and discount and deposit rates is not as strict as traditional mark-up theories sustain, especially when credit risk conditions change.

Particularly, banks control the spread to deal with increasing risk. That is, for a given cost of reserves, the mark-up reacts upwards when both the bank's risk and its preference for money increase[22]. In particular, for a given level of reserves, the spread between credit and debit rates becomes wider as loans and deposits expand. The same might occur when, for a given effective reserve ratio, bankers' subjective preference for money increases. Thus, when bank risks increase, they resort to mark up increases to curtail the demand for loans and prevent further reductions on the effective reserve ratio.

Screpanti's (1997) structural theory of endogenous money considers the short-run adaptation of supply to demand at the expense of interest rate increases in the presence of

[22] The preference for money is a measure of the bank's degree of risk aversion; the greater the preference for money the greater the desired reserve ratio (Screpanti, 1997). See section 4 for the precise definition.

expanding risk[23]. He shows that as long as the time horizon is properly identified, there is no major difference between the Horizontalist and Structuralist approach: while in the short-run supply could fully accommodate demand − e.g. when banks are sluggish in modifying rates, in the long-run the same could occur when central banks are unwilling to repress the banking system, or when financial innovations emerge as a reaction to monetary tightening.

Fortunately, the recent debate among Horizontalists and Structuralists has evolved towards the identification of which interest rates are exogenous and which are not. Furthermore, nowadays, Post Keynesians are mainly concerned with how effective monetary policy is to stabilize the economy, the effects of monetary policy upon income distribution and, above all, how and at what level must the rate of interest be set. This might be due to the growing interest in the New Consensus (NC) orthodox approach to macroeconomics, which depicts an (exogenous) interest rate targeting process.

The recent Post Keynesian literature reflects the evolution of this more interesting debate. For instance, while Moore (1988b), Fontana and Palacio-Vera (2006), and Palley (2006) argue in favor of an activist approach to interest rate targeting as a tool to stabilize the economy, Smithin (2004), Mosler and Forstater (2004), Lavoie and Seccareccia (1999), Gnos and Rochon (2007) and Wray (2007) argue in favor of adopting long-run interest rate parking-it rules and abandoning the so-called short-run interest rate reaction functions (Rochon and Setterfield, 2007).

[23] Screpanti (1997) considers four different cases of adaptation depending on: (i) if banks try to follow demand; (ii) if banks try to encourage it; (iii) if they rather try to enliven reserves; and finally, (iv) if they try to attract reserves.

Further, based on Smithin (1994)'s rejection of the notion of the natural rate of interest (e.g. Wicksell's natural rate), this second approach proposes fiscal and incomes policies to stabilize aggregate demand and inflation, instead of interest rate reaction functions which not only rely on causing unemployment to stabilize the economy but also perturb income distribution among net creditors and debtors.

Three suggestions have so far been put forward: (i) the Smithin rule which implies setting the real rate of interest equal to zero, (ii) the Kansas City-rule advocated by Mosler and Forstater (2004) and Wray (2007), which entails setting instead the nominal rate of interest equal to zero − resulting, most likely, in a negative real rate, and (iii) Pasinetti's fair rate rule, defended by Lavoie and Seccareccia (1999) and Gnos and Rochon (2007), which implies setting the real rate equal to the rate of growth of labor productivity.

I.7 Final Remarks

This paper assessed the relevant literature on banking and the endogenous money theory. It was argued that both the industrial organization approach and the contemporary theory of financial intermediation explain the presence of financial intermediaries from an orthodox view and that, hence, they must rely on *ad-hoc* assumptions regarding frictions in transaction technologies and information costs, while being unable to explain the process of money creation and the systemic need for money as the core of banking.

Further, it was argued both the Post Keynesian view and the Circuit approach are able to explain the core of the banking business and the very nature of money, as they reverse the causal links implied by the quantity theory, the saving-investment cycle, and the base-multiplier, while focusing on the asset side of banks' balance sheets.

Fundamental uncertainty, rather than specific risks, is behind the systemic need for banks and liquidity (Davidson, 1988). The business and role of commercial banks is to make the generic credit risk saleable (Screpanti, 1997), as they transform risky, illiquid, nonmarketable assets that are based on personal credit into safe, liquid, and marketable bank deposits which are socially perceived as money.

This paper also considered the major divergence among Horizontalists and Structuralists, namely the degree of interest rate exogeneity. Here, it was argued that such a divergence is rather the result of an imprecision in the definition of time horizons, or simply a misinterpretation of the impact of cyclically increasing risk upon mark-ups and commercial bank rates. Finally, the most recent Post Keynesian literature on interest rate targeting procedures, and the role of monetary policy was reviewed.

Chapter II

International Monetary Asymmetries and the Central Bank[*]

ANGEL GARCIA BANCHS[**] & LUIS MATA MOLLEJAS[***]

***Abstract*:** We argue that the current international monetary system is fully asymmetric, as it divides the world among reserve issuing economies (RIEs) and reserve earning ones (REEs). Thus, monetary theory, we argue, should take into account whether or not the central bank issues an international reserve currency, as that would largely determine its balance sheet structure, interest rate targeting procedure, the elasticity of monetary policy and of the exchange rate regime. The reason is plain: as opposed to RIEs, the central bank in REEs must target a minimum stock of foreign currency assets, as the local currency does not circulate abroad.

Keywords: International Monetary Asymmetries, Central Banks.
Jel Classification: E12, E58, F30

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II.1 Introduction

The fact that all national states are able to circulate domestically their own currencies due to their capacity to collect taxes (Knapp, 1905; Keynes, 1930; Lerner, 1943; Wray, 2004) contrasts with the fact that not all of them are in the position to do so internationally. Based on this reasoning, and our findings regarding the strikingly different balance sheet structures of fifteen central banks from North America, South America, Europe and Asia, we argue that the current international monetary system is fully asymmetric, as it divides the world among a few reserve issuing economies (RIEs) and a larger group of reserve earning ones (REEs).

Further, we explain why the presence of such asymmetries is so relevant to monetary theory and policy, how different monetary practices can be observed and, finally, which economies tend to follow similar patterns or stereotypes which we define in order to classify the behavior of central banks.

The paper is organized as follows: section 2 studies the causes and effects of the presence of, what we label, *international monetary asymmetries*, particularly in a context which can only be consistent with the endogenous money theory for which money affects motives and decisions (i.e. money is always non-neutral), and the short-term rate of interest is exogenous; section 3 proposes a complementary method of study of central banks based on their balance sheet structure; section 4 describes our methodology and presents the empirical findings and section 5 concludes.

II.2 Monetary Asymmetries and the endogenous theory of money

III.2.1 New concepts for a new environment

Firstly, we define a *reserve earning-economy* (REE) as one whose transactions with the rest of the world are all settled through the use of a foreign currency, for the local currency (in case of existing one) is nowhere considered an international means of settlement − e.g. all economies except for the US, the EU, Japan and the UK. In this case, the authorities exhibit a high degree of concern with the accumulation of foreign currency reserves (quantity effect) and the stability of the foreign exchange rate (price effect).

These economies, characterized by a large foreign currency liquidity preference, must accumulate foreign reserves not only to guarantee their means of international payment but also to stabilize the foreign exchange rate. This is not only because they must face the uncertainty caused by the unavailability of reliable international overdraft credit facilities, but also because the price mechanism might not deliver the best possible outcome.

For instance, under a flexible exchange rate regime, the price mechanism might lead to an appreciating currency and deflation in the presence of large foreign currency inflows and conditions of exports dependence (e.g. if the Marshall-Lerner condition holds); and also, the opposite, it might lead to a depreciating currency and, hence, inflation in the presence of large foreign currency outflows and conditions of imports dependence − e.g. if the Marshall-Lerner condition does not hold. There are many other important reasons such as currency mismatches and balance sheet problems. But what matters is that, in general, REEs are concerned with the accumulation of foreign currency reserves and the stability of the exchange rate.

Moreover, in the case in which foreign reserves are large and the economy faces net foreign currency inflows, the costs of accumulating foreign reserves in terms of interest payments, sterilization and reserve allocation are usually inferior to its benefits in terms of welfare and economic growth. This is because, in such a case, the authorities can always sterilize their interventions by increasing their reserve requirement rates and government deposits at the central bank, reducing the need for new issues of treasury and central bank bills. In other words, REEs are able to resist currency appreciations indefinitely, but they are only in the position to resist depreciations in as much as some minimum stock-flow norm of foreign currency reserve holdings has not yet been reached (e.g. imports/foreign reserves).

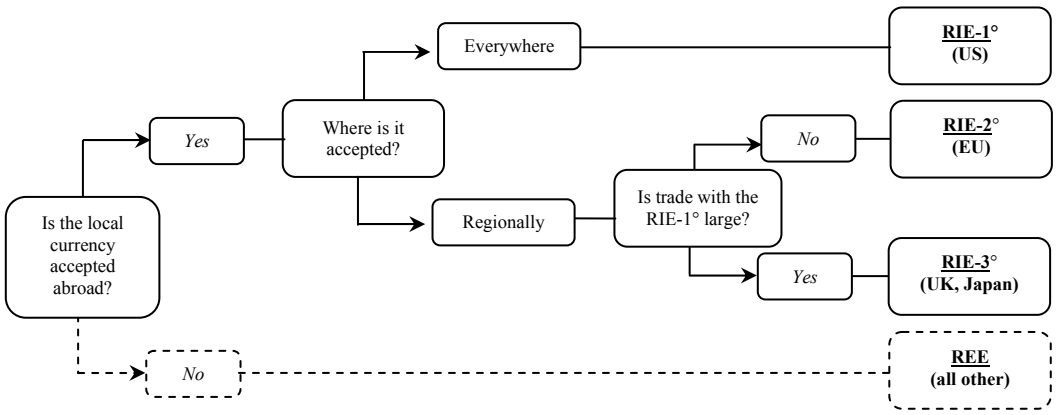
Secondly, we define a *first order reserve issuing-economy* (RIE-1°) as that unique economy whose transactions with the rest of the world are all settled through the use of its own currency, referred to hereafter as *the dominant reserve currency* − e.g. the US. Here, the degree of concern with the accumulation of foreign currency reserves is null and, hence, no balance of payments restrictions in the monetary sense apply.

Third, we define a *second order reserve issuing-economy* (RIE-2°) as one whose transactions within a region of influence are all settled through the use of the domestic currency, but whose transactions elsewhere are usually settled through the use of *the dominant reserve currency*. Given their small volume of extra-regional trade, RIEs-2° need not hold large stocks of foreign currency assets and, hence, behave quite similar to (and usually get confused with) the RIE-1°. The unique example nowadays is the EU.

Finally, we define a *third order reserve issuing-economy* (RIE-3°) as that which, apart from being able to circulate its currency regionally, is also distinguished by its large volume of trade with the *first order reserve issuing-economy* (Diagram II.1). There are two examples nowadays: Japan and the UK. Notice, the need for a larger stock of foreign currency assets in RIEs-3° implies they must hold larger reserves than RIEs-2°.

Thus, from the highest to the lowest degree of concern for foreign currency accumulation, REEs rank first, followed by RIEs-3° and then by RIEs-2°. For simplicity, nevertheless, we shall refer hereafter only to reserve issuing economies and reserve earning economies (RIEs and REEs)[24].

Diagram II.1. Definitions: *Reserve Earning Economies* (REE) and first, second and third-order *Reserve Issuing Economies* (RIE)



[24] Notice that these definitions are more precise in today's world than the fuzzy distinction among hard and soft currencies which was originally based on the evolution of the balance of payments with the rest of the world. These four concepts, which for simplicity may be reduced to two, are rather tied to the functions, practices and institutional environment faced by contemporaneous central banks. Thus, for instance, under our terminology, the current RIE-1° is the US economy, and the dominant reserve currency: the US dollar. But, while the EU represents the case of a RIE-2°, both the UK and Japan represent that of RIEs-3°. This is because, opposed to the case of the EU, both the UK and Japan are largely involved in trade with the US and, hence, must accumulate dollar reserves and be concerned with the evolution of the foreign exchange rate against the dollar. Finally, notice, for instance, that although Switzerland is a REE it still has a hard currency, and that although the US is the unique RIE-1° its currency has in the past weakened against the euro, the pound, the yen and several other currencies. Consequently, under our terminology it is always possible to observe a hard currency which is not a reserve currency and a soft currency which is.

II.2.2 Monetary asymmetries and the endogenous view

To a lesser or greater degree, the stability of the exchange rate, foreign capital flows and net payments to the rest of the world, represent a concern for both reserve issuing and reserve earning central banks. Thus, interest rate targeting policies in both economies must take into account the impact on these variables.

Nevertheless, notice international monetary asymmetries imply that: (i) reserve earning central banks must accumulate a minimum stock of foreign currency reserves (asset side), and sterilize or compensate (endogenously) such accumulation through an increase in central bank securities, bank reserve requirements, and government deposits held at the central bank (liability side); (ii) they must target interest rates to reach the minimum level of reserves, influencing indirectly capital flows and the expansion of domestic credit; and (iii) once the minimum has been reached, they must decide whether in the future they want to limit the influence of interest rate changes upon the exchange rate by compensating changes in foreign currency flows with fluctuations in foreign reserves.

Put differently, the other side of the coin of having to accumulate foreign reserves is counting on a policy instrument to influence directly the exchange rate. Notice, this is not the case of RIEs, where exchange rates can only be influenced indirectly through changes in interest rates. In REEs, as long as foreign reserves can vary sufficiently, an interest rate reduction (increase) leading to foreign currency outflows (inflows) might be compensated with a decrease (increase) in foreign reserves, limiting the impact upon the exchange rate. This, along with the bias against appreciations, and the relatively small sterilization costs, explains why REEs are often willing to accumulate large stocks of foreign reserves.

The reason why the authorities of RIEs cannot influence foreign exchange rates directly (but only indirectly through interest rate changes) is that they are not required to accumulate foreign currency assets in the first place, as the external imbalances of those economies are financed through the expansion of domestic credit, and funded through counterpart local currency-liabilities such as deposits, CDs, bills, securities, etc.[25]

In other words, while the causality between the current, financial, and monetary accounts of the balance of payments is tri-directional in REEs, it is essentially uni-directional in RIEs or more precisely in the RIE-1° (e.g. the US), where the current account causes the financial account and not the opposite, as the local currency is an international reserve.

International monetary asymmetries, thus, imply two effects. The first is a *quantity effect* which arises from the fact that REEs must target a minimum stock of foreign reserves, namely because their own currencies do not circulate abroad. This effect, which is not market-determined but policy-determined, establishes a link between the short-term rate and the minimum target level of foreign reserves.

Particularly, the authorities might increase the interest rate to indirectly limit the expansion of domestic credit and induce capital inflows when the level of reserves is below the minimum target; and, the opposite, they might reduce it after such a minimum has been reached.

[25] Instead, in REEs, net outflows of foreign currency, expectations of a fall in the stock of foreign reserves or an expected depreciation, tend to lead to a loss of flexibility characterized by the setting of an interest rate above the level the central bank would set under different external conditions. This occurs when the stability of the foreign exchange rate and the level of foreign reserves is a concern for the central bank, as it is the case of REEs.

The second is the *price effect*, and derives from the fact that, in REEs, central banks must deal with two forms of monetary reserves: local currency-base money reserves and foreign currency reserves. The price of the former is the interest rate and that of the latter the exchange rate.

This effect implies that, in REEs, the link between the exchange rate and the short-term interest rate depends largely on the availability of foreign reserves − e.g. interest rate reductions (increases) impact the exchange rate when foreign reserves cannot/do not decrease (increase) as much as foreign currency outflows (inflows).

That is to say, the link between the interest rate and the foreign exchange rate in REEs weakens as the stock of foreign reserves becomes larger (or is allowed to fluctuate more). The reason is: the larger the stock is (or actually, the more it can fluctuate), the more the impact of interest rates on foreign currency flows can be compensated with fluctuations in the stock. Notice, this link rather than demand-determined is policy-determined because it is the central bank not the market which is responsible for connecting and disconnecting the two prices.

The point is that, at the time of fixing the short-term rate, the authorities of REEs must take into account the size of their stock of foreign reserves, as well as the expected fluctuation in foreign currency flows. Thus, the interest rate-exchange rate connection in REEs differs from that observed in RIEs in that the latter do not count on foreign reserves to limit the impact of capital flows on the exchange rate.

The international monetary system is asymmetric because RIEs need not preserve a minimum stock of foreign currency assets, implying their central banks can accommodate

the demand for local currency-reserves in the most elastic possible way. That is to say, reserve issuing central banks need not adjust interest rates to accumulate reserves, although they certainly need to take into account the impact on capital flows and exchange rate fluctuations when setting the short-term rate.

The latter is because the base money and private bank money of RIEs circulate abroad, implying the exchange rates between reserve currencies and the currencies of REEs are largely determined by the accumulation of foreign reserves on the part of the latter. Notice this explains why often interest changes might not be sufficient to influence the foreign exchange rates between a reserve currency and the currencies of REEs and, hence, why RIEs must resort to political pressure to increase their influence upon them (e.g. the yuan/dollar exchange rate). Finally, notice that this is not the case of the exchange rates between reserve currencies (e.g. the dollar/euro rate), which instead are mostly endogenously determined by markets.

The above postulates regarding both RIEs and REEs are completely consistent with the endogenous theory of money, as in both economies it is the central bank, not the market, which determines the short-term rate; but, above all, because such postulates imply that money (and, particularly, the preference for liquidity in local and foreign currency) plays a main role in determining motives, portfolios, and behaviors. Modern monetary theory, therefore, must take into account the role played by *international monetary asymmetries*, as whether or not a country issues an international reserve currency affects not only the balance structure of central banks, but also the flexibility of the exchange rate regime, and the management of the short-term rate.

Notice that our definition of *international monetary asymmetries* is complementary to *Thirlwall's law* (Thirlwall, 1979). Both notions are concerned with economic growth sustainability, although in that respect the latter is much more precise. *Thirlwall's law* tells us that international payments imbalances can have relevant implications for economic growth, but its focus is on the goods market (i.e. the real sphere), while ours is on the money market (i.e. the financial sphere). Hence, whether or not money is a real commodity in fixed supply is immaterial to *Thirlwall's law*. But for our argument, the presence of international reserve currencies in elastic supply is fundamental. In this respect, our approach can explain certain phenomena which cannot be explained by *Thirlwall's law*; for instance, why only REEs must be concerned with the accumulation of foreign currency assets, and, hence, why monetary and fiscal policies depend on whether or not the economy issues an international reserve currency.

Diagram II.2 International Monetary Asymmetries and the link between the Foreign Exchange Rate and the Short-term Interest Rate

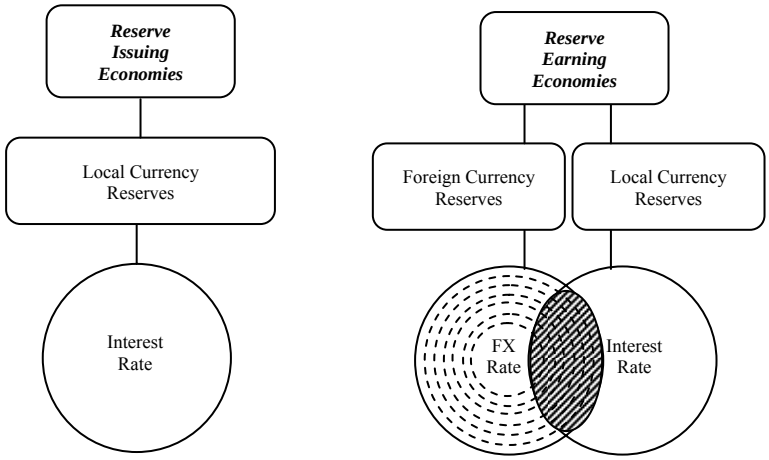


Diagram II.2: The shaded area represents the intersection of two spheres within the money market of REEs. It exists due to the coexistence of two forms of monetary reserves, although the size of the intersection depends on the structure of the domestic economy and, hence, on the intensity of the *price effect* (e.g. the trade/GDP ratio, the presence of currency mismatches, etc.). The smaller the central bank stock of foreign currency assets, the more flexible the exchange rate regime becomes and, hence, the smaller is the shaded area. But, on the other hand, the larger the shaded area is, the larger the degree of control over the exchange rate, and the weaker the link between the interest rate and the exchange rate. Foreign reserves, thus, act as a buffer stock compensating the impact of interest rate changes upon foreign currency flows and, hence, upon the exchange rate.

In short, our notion explains why *Thirlwall's law* is mainly applicable to the case of REEs, as RIEs can always expand their supply of local currency in face of payments imbalances with the rest of the world − put, differently, why RIEs might experience credit crises but not currency crises, in the sense that there is always (at least) one exchange rate at which their currencies are accepted abroad. These differences are reflected in Diagram II.2.

II.3 Central Bank Balance Sheets and Quantitative Indexes

Here, we argue that the structure of assets and liabilities of a central bank conveys lots of information. It reflects the asymmetries of the international monetary system, the structure and institutional framework of the domestic economy, and the exchange rate regime in place. But, as well, it reflects the monetary policy decisions of central banks, the degree of injection and extraction of exogenous monetary components, and so on.

However, as the demand for money is not directly observed, some inferences from the study of central bank balance sheet data might not necessarily be conclusive by themselves, requiring the simultaneous observation of the level, first difference, and variability of key price variables such as the rate of interest, the nominal exchange rate, the inflation rate, and so on. Nevertheless, in conjunction with such data, the analysis of the ratios, and the mix of central bank assets and liabilities, remains crucial for detecting diverse forms of monetary practices worldwide. Previous to introducing such ratios, though, the next subsection studies the particularities of central bank balance sheets.

II.3.1 Central Bank Assets and Liabilities

Table II.1 proposes a simple classification of a central bank balance sheet. On the one hand, an increase (decrease) in most asset components is recorded as an operation of injection (extraction) of *Base Money* liquidity[26]. On the other hand, the liability side reflects multiple operations. Above of all, it records variations in *Cash* and *Bank Reserves* as part of *Base Money*, although, it also registers all operations that drain liquidity through the use of extracting liability components, as well as all operations which affect the equity *Capital* of the central bank.

Table II.1 Central Banks' balance sheet

Assets, Liabilities and Capital
ASSETS
Gross Intl Reserves (GIR)
Gold and Gold Certificates
Foreign Currency Assets
Other International Reserve Assets
Domestic Credit (DC=CG+CFS)
Credit to Gov (CG)
Credit to Financial Sys (CFS)
IMF
Subtotal Other Assets
Other Assets in Foreign Currency not GIR
Other Assets
TOTAL ASSETS (ASS)

Assets, Liabilities and Capital
LIABILITIES
International Reserve Liabilities (IRL)
IMF
Base Money (BM =CASH+BRES)
Notes and Coins in Circulation (CASH)
Deposits from Banking Institutions (BRES)
Debt Securities (DS)
Deposits Public Adm (GD)
Other Liabilities
TOTAL LIABILITIES (LIA)
CAPITAL
Capital (K)

The extracting liability components are: own *Debt Securities* issued by the central bank, *Government Deposits*, and (exogenous) adjustments of the rate of reserve requirements. The use of *Debt Securities* carries on a loss of seignorage, for it implies the central bank

[26] For instance, the direct effect of an increase in the Gross International Reserves component is an equal increase in Base Money, which results from an increase either in the Cash subcomponent or the Bank Reserves subcomponent. The same occurs as a result of an increase in Domestic Credit – either through the exogenous channel which supplies Credit to the Government or through the endogenous channel which supplies Credit to the Financial Sector. However, that is not necessarily the case of financial assistances provided by the IMF or any other institution of the international system, for in such a case the increase in the asset side may be accompanied by an equivalent increase in Government Deposits rather than by an increase in Base Money; this, of course, with the purpose of guaranteeing that the latter will increase only when funds are circulated through the private bank system.

must pay an interest rate in order to drain liquidity from the system. An exogenous increase in the rate of reserve requirements, however, implies the central bank is using its coercive power in order to force a liquidity drain. And, finally, *Government Deposits* within the central bank are also a mechanism to drain liquidity from commercial banks, both endogenously, because of the dependence upon taxes and economic growth, and exogenously, because of the government's ability to place its own treasury securities.

Table II.2 summarizes the set of control variables for the central bank. First of all, under a flexible exchange rate regime, the central bank's stock of *Gross International Reserves* (GIR) is under the control of the monetary authority, precisely because it is relatively smaller than in the case of a fixed exchange rate regime, implying in the former case the central bank needs not accommodate the demand for foreign currency assets.

Table II.2. Central Bank control variables

Variable	Flexible Exchange Rate Regime		Fixed Exchange Rate Regime	
	Very Short-run	Short, Medium and Long-run	Very Short-run	Short, Medium and Long-run
GIR	***Exog***	***Exog***	*Endo*	*Endo*
DC	***Exog***	*Endo*	***Exog***	*Endo*
IRL	*Endo*	***Exog***	*Endo*	***Exog***
BM	***Exog***	*Endo*	***Exog***	*Endo*
DS	***Exog***	***Exog***	***Exog***	***Exog***
GD	*Endo*	*Endo*	*Endo*	*Endo*
K	*Endo*	*Endo*	*Endo*	*Endo*

Regardless of the foreign exchange rate regime, *International Reserve Liabilities* (IRL) can only be controlled in the medium to long-run, and it is the case *Domestic Credit* (DC) and *Base Money* (BM) are endogenously determined[27]. On the other hand, the stock of

[27] Yet, some would argue Domestic Credit (DC) and Base Money (BM) could be managed in the very short-run (e.g. during a few weeks or so), depending on the stability of the payments system and on institutional arrangements regarding the compliance with bank reserve requirements.

Debt Securities (DS) is always under the control of the central bank, as the latter could always inject reserves through the asset side (purchasing T-Securities from banks) and extract them back through the liability side, paying an interest rate above the one paid by the treasury. Finally, the equity *Capital* (K) of the central bank works as a buffer stock which absorbs losses and profits from monetary policy, so that strong declines in *Capital* may be seen as a prelude to a currency-depreciation aimed at restoring flexibility.

In formal terms, after neglecting the conglomerate of *Other Assets* and *Other Liabilities*, assuming they cancel each other out, the balance of assets and liabilities of a central bank leads to the following identity equation:

$$GIR + DC = IRL + BM + DS + GD + K \tag{1}$$

From (1), the central bank's *Base Money* can then be expressed as[28]:

$$BM = \left[\left(GIR - IRL\right) + \left(DC - DS - GD\right)\right] - K \tag{1'}$$

To avoid losses of seignorage (BM = DS) which may lead to pressures upon the level and stability of the interest rate, the stock of *Base Money* should be larger than the stock of own *Debt Securities* issued by the central bank[29]. Thus, the condition BM > DS implies:

$$BM > \left(GIR - IRL\right) + \left(DC - BM - GD\right) - K \tag{2}$$

[28] Where [(GIR-IRL) + (DC-DS-GD)] refers to the central banks' Net Stock of Credit, and (GIR-IRL) = NIR to Net International Reserves.

[29] If one accepts the definition of seignorage as the capacity to issue debt without having to pay an interest rate, then the increase in Debt Securities (DS), which pays interest, in substitution of Base Money (BM), which does not, represents an obvious loss. Thus, although it is still possible for BM to be inferior to DS − e.g. when a central bank is making a strong effort to defend a peg − such a situation cannot be sustained for a long time because it implies continuous losses for the central bank.

or equivalently, after some manipulation: $BM > \frac{1}{2} * [(GIR - IRL) + (DC - GD) - K]$ (2)′

Then, by combining (1)′ and (2)′, and solving for DS, the following expression is obtained: $DS < \frac{1}{2} * [(GIR - IRL) + (DC - GD) - K]$ (3)

The latter implies that a minimum degree of flexibility for monetary policy requires the following condition to hold[30]:

$$DS \leq \frac{1}{2} * [(GIR - IRL) + (DC - GD) - K] \leq BM \quad (4)$$

II.3.2 Central Bank Stereotypes

Table II.3 summarizes all possible theoretical stereotypes of central banks in accordance with their balance sheet structure − i.e. (1), (2),..., (6). Case (1) is that of RIEs, and the rest those of REEs. Clearly, the concerns faced by the central bank at the time of setting the short-term rate increase as one goes down the list. The rationale is that as one goes from case (1) to (2), the *quantity effect* becomes significant, as the authorities must target a minimum stock of foreign assets, a complexity not present in (1).

But, additionally, as one goes from case (2) to (6), it is the *price effect* which gains increasing significance. Therefore, depending on the structure of the domestic economy, the central bank will have to pay closer and closer attention to exchange rate

[30] Note that this normative rule is not necessarily derived from a central bank welfare loss function as such a function would necessarily be defined by the preferences and objectives of the monetary authorities, which are themselves endogenously determined by the central banker's beliefs regarding what monetary policy is capable of achieving. The loss function of the central banker is shaped by economic theory and, hence, its optimization need not lead to an adequate normative rule. Rather its derivation must be seen as the result of balancing concerns regarding the stabilization of the interest rate, the exchange rate and the level of Gross International Reserves.

fluctuations[31,32]. Next section proposes a few examples of ratios that might be used to measure the elasticity of monetary policy in RIEs and REEs.

Table II.4. Central Bank Stereotypes

Case	Diagnosis				Symptoms	
	Is the Local Currency an International Reserve Currency?	Concern for foreign currency accumulation / Quantity Effect	Concern for exchange rate fluctuations / Price Effect	Monetary Policy and FX Rate Regime in Place	Largest Component of Asset Side	Largest Component of Liability Side
(1)	Yes	Null	Weak	Fully Flexible	*Domestic Credit*	*Cash*
(2)[33]	No	Adverse and slightly significant	Weak	Flexible	*Domestic Credit*	*Total Base Money*
(3)	No	Adverse and significant	Intermediate	Flexible/Fixed	*Domestic Credit*	*Debt Sec. and Gov. Deposits*
(4)	No	Adverse and significant	Intermediate	Flexible/Fixed	*Gross Intl Reserves*	*Total Base Money*
(5)[34]	No	Adverse and extremely significant	Strong	Fixed	*Gross Intl Reserves*	*Debt Sec. and Gov. Deposits*
(6)[35]	No	Adverse and extremely significant	Strong	"Fully" Fixed	*Gross Intl Reserves*	*Cash*

[31] Moreover, under inflexible exchange rate regimes − cases (4) to (6), the degree of concern of the central bank diminishes with foreign currency-inflows and increases with foreign currency-outflows. This is because under the former situation the central bank can always print additional Base Money pari passu with the inflows of foreign currency while still being able to control fully the short-term interest rate. But, in the latter situation, as the foreign currency cannot be printed domestically, the central bank would soon or later lose control over the short term rate if it is unwilling to forgo the stability of the exchange rate.

[32] How much should the authorities struggle to defend its Gross International Reserves will depend mainly on the variability of the interest rate. For whenever the stability of the domestic interest rate is being sacrificed, a structural portfolio adjustment, soon or later, will have to be carried out by the central bank. Otherwise, monetary policy will become extremely costly in terms of interest payments, but, above all, it will distort the well functioning of the payments and financial markets. That is to say, monetary policy reactions should not to be allowed to lead to interest rate volatility. Moreover, here, such volatility is interpreted as a sign of persistence of the old flawed orthodox attempt to control the economy's overall volume of money, a practice associated with the exogenous theory of the money supply.

[33] As Base Money corresponds to the sum of Cash and Bank Reserves, cases (2) and (4) refer to those central banks for which the whole Base Money, instead of Cash itself, represents the largest liability component of the central bank.

[34] In this case, depending on the predominance of Debt Securities, one could argue that the accumulation of Gross International Reserves is being financed by securities which yield a positive interest rate rather than by Base Money reserves which do not. But, although central bank Debt Securities usually yield an interest rate higher than that paid on holdings of international reserve assets, the major concern here should not be the financial loss incurred by the central bank but, instead, the distortion caused by such monetary practices (e.g. under foreign currency outflows). In short, under such conditions, the exchange rate regime may soon or later become extremely costly.

[35] An extreme version of this case may lead to a currency board, in the sense that the banking department of the central bank tends to disappear in relative terms as the operations undertaken by the issuing department tend to acquire much greater importance.

II.3.3 Central Bank Quantitative Indexes

This subsection introduces some examples of various ratios which can be used for measuring the degree of flexibility of monetary policy and the exchange rate regime in REEs and RIEs (the reader is encouraged to propose and compute alternative ratios, but keeping in mind that not all of them make sense in both types of economies).

II.3.3.a The ratio of External Dependence

The first ratio proposed here represents a measure of the external source of liquidity arising from foreign currency inflows. It shall be computed as *Total Base Money* over *Gross International Reserves* (BM/GIR), and labeled: *External Dependence*. It applies only when *Gross International Reserves* represent the largest asset component (GIR>DC) − e.g. in the case of most reserve-earning central banks, but it does not make sense in the case of RIEs (this is because RIEs do not hold large stocks of foreign currency reserves).

The more flexible monetary policy is in a REE, the larger will be the value of the ratio. Recall that (at least, in principle) the stock of *Gross International Reserves* could be fully built in exchange for *Base Money*, either in the form of *Cash* or *Bank Reserves*. Therefore, one would expect the value of such a ratio to be greater (or equal) than the unit whenever the monetary policy of the central bank enjoys a relatively high elasticity.

Nevertheless, this is not always necessarily the case, as the *price effect* – i.e. the need to sterilize exchange rate interventions – as well as the concern for preserving a minimum level of *Gross International Reserves* may force the central bank to build part of the stock of such reserves upon the expansion of *Debt Securities* (reflecting monetary inflexibility); equation (4), thus, must be used to establish a minimum reference value for the ratio:

$$\frac{BM}{GIR} \geq \frac{1}{2} * \frac{\left[(GIR - IRL) + (DC - GD) - K\right]}{GIR} \tag{5}$$

Here, when the left hand side (LHS) of (5) is smaller than the right hand side (RHS), monetary policy will be considered as inflexible. The RHS of (5) tells us that in order to preserve a minimum degree of elasticity (a larger stock of base money than securities), some variables must be kept in balance. For instance, given *Gross International Reserves*, exogenous and endogenous expansions of *Domestic Credit* $(\Delta DC - \Delta GD > 0)$, in the RHS, call for greater flexibility of the exchange rate regime, in the LHS, implying that the minimum level of the ratio must increase in presence of expanding credit activities and fiscal deficits not fully absorbed by T-Securities. Notice that the opposite occurs under the expansion of *Government Deposits* because the latter reduce the need for issuing own *Debt Securities*[36].

II.3.3.b The ratio of *Domestic Freedom*

The second index is a measure of the internal source of liquidity arising from the expansion of *Domestic Credit* either via the exogenous channel in the form of *Credit to the Government* or via the endogenous channel through *Credit to the Financial Sector*. It shall be defined as the ratio of *Base Money* to *Domestic Credit* (BM/DC), and labeled: *Domestic Freedom*. It is only meaningful in the case in which *Domestic Credit* (DC) is the largest asset component − e.g. in the case of all reserve issuing central banks.

[36] Additionally, when the condition (DC - GD) < K + IRL holds, the greater the buffer stock of Gross International Reserves held by the central bank the lower will be the value of the ratio required to guarantee a minimum level of flexibility for monetary policy. But if the above condition does not hold, it must be the case that the accumulation of Gross International Reserves is being financed by means of Debt Securities to such an extent that flexibility is reduced. Finally, the greater the buffer stock of Capital held by the central bank, the more can the pressures to increase the ratio be resisted. But strong declines in the amount of Capital may be seen as a prelude to a currency-depreciation aimed at restoring flexibility.

The larger the ratio, the larger is the monetary flexibility of the central bank. Indeed, provided the expansion of *Domestic Credit* leads to the expansion of *Base Money*, one would expect this ratio to be close to the unit. Yet, again, there is nothing precluding the central bank from replacing base money with base money substitutes (e.g. securities) on the liability side (what would reflect inflexibility). Thus, equation (4) must be used once more to establish a minimum reference value (RHS) for the ratio:

$$\frac{BM}{DC} \geq \frac{1}{2} * \frac{[NIR + (DC - GD) - K]}{DC} \qquad (6)$$

Notice that in the case of reserve issuing central banks, *Net International Reserves* (NIR) and *Government Deposits* (GD) tend to be negligible in practice, implying that the condition expressed in equation (6) boils down to:

$$BM \geq \frac{1}{2}[DC - K] \qquad (6)''$$

a condition one would expect to always be satisfied by reserve issuing central banks, as in their case, *Base Money* and *Domestic Credit* always tend to move together, remaining approximately equal (and the capital of the central bank, K, is small relative to the stock of domestic credit, DC)[37]. That is, one would expect monetary policy in RIEs to be relatively flexible (in that base money should exceed central bank securities).

[37] But, in the unusual cases (2) and (3) in Table II.3, the desired level of the ratio to guarantee a minimum degree of freedom for monetary policy will once again be reduced by the accumulation of Capital and Government Deposits. Notice, however, that in this case, the accumulation of Gross International Reserves increases the desired minimum level of the ratio, implying that, if the domestic freedom of monetary policy is to be preserved, the stock of Gross International Reserves must be built upon the expansion of Base Money rather than upon Debt Securities. This is equivalent to the old argument which states that the domestic freedom of monetary policy depends on the flexibility of the exchange rate regime in place. Indeed, under a flexible regime one would expect Government Deposits and Debt Securities to be smaller, and Base Money to be larger. But, again, the flexibility of the regime will depend as well on the degree of liquidity preference in both currencies, the presence of excess reserves and of treasury securities, the structure of the domestic economy, the influence of the price effect, and so on.

II.3.3.c The importance of the Extracting Liability Components

The third ratio measures the relative importance of two extracting liability components (base money substitutes): *Debt Securities* and *Government Deposits*. It shall be defined as the ratio of the sum of *Debt Securities* and *Government Deposits* to *Total Base Money* ((DS + GD)/BM), and it is meaningful in all cases (i.e. in the case of REEs and RIEs), implying a relatively large loss of elasticity when it exceeds 100%; that is to say, whenever the base money stock is smaller than the stock of base money substitutes.

II.3.3.d The ratio of *Seignorage Loss*

The fourth ratio is simply an alternative measure of the relative importance of the extracting liability components. It is defined as the sum of *Government Deposits* and *Debt Securities* over *Total Liabilities* ((DS+GD)/LIA), and labeled: *Seignorage Loss*. Furthermore, it is meaningful in the case of all central banks and its value should be lower than 50%, as otherwise *Base Money* would tend to fade away (in relative terms) from the system: the larger the ratio, the larger the government's seignorage loss; that is to say, the amount of government interest bearing debt.

II.3.3.e *Net Extraction of Internal Liquidity*

The fifth index is a measure of the *net extraction of internal liquidity*. It is defined as the ratio of the sum of *Government Deposits* and *Debt Securities* to *Domestic Credit* ((DS+GD)/DC). It applies when *Domestic Credit* (DC) is the major asset component and its value should not exceed 100%, as otherwise a net drain of *Base Money* would occur (the amount of base money injected through *Domestic Credit* would be fully extracted). Indeed, one would expect the value of the ratio to be closer to 0% than to 100% in RIEs.

II.4.3.f *Net Extraction of External Liquidity*

The sixth index is a measure of the *net extraction of external liquidity*. It shall be computed as the ratio of the sum of *Government Deposits* and *Debt Securities* to *Gross International Reserves* ((DS+GD)/GIR). It applies whenever the latter are the largest asset component − e.g. in the case of reserve earning economies when GIR>DC − and it should not exceed 100%, as otherwise the costs of preserving the regime (the cost of foreign exchange interventions/sterilizations in terms of interest payments) would surge. Thus, the larger the ratio, the lower the degree of flexibility of the exchange rate and monetary regime and, hence, the larger sterilization costs become, simply because the base upon which interest are paid increases.

II.3.3.g *Liquidity Requirements*

The seventh ratio, a measure of the liquidity requirements demanded by the central bank, is that of *Bank Reserves* to *Domestic Credit* (BRES/DC), and applies to all central banks, with values above 100% implying a net drain of *Domestic Credit* most likely in order to sterilize large foreign exchange interventions (without issuing interest-bearing debt).

Thus, the larger the ratio the lower the degree of monetary flexibility, but also most likely the greater the importance of coercion (the imposition of high reserve requirement rates) as part of the central bank's effort to sterilize foreign exchange interventions without having to incur (fiscally costly) interest payments. Most probably, this should be the most illuminating ratio here proposed, firstly because it applies to both RIEs and REEs and, secondly, because it should, in principle, reflect low values in the first case and large values in the second, as non-interest bearing reserves reduce sterilization costs.

II.4 Empirical approach and Fundamental Findings

Central Bank balance sheet data was collected for 48 months of observations during the period starting from Jan 2003 to Dec 2006. These data was supplemented with overnight interbank interest rate and foreign exchange rate data, with an average of around 1045 daily observations during the same period. Additional monthly data includes inflation rates, international reserves, fiscal data, and so on (see Table II.7 in the Appendix).

Central bank balance sheet data and the above proposed ratios were computed for the following cases: Argentina, Brazil, Mexico, Peru, the United States of America, and Venezuela in Latin America and North America; the EU, the UK, and Norway in Europe; and China, Japan, Kuwait, India, Saudi Arabia, and the United Arab Emirates in Asia.

As the empirical contrast is based on identity equations, and not on behavioral equations, the econometric analysis has been discarded, as that would only lead to R-squared values equal to the unit and the absence of statistical errors.

Rather than providing a detailed study of the intricacies of every single case − a task which is out of the scope of this paper − the rest of this section presents the general empirical findings. First of all, regarding financial price data, the stability of overnight interbank interest rates in the sample − see Graph II-1 − suggests that, during the period of study, most central banks tended to accommodate day after day the demand for reserves on the part of commercial banks[38]. Yet, the level and volatility of overnight

[38] The exception to the rule was the case of Venezuela which exhibited (for every single year) the greatest interest rate volatility among all economies in the whole sample. Indeed, the country's average daily interest rate volatility during 2003 was around 12%, suggesting the Central Bank of Venezuela is the only central bank in the whole sample which pretends to follow a policy based on monetary-targeting. An additional, but transitory, exception was Brazil where the average daily interest rate volatility exceeded 2%

interest rates was lower in reserve issuing countries and in countries with more stable fixed-exchange regimes, such as China, United Arab Emirates, and Saudi Arabia.

Regarding balance sheet structures (see Tables II-5,II-6), all reserve issuing central banks behaved as expected in line with stereotype (1). During the whole period from Jan-2003 to Dec-2006, *Domestic Credit* was the largest asset component, with an average of 93%, 49%, 69% and 94% in the case of the USA, the EU, the UK and Japan. While, on the liability side, *Cash* was the largest component, reaching up to 92%, 55%, 49% and 55%, respectively.

Notice, however, that while *Bank Reserves* are small in the case of the USA (3%), they are relatively large in the case of the EU (17%), the UK (27%) and Japan (21%). Moreover, in the latter case, the amount of *Debt Securities* reached up to 17%, while in the case of the USA, the EU and the UK the amounts were insignificant.

Yet, the overall results confirm that reserve-issuing central banks, such as the FED and the ECB and to a lesser extent the BoE and the BoJ, need not, in general, be concerned with the accumulation of foreign currency assets. Indeed, foreign currency assets, which form part of all *Gross International Reserve* assets, represented 0%, 16%, 15% and 4%, respectively − see footnote[39].

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during 2003, only. Apart from the case of Venezuela, where the old-flawed attempt to control monetary aggregates seems to persist, the above results show evidence of convergence towards monetary practices based on interest rate-targeting.

[39] One should bear in mind though, that in Japan, the UK and the USA (and also at the national level within the EU), the treasury builds a separate and larger stock of foreign currency assets than that built by their respective central banks (including the ECB). Indeed, the 2006 average of total US Reserve Assets held by both the Treasury and the Federal Reserve Banks of the USA reached up to 66 billion dollars, out of which only 14 were held by the latter. Equivalently, in the case of Japan, total Reserve Assets held by both the Ministry of Finance and the Bank of Japan reached up to 870 billion dollars, out of which only 48 were held by the latter. And in the case of the UK out of a total of 79 billion dollars, only 30 were held by the

Regarding reserve earning economies, the findings (as expected) are divided among those central banks which behaved as stereotype (4) and those which behaved as stereotype (5). The first group was composed by Argentina, China, India, Kuwait, Mexico and Peru, and the second by almost all of the oil exporting countries in the sample: Norway, UAE, Saudi Arabia, and Venezuela.

The largest asset component for both groups was, as expected, the *Gross International Reserves* component, reaching, respectively, 61%, 56%, 86%, 98%, 74%, 89%, 95%, 92%, 98% and 78% in the case of Argentina[40], China, India, Kuwait, Mexico, Peru, Norway[41], Saudi Arabia, United Arab Emirates and Venezuela. However, in accordance with Table II.3, the liability structure varied across groups. That is to say, for instance, while *Base Money* was the largest liability component for the first group, the sum of *Government Deposits* and *Debt Securities* was the largest for the second.

Indeed, for the first group, total *Base Money* reached up to 39%, 66%, 71%, 54%, 52%, 70% in the case of Argentina, China, India, Kuwait, Mexico and Peru[42], respectively,

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Bank of England. Yet, during the same period, Domestic Credit represented 793 billion dollars in the case of the USA, and, respectively, around 1014 billion dollars and 120 billion dollars in the case of Japan and the UK, the last two values being computed at the year-average foreign exchange rates of 116.29 JPY/USD$ and 0.54 GBP/USD$. See Table II.7, in the Appendix, for information regarding the source of the data.

[40] In the case of Argentina, it is clear that the relevant value should correspond to the sum of Gross International Reserves (39%) and IMF loans (22%), as the latter represent as well foreign currency reserve assets which are recorded separately. This is confirmed by the evolution of the data, showed in Table II.5, in the Appendix, which reflects the increase in Gross International Reserves from 30% in 2003 to 50% in 2006. Yet, the average of this last figure during the whole period was 39%.

[41] Equivalently, in the case of Norway, the relevant value should correspond to the sum of Gross International Reserves (20%) and the value of the assets accumulated under the Oil Fund (75%), as the latter represent as well foreign currency reserve assets which, not being monetized, are recorded separately.

[42] The relevant value in the case of Peru is the sum of Base Money (25%) and Bank Reserves in Foreign Currency (45%). This is because the Peruvian economy is financially-dollarized, implying a large component of Base Money is represented by bank reserves which are denominated in foreign currency and here registered separately. Such a concept represented 45% of total liabilities during the whole period, implying that around a 50% of the stock of Gross International Reserves of the Central Bank of Peru has

while for the second group, the sum of *Government Deposits* and *Debt Securities* represented 89%, 32%, 42% and 42% in the case of Norway[43], Saudi Arabia[44], United Arab Emirates and Venezuela, respectively.

The case of Brazil represents an unexpected result, for the balance sheet structure of its central bank exhibits *Domestic Credit* as largest asset component (65%) and the sum of *Government Deposits* and *Debt Securities* (53%) as largest liability component. This may reflect a small price effect or a relatively low degree of concern with foreign exchange fluctuations − e.g. due to a low ratio of trade to GDP − but that leaves unexplained the basis for such large government deposits[45].

Regarding central bank quantitative indexes, the results show strong evidence of high elasticity in the case of the monetary systems of reserve issuing economies and low flexibility in the case of reserve earning systems − see in the Appendix Table II.6 and Graphs II.5 to II.11. Finally, the data suggests that balance sheet structures are steady

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been built as the result of the imposition of reserve requirements over foreign currency-bank deposits (50% = 45% * 99% ÷ 89%).

[43] This is after considering the liability counterpart of the assets held in the Norwegian Oil Fund as a form of Government Deposit.

[44] In the case of Saudi Arabia, 44% of total liabilities during the period were composed of "Other Miscellaneous Liabilities". It would be interesting to know their composition but no report from the webpage of the Saudi Arabian Monetary Agency (SAMA) mentions anything with respect to it; and by the time of writing no department of the bank has replied to our inquiries regarding this matter. One thing is for sure, though, such a concept must include the Equity Capital and what SAMA calls elsewhere "reverse repos" or, in our terminology, Debt Securities. So, it is very likely the sum of the extracting liability components − Debt Securities and Government Deposits − exceeds 32% in the case of SAMA. For instance, if one assumes half of the 44% mentioned above were Debt Securities, then the sum of the extracting components would be 54% rather than 32% and, hence, would represent the second greatest effort of extraction (sterilization) in the whole sample. Such a number is certainly consistent with the riyal peg against the US dollar in place since May 1981.

[45] Perhaps, the answer is the aggressive policy of high interest rates followed by the central bank or the process of debt restructuring undertaken by the government. Indeed, notice that, measured as a percentage of GDP, primary fiscal surpluses, as published by the Central Bank of Brazil, reached up to 4.27%, 4.38%, 4.37% and 4.32% by the end of 2003, 2004, 2005 and 2006, respectively, while financial results after debt service registered fiscal deficits of around 5.09%, 2.55%, 3.98% and 3.35% during the same years. Moreover, these results were more than offset by the domestic placement of treasury securities which reached up to 7.92%, 3.70%, 8.83%, and 7.43%, implying the Brazilian government was restructuring its debt, as further data shows it was reducing its (internal) bank debt and its overall external debt.

over the business cycle, in the sense that no economy can jump from one extreme position to the other; that is, no reserve earning central bank − stereotypes (2) to (6) − can suddenly behave as a reserve issuing one − stereotype (1). Yet, portfolio adjustments and exchange rate adjustments within a particular stereotype might affect the flexibility of the domestic monetary system in the short-run.

II.5 Conclusions

Based on our findings of strikingly different central bank balance sheet structures worldwide, we argued that the current international monetary system is fully asymmetric, as it divides the world among a few reserve issuing economies (RIEs) and a larger group of reserve earning ones (REEs). Further, we argued that international monetary asymmetries are relevant to monetary theory and policy because they affect the behavior of central banks, their balance sheet structure, the flexibility of the exchange rate regime, and the design of interest rate targeting rules.

Both RIEs and REEs must be concerned with the exchange rate, foreign capital flows and net payments to the rest of the world, but only the latter must be concerned with the accumulation of foreign currency assets, as their local currencies do not circulate abroad. International monetary asymmetries cause two effects. The first implies that in REEs there is a strong policy-induced connection between the quantity of foreign reserve assets and the short-term rate of interest, as the fact that reserve earning central banks must target a minimum stock of foreign currency assets affects interest rate targeting.

The second effect derives from the first. That is, from the fact that in REEs two forms of monetary reserves coexist: local currency base money reserves which are elastic and

foreign currency reserves which are not. The price of the former is the interest rate and that of the latter the exchange rate. This effect means that in REEs the connection between the foreign exchange rate and the short-term rate weakens as foreign currency reserves increase. This is because the larger such a stock is, the greater the capacity of the central bank to limit the impact of interest rate changes upon the exchange rate.

For instance, as long as foreign reserves can vary sufficiently, an interest rate reduction (increase) that leads to foreign currency outflows (inflows) might be compensated by an equivalent reduction (increase) in the stock of foreign reserves, limiting the impact upon the exchange rate. This, along with the authorities' bias against currency appreciations, explains why REEs are often willing to accumulate large stocks of foreign reserves, provided (as it is the case) sterilization costs are relatively small.

Notice RIEs need not accumulate or target a minimum stock of foreign currency reserves, as their local currencies circulate abroad. Further, notice this implies their exchange rates against the currencies of REEs largely depend on the accumulation of foreign reserves on the part of the latter (e.g. the yuan/dollar exchange rate).

Moreover, here it is argued that the dominant reserve issuing central bank (e.g. the FED) cannot engineer a depreciation of its currency against the currencies of REEs through a reduction in its short-term rate. This is because, by definition, it is not used to allow its stock of foreign currency assets (e.g. of yuans) increase sufficiently so as to be able to impose a target (or given) price (this is because the FED does not need foreign currency in the first place); but, above all, because even if it increased its stock of foreign currency (e.g. of yuans), the REE whose currency is being purchased (e.g. China) could always

neutralize the effect of such purchases upon the (e.g. yuan/dollar) exchange rate by intervening as well; thus, rather, such adjustment often requires international coordination (or political pressure). But, notice that, this is not the case of exchange rates between reserve currencies (e.g. the dollar/euro rate), which instead are largely determined by market forces and interest rate differentials.

Further, we have argued that the differences among monetary practices are captured by the diverse structures of central bank assets and liabilities, and shown that RIEs and REEs follow entirely different patterns or stereotypes. For instance, while the former behave as the stereotype (1) proposed in section 4, with *Domestic Credit* and *Cash* as largest asset and liability components, the latter always behave as stereotype (4), with, respectively, *Gross International Reserves* and *Base Money* as largest components. The exception to the rule is that of some oil exporting countries which, due to their fixed exchange rate regimes (and sterilization needs), behave as stereotype (5). Yet, in general, one would expect stereotypes (1) and (4) to be the rule, respectively, for RIEs and REEs.

Moreover, it was shown that the efforts to stabilize the exchange rate in REEs lead to a substitution (sterilization, or compensation) process whereby *Base Money* is partially replaced with *Debt Securities*, *Government Deposits*, and larger *Bank Reserve* requirements[46]. Thus, one corollary of our analysis is that to distinguish whether or not a central bank makes an effort to stabilize the currency, one should focus on the structure of its balance sheet rather than on the evolution of the foreign exchange rate itself.

[46] Indeed, REEs are usually guided by criterions of "sound finance", including the preservation of large volumes of local currency Bank Reserves.

In addition, regarding the ratios, the results also suggest the presence of "sounder" monetary practices in REEs than in RIEs. But this, rather than being a merit, reflects a lower degree of monetary elasticity in the former case, where guaranteeing a large stock foreign currency assets is crucial. Thus, apart from Brazil, the results suggest a case for inflexible exchange rate regimes in REEs, a finding contrary to the orthodox principle of *price flexibility* (Garcia, Mata and Nell, 2008; Garcia and Mata, forthcoming)[47].

This explains why monetary policy is much more elastic in RIEs than in REEs. For, apart from targeting short-term interest rates to influence indirectly foreign currency flows and exchange rate fluctuations, reserve earning central banks must intervene directly in foreign exchange markets to accumulate reserves (asset side); and, hence, they must endogenously compensate such interventions reducing the proportion of cash, and increasing that of own securities, bank reserves, and government deposits (liability side).

[47] Moreover, the results also illustrate how two orthodox principles may be in contradiction. For price flexibility and policies of sound finance cannot coexist simultaneously, as no exchange rate regime can remain flexible under "sound practices" of central banking.

II. Appendix

A L L C O U N T R I E S

TABLE II.4. PERIOD JAN 2003 TO DEC 2006-AVERAGE STRUCTURE OF (CENTRAL BANKS') MONTHLY BALANCE SHEETS

Assets, Liabilities and Capital	ARG	BRA	MEX	PERU	USA	VEN	UK	EU	NOR	CHI	JAP	KUW	IND	SAU	UAE
	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06
A S S E T S															
Gross Intl Reserves (GIR)	**39%**	**32%**	**74%**	**89%**	**2%**	**78%**	**20%**	**34%**	**20%**	**56%**	**4%**	**98%**	**86%**	**92%**	**98%**
Gold and Gold Certificates	1%	0%	0%	4%	1%	17%	0%	15%	0%	0%	0%	1%	3%	0%	**0%**
Foreign Currency Assets	38%	32%	73%	83%	0%	60%	15%	16%	19%	56%	4%	97%	83%	92%	**98%**
Other International Reserve Assets	0%	0%	1%	2%	0%	2%	4%	3%	0%	0%	0%	0%	0%	0%	**0%**
Domestic Credit (DC=CG+CFS)	**29%**	**65%**	**19%**	**1%**	**93%**	**7%**	**69%**	**49%**	**2%**	**31%**	**94%**	**0%**	**3%**	**0%**	**1%**
Credit to Gov (CG)	17%	61%	11%	0%	92%	7%	22%	5%	1%	4%	92%	0%	2%	0%	**0%**
Credit to Financial Sys (CFS)	12%	4%	7%	1%	0%	0%	48%	45%	1%	27%	2%	0%	1%	0%	**1%**
IMF (and other resources from other funds)	**22%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**75%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Subtotal Other Assets	**9%**	**3%**	**7%**	**10%**	**6%**	**16%**	**11%**	**17%**	**3%**	**13%**	**2%**	**2%**	**12%**	**8%**	**1%**
Other Assets in Foreign Currency not GRI	4%	2%	1%	7%	0%	14%	0%	2%	0%	1%	0%	0%	0%	0%	**0%**
Other Assets	6%	1%	6%	3%	6%	2%	11%	15%	3%	11%	2%	2%	12%	8%	**1%**
TOTAL ASSETS (ASS)															
L I A B I L I T I E S															
International Reserve Liabilities (IRL)	**4%**	**7%**	**5%**	**9%**	**0%**	**21%**	**19%**	**2%**	**5%**	**1%**	**0%**	**2%**	**0%**	**0%**	**0%**
IMF and resources from other funds or *Bank Reserves* in foreign currency	**28%**	**10%**	**0%**	**45%**	**0%**	**0%**	**0%**	**0%**	**81%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Base Money (BM =CASH+BRES)	**39%**	**29%**	**52%**	**25%**	**95%**	**34%**	**76%**	**72%**	**6%**	**66%**	**76%**	**54%**	**71%**	**24%**	**56%**
Notes and Coins in Circulation (CASH)	28%	11%	30%	18%	92%	14%	49%	55%	3%	29%	55%	29%	55%	18%	**27%**
Deposits of Banking Institutions (BRES)	11%	18%	22%	6%	3%	19%	27%	17%	2%	37%	21%	26%	16%	6%	**29%**
Debt Securities (DS)	**17%**	**19%**	**23%**	**13%**	**3%**	**27%**	**1%**	**0%**	**0%**	**14%**	**17%**	**4%**	**5%**	**0%**	**27%**
Deposits Public Adm (DG)	**1%**	**34%**	**15%**	**2%**	**1%**	**15%**	**1%**	**7%**	**8%**	**14%**	**4%**	**25%**	**1%**	**32%**	**15%**
Other Liabilities	**10%**	**1%**	**5%**	**6%**	**1%**	**4%**	**3%**	**19%**	**0%**	**5%**	**3%**	**15%**	**23%**	**44%**	**3%**
TOTAL LIABILITIES (LIA)	**88%**	**99%**	**103%**	**99%**	**97%**	**77%**	**100%**	**93%**	**93%**	**100%**	**98%**	**91%**	**100%**	**100%**	**98%**
C A P I T A L															
Capital (K)	**12%**	**1%**	**-3%**	**1%**	**3%**	**22%**	**0%**	**7%**	**7%**	**0%**	**2%**	**9%**	**0%**	**0%**	**2%**
Central Bank Stereotype (1), (2), ..., (6)	**(4)**	**(3)**	**(4)**	**(4)**	**(1)**	**(5)**	**(1)**	**(1)**	**(5)**	**(4)**	**(1)**	**(4)**	**(4)**	**(5)**	**(4)**

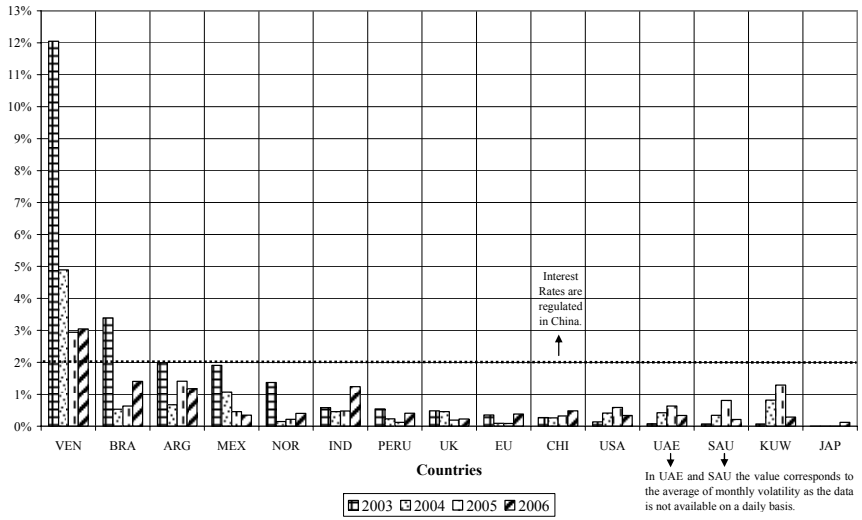
A L L C O U N T R I E S

TABLE II.5. EVOLUTION OF SOME KEY VARIABLES FROM YEAR-AVERAGE 2003 TO YEAR-AVERAGE 2006

Assets, Liabilities and Capital	ARG	BRA	MEX	PERU	USA	VEN	UK	EU	NOR	CHI	JAP	KUW	IND	SAU	UAE
	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06
A S S E T S															
Gross Intl Reserves (GIR)	**30-50%**	**32-32%**	**70-77%**	**87-89%**	**2-2%**	**74-74%**	**19-19%**	**41-29%**	**22-16%**	**48-63%**	**4-4%**	**99-98%**	**78-89%**	**88-96%**	**99-97%**
Domestic Credit (DC=CG+CFS)	**26-39%**	**64-66%**	**22-19%**	**1-3%**	**92-93%**	**6-14%**	**69-70%**	**42-51%**	**2-2%**	**40-26%**	**94-93%**	**0-1%**	**8-1%**	**0-0%**	**0-2%**
IMF (or Norway's Oil Fund)	**37-0%**								**68-82%**						
L I A B I L I T I E S															
IMF (or Peru's Foreign Currency Bank Reserves and Norway's Oil Fund)	**46-3%**	**17-0%**		**29-25%**					**76-85%**						
Base Money (BM =CASH+BRES)	**36-49%**	**24-35%**	**51-54%**	**18-30%**	**95-95%**	**34-36%**	**80-67%**	**68-72%**	**8-4%**	**67-56%**	**79-75%**	**66-50%**	**73-72%**	**34-14%**	**55-55%**
Notes and Coins in Circulation (CASH)	22-38%	8-14%	29-30%	16-21%	92-93%	17-13%	54-42%	51-56%	4-3%	35-23%	55-62%	27-25%	58-55%	27-10%	29-24%
Deposits of Banking Institutions (BRES)	13-11%	16-22%	22-24%	2-10%	3-2%	17-23%	26-25%	18-16%	4-1%	32-33%	23-13%	38-26%	15-17%	7-5%	26-30%
Debt Securities (DS)	**6-30%**	**22-19%**	**27-18%**	**8-11%**	**3-3%**	**18-42%**	**0-4%**	**0-0%**	**0-0%**	**4-24%**	**14-19%**	**0-10%**	**0-4%**	**0-0%**	**24-32%**
Deposits Public Adm (DG)	**1-2%**	**27-40%**	**14-17%**	**26-20%**	**1-1%**	**14-7%**	**1-1%**	**8-6%**	**8-6%**	**25-11%**	**5-4%**	**21-22%**	**0-2%**	**29-42%**	**19-11%**
FOREIGN EXCHANGE RATE															
Foreign Exchange Rate Variation (against the US dollar)	**2.95** **3.07**	**3.07** **2.18**	**10.79** **10.90**	**3.48** **3.28**	**N/A**	**1607.60** **2150.00**	**0.61** **0.54**	**0.89** **0.80**	**7.08** **6.42**	**8.28** **7.97**	**115.93** **116.29**	**0.30** **0.29**	**46.56** **45.42**	**3.75** **3.75**	**3.67** **3.67**
Foreign Exchange Rate Variation (%)	**4.07%**	**-28.99%**	**1.02%**	**-5.75%**	**N/A**	**33.74%**	**-11.48%**	**-10.11%**	**-9.32%**	**-3.68%**	**0.31%**	**-2.63%**	**-2.45%**	**0%**	**0%**
Central Bank Stereotype (1), (2), ..., (6)	**(4)**	**(3)**	**(4)**	**(4)**	**(1)**	**(5)**	**(1)**	**(1)**	**(5)**	**(4)**	**(1)**	**(4)**	**(4)**	**(5)**	**(4)**

A L L C O U N T R I E S

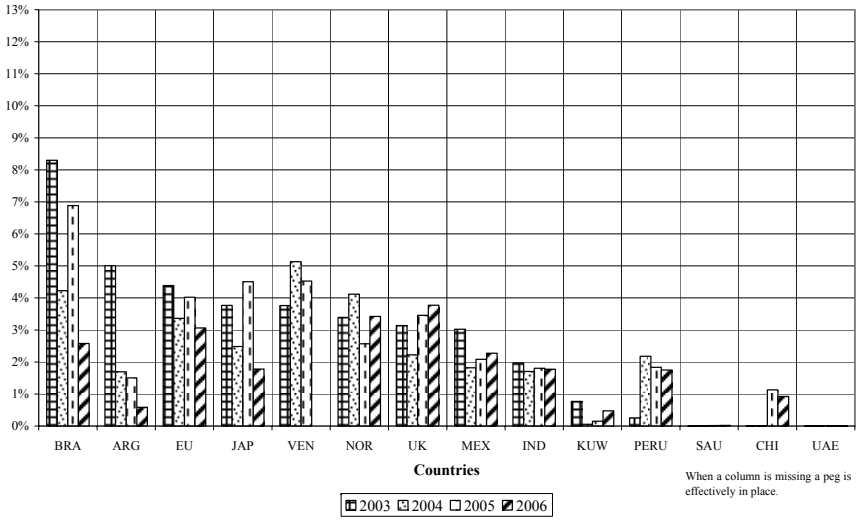
Graph II-1: Average Daily Interest Rate Volatility in the Interbank Market



In UAE and SAU the value corresponds to the average of monthly volatility as the data is not available on a daily basis.

A L L C O U N T R I E S E X C E P T U S A

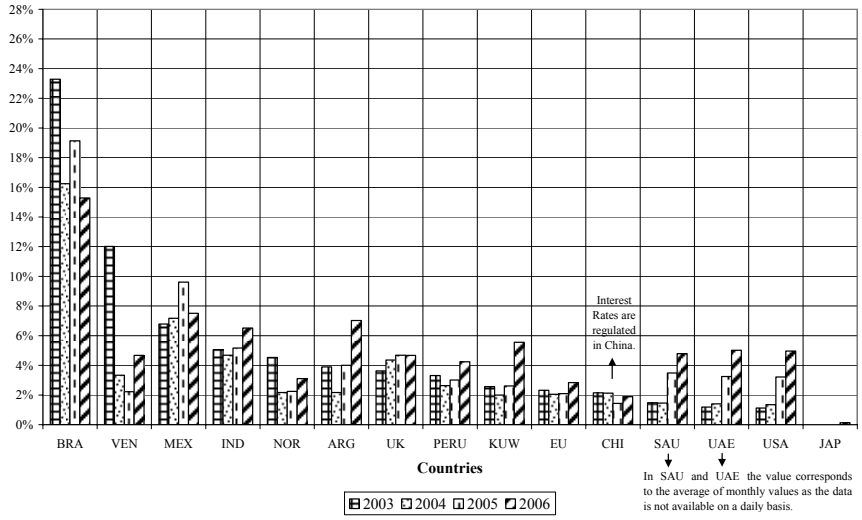
Graph II-2: Average Foreign Exchange Rate Daily Volatility over Mean in the Interbank Market



When a column is missing a peg is effectively in place.

A L L C O U N T R I E S

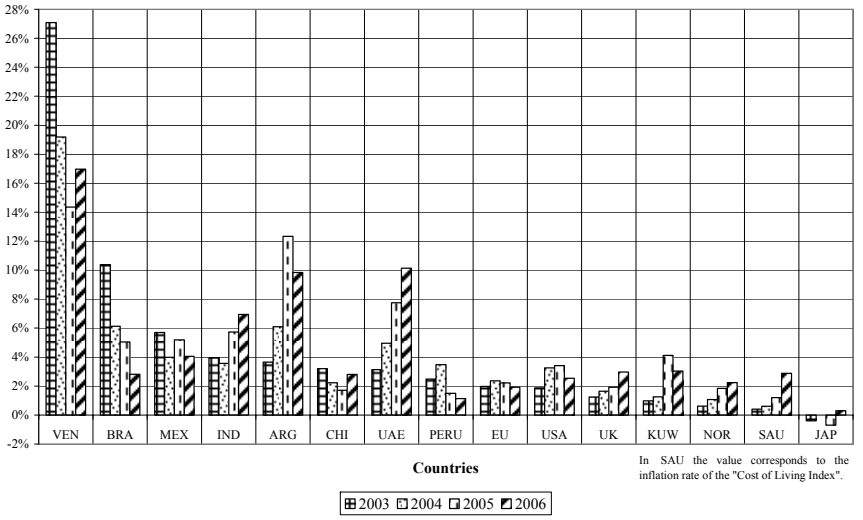
Graph II-3: Average Interest Rate in the Interbank Market



In SAU and UAE the value corresponds to the average of monthly values as the data is not available on a daily basis.

A L L C O U N T R I E S

Graph II-4: Annualized CPI Inflation Rate



In SAU the value corresponds to the inflation rate of the "Cost of Living Index".

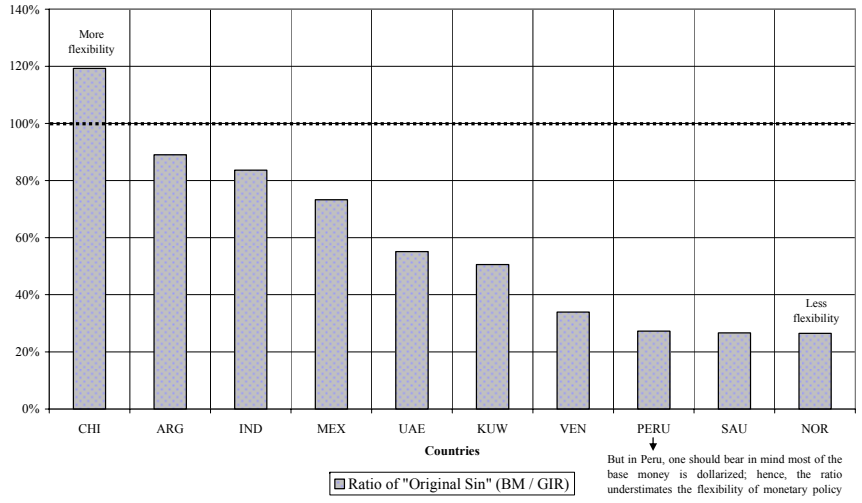
A L L C O U N T R I E S

TABLE II.6. AVERAGE RATIOS AND THE FLEXIBILITY OF MONETARY POLICY DURING THE ENTIRE PERIOD 2003-2006

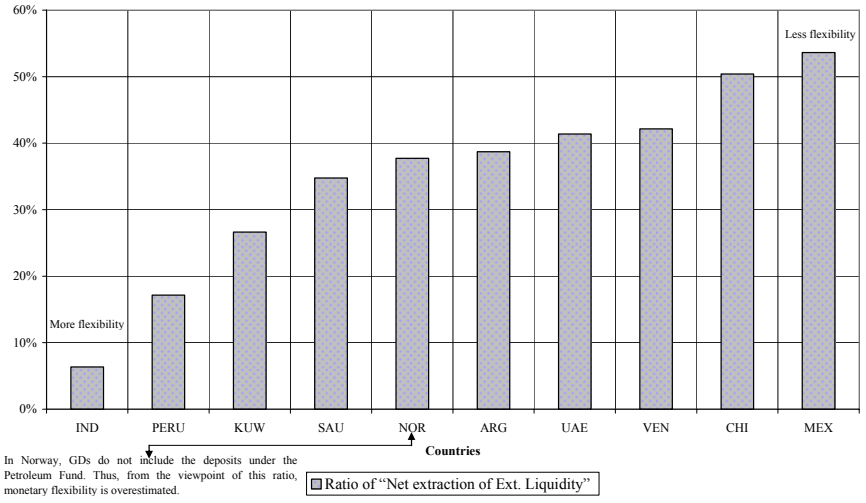
Ratio	ARG	BRA	MEX	PERU	USA	VEN	UK	EU	NOR	CHI	JAP	KUW	IND	SAU	UAE
	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06	2003-06
"Original Sin" (BM / GIR)	89%	...	73%	27%	...	34%	...	...	26%	119%	...	51%	84%	27%	55%
BM > 0.5 * [NIR +DC- GD -K]		N/A			N/A		N/A	N/A			N/A			√	
"Domestic Freedom" (BM / DC)	...	44%	...	...	100%	...	110%	135%	...	...	80%	...	...	...	...
BM > 0.5 * [NIR +DC- GD -K]	N/A		N/A	N/A		N/A			N/A	N/A		N/A	N/A	N/A	N/A
Importance Extracting Liability Comp	45%	187%	74%	62%	4%	126%	3%	10%	156%	45%	28%	57%	8%	158%	75%
(DS + GD) / BM < 1		√				√			√					√	
"Orthodox Favoritism"	18%	53%	38%	15%	4%	42%	2%	7%	8%	28%	21%	29%	6%	32%	42%
(DS + GD) < 0.5 LIA		√													
"Net extraction of Ext. Liquidity"	39%	...	54%	17%	...	42%	...	...	38%	50%	...	27%	6%	35%	41%
(DS + GD) < GIR		N/A			N/A		N/A	N/A			N/A				
"Net extraction of Int. Liquidity"	...	81%	...	...	4%	...	3%	14%	...	...	22%	...	...	...	...
(DS + GD) < DC	N/A		N/A	N/A		N/A			N/A	N/A		N/A	N/A	N/A	N/A
Liquidity Requirements	37%	28%	126%	329%	3%	221%	39%	32%	118%	121%	22%	…	…	…	…
BRES < DC			√	√		√			√	√		√	√	√	√
Ratios showing Inflexible Performance	-	2/5	1/5	1/5	-	2/5	-	-	2/5	1/5	-	1/5	1/5	3/5	1/5
Signs of Inflexibility √ if ≥ 2/5		√				√			√					√	
Central Bank Stereotype (1), (2), ..., (6)	(4)	(3)	(4)	(4)	(1)	(5)	(1)	(1)	(5)	(4)	(1)	(4)	(4)	(5)	(4)

Note: "… " implies N/A or the ratio exceeds 1000%

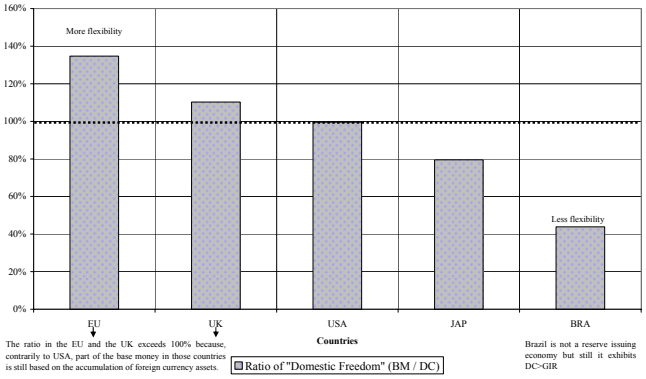
A L L R E S E R V E E A R N I N G Countries (GIR > DC)
Graph II-5: The Average Ratio of "Original Sin" (BM/GIR)
during the whole period from January 2003 to December 2006



A L L R E S E R V E E A R N I N G Countries (GIR > DC)
Graph II-6: The Average Ratio of "Net Extraction of External Liquidity" (DS+GD/GIR)
during the whole period from January 2003 to December 2006



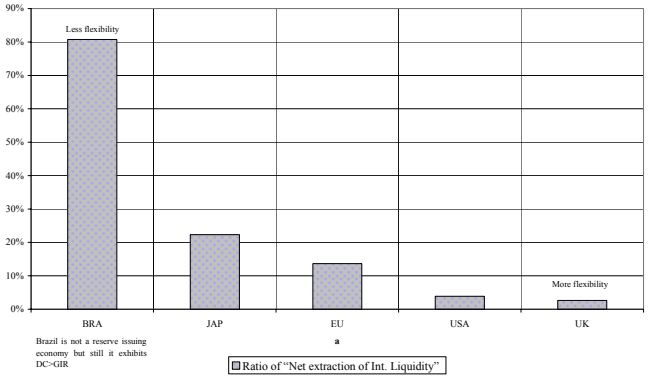
R E S E R V E I S S U I N G Countries + Brazil (DC > GIR)
Graph II-7: The Average Ratio of "Domestic Freedom" (BM / DC)
during the whole period from January 2003 to December 2006



The ratio in the EU and the UK exceeds 100% because, contrarily to USA, part of the base money in those countries is still based on the accumulation of foreign currency assets.

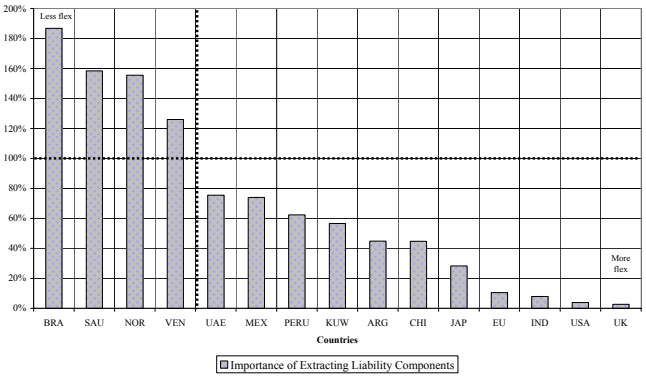
Brazil is not a reserve issuing economy but still it exhibits DC>GIR

R E S E R V E I S S U I N G Countries + Brazil (DC > GIR)
Graph II-8: The Average Ratio of "Net extraction of Int. Liquidity" (DS+GD/ DC)
during the whole period from January 2003 to December 2006

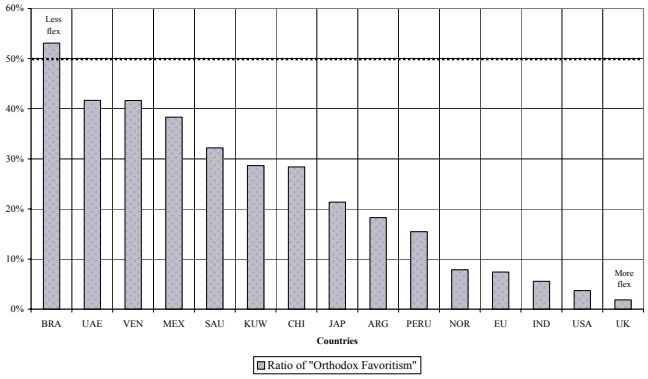


Brazil is not a reserve issuing economy but still it exhibits DC>GIR

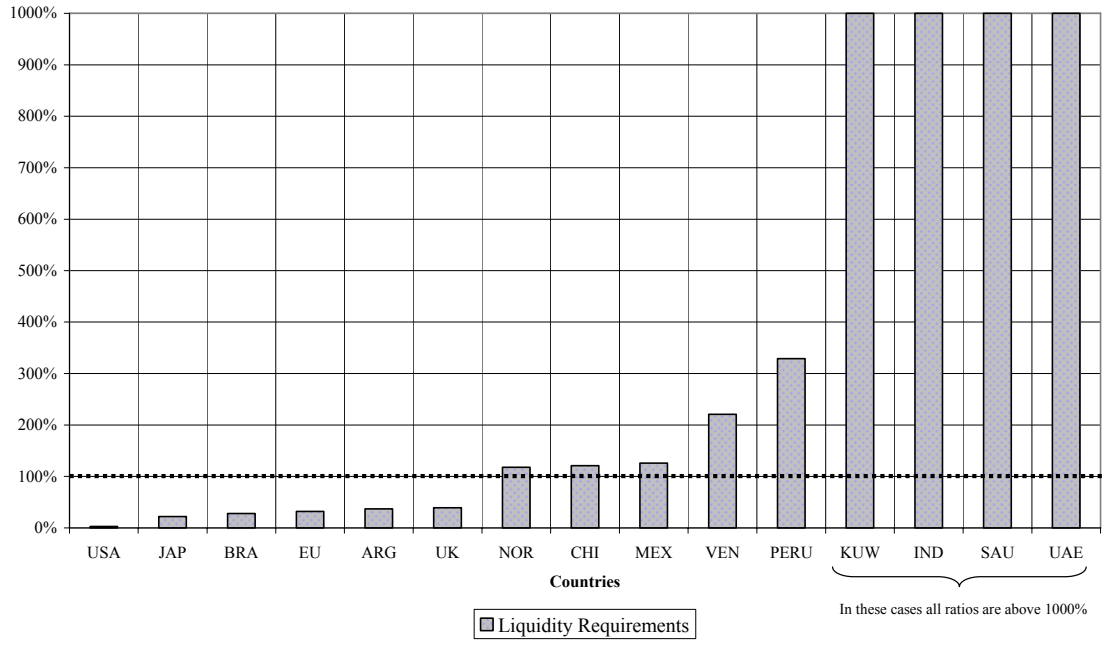
A L L C O U N T R I E S
Graph II-9: The Average Ratio of the "Importance of Extracting Liability Components" (DS + GD) / BM
during the whole period from January 2003 to December 2006



A L L C O U N T R I E S
Graph II-10: The Average Ratio of "Seignorage Loss" (DS + GD) / LIA
during the whole period from January 2003 to December 2006



A L L C O U N T R I E S
Graph II-11: The Average Ratio of "Liquidity Requirements" (BRES/DC) during
the whole period from January 2003 to December 2006



A L L C O U N T R I E S

TABLE II.7. DESCRIPTION OF THE DATA - PERIOD JAN 2003 TO DEC 2006

V A R I A B L E						
COUNTRY	**BALANCE SHEET DATA** **48 months from Jan-2003 to Dec-2006**	**INTEREST RATE DATA** **Approx 1045 daily observations**	**SPOT FX RATE DATA** **Approx 1045 daily observations**	**INFLATION RATE DATA** **48 months from Jan-2003 to Dec-2006**	**GROSS INTERNATIONAL RESERVES DATA** **48 months from Jan-2003 to Dec-2006**	**OBSERVATIONS**
ARG	Source: Central Bank of Argentina	Buenos Aires Interbank Offered Rate (BAIBOR), Overnight-Annualized, Source: Central Bank of Argentina	ARS / 1 USD$, Daily, Source: Central Bank of Argentina	CPI Inflation Rate (Monthly) 1999=100 Source: National Institute of Statistics and Censuses	Taken from Balance Sheet Data: Foreign Assets divided by the average Foreign Exchange Rate, the latter being computed as the unweighted average of daily rates.	None
BRA	Source: Central Bank of Brazil	Special System of Clearance and Custody (SELIC), Overnight-Annualized, Source: Central Bank of Brazil	BRL / 1 USD$, Daily, Source: Central Bank of Brazil	CPI Inflation Rate (Monthly) 1993=100 Source: Brazilian Institute of Geography and Statistics (IBGE)	Idem	None
MEX	Source: Bank of Mexico	Money Market Rate (TIIE), Overnight-Annualized, Source: Bank of Mexico	MXN / 1 USD$, Daily, Source: Bank of Mexico	CPI Inflation Rate INPC (Monthly) 2002=100 Source: Bank of Mexico	Idem	None
PERU	Source: Central Reserve Bank of Peru Detailed version was provided by the Statistics Department by email.	Interbank Offered Rate, Overnight-Annualized, Source: Central Reserve Bank of Peru	PEN / 1 USD$, Daily, Source: Central Reserve Bank of Peru	CPI Inflation Rate IPC-Lima (Monthly) 2001=100 Source: Central Reserve Bank of Peru	Idem	Detailed balance sheet data is available on the web page only on a annual basis. Monthly data was though provided on demand. Most of the economy's base money is dollarized in the form of dollar bank reserves.
USA	Source: Board of Governors of the Federal Reserve System (Washington)	Federal Funds Rate, Overnight-Annualized, Source: Board of Governors of the Federal Reserve System (Washington)	N/A	CPI Inflation Rate - All Urban Consumers (Monthly) 1982-84=100 Source: U.S. Department of Labor	Idem	None
VEN	Source: Central Bank of Venezuela	Interbank Offered Rate, Overnight-Annualized, Source: Central Bank of Venezuela	VEB / 1 USD$, Daily, Source: Central Bank of Venezuela	CPI Inflation Rate IPC-Caracas (Monthly) 1997=100 Source: Central Bank of Venezuela	Idem	None
UK	Source: Bank of England	Daily Sterling Overnight Interbank Average (SONIA), Overnight-Annualized, Source: Bank of England	GBP / 1 USD$, Daily, Source: Bank of England	CPI Inflation Rate (Monthly) 2005=100 Source: Office for National Statistics	Idem	The separation between the Issuing Department and the Banking Department within the BoE required consolidation of balance sheet data.
EU	Source: European Central Bank	Euro Overnight Index Average (EUONIA), Overnight-Annualized, Source: European Central Bank	EU / 1 USD$, Daily, Source: European Central Bank	Harmonised Index of Consumer Prices (HICP) - Overall index (Monthly) 2005=100 Source: Eurostat	Idem	None
NOR	Source: Central Bank of Norway	Norwegian InterBank Offered Rate (NIBOR-T), Overnight-Annualized, Source: Central Bank of Norway	NOK / 1 USD$, Daily, Source: Central Bank of Norway	The Norwegian Consumer Price Index (Monthly) 1998=100 Source: Statistics Norway	Idem	None
CHI	Source: The People's Bank of China	China Interbank Offer Rate (CHIBOR), Overnight-Annualized, Source: Bloomberg (CNIBR1D)	CNY / 1 USD$, Daily, Source: Bloomberg (CNY)	CPI Inflation Rate (Monthly) 1996=100 Source: National Bureau of Statistics of China and Economist Intelligence Unit	Idem	None
JAP	Source: Bank of Japan	Uncollateralized Call Rates, Overnight-Annualized, Source: Bank of Japan	JPY / 1 USD$, Daily, Source: Bank of Japan	CPI Inflation Rate (Monthly) 2005=100 Source: Statistics Bureau (Ministry of Internal Affairs and Communications)	Idem	None
KUW	Source: Central Bank of Kuwait	Kuwait Inter-Bank Offered Rate (KIBOR1M), One Month-Annualized, Source: Bloomberg (KIBOR1M)	KWD / 1 USD$, Daily, Source: Bloomberg (KWD)	CPI Inflation Rate (Monthly) 2000=100 Source: Economist Intelligence Unit	Idem	None
IND	Source: Reserve Bank of India	Mumbai Interbank Offer Rate (MIBOR), Overnight-Annualized, Source: National Stock Exchange of India Ltd	INR / 1 USD$, Daily, Source: Reserve Bank of India	Consumer Price Index Numbers for Urban Non-manual (Monthly) 1984-85=100 Source: Reserve Bank of India	Idem	The "Equity Capital" of the Reserve Bank of India was not available on the web page and hence is included under the concept of "Other Liabilities" of the bank's balance sheet.
SAU	Source: Saudi Arabian Monetary Agency	Money Market Rates from Jan-2003 to Feb-2006 and from Sep-2006 to Dec-2006, Overnight-Annualized, Source: Saudi Arabian Monetary Agency (SAMA) and Overnight interbank deposit rate from Mar-2006 to Aug-2006, Source: Bloomberg (SRDR1T)	SAR / 1 USD$, Daily, Source: Bloomberg (SAR)	Cost of Living Saudi Arabia (Monthly) 1999=100 Source: Central Department of Statistics of Ministry of Economy and Planning	Idem	"Other Liabilities" correspond to "Other Miscellaneous Liabilities" in the original balance sheet. They represent around 40% of "Total Liabilities" and include components such as reverse repos, debt securities, etc. whose proportion is not published on SAMA's web page
UAE	Source: Central Bank of United Arab Emirates	Interest Rates on Interbank Deposits, One Month-Annualized, Source: Monetary and Banking Developments of the Central Bank of United Arab Emirates	AED / 1 USD$, Daily, Source: Bloomberg (AED)	CPI Inflation Rate (Annually) 2000=100 Source: IMF	Idem	CPI Index data is not available elsewhere but on the IMF's web page.

Chapter III

Understanding Monetary and Fiscal Policies in Reserve Earning Economies[*]

ANGEL GARCIA BANCHS[**]

***Abstract*:** Based on the Post Keynesian stock-flow consistency approach (PK-SFC) and previous findings regarding the implications of international monetary asymmetries (Chapter II; García and Mata, forthcoming; García Mata and Nell, 2008), this paper models the behavior of reserve earning economies (REEs), those whose currencies do not circulate abroad. The model reflects the relevance of buffer stocks and stock-flow norms affecting the real and financial spheres, how the relative availability of foreign reserves determines fiscal and monetary policies, the growth rate of public expenditures, the issue of foreign and local currency debt, interest rate targeting procedures, exchange rate intervention and switching mechanisms, and compensation instruments. To understand the system, several different simulations are performed, including a fiscal policy response (*ala* Chinese) to a global economic crisis like that of 2009.

Keywords: International Monetary Asymmetries, Stock-Flow Consistency.
Jel Classification: E12, E20, E40

[*] This paper is currently being considered for publication.

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III.1 Introduction

In Chapter II, we argued the current international monetary system is fully asymmetric because not all national currencies circulate internationally or, what is the same, because the world is divided among reserve issuing economies (RIEs) and reserve earning ones (REEs) (García and Mata, forthcoming; García, Mata and Nell, 2008).

We have sustained that international monetary asymmetries are relevant to both economic theory and policy because they affect the balance sheet structure and behavior of all the institutional sectors in the economy. We have explained that both RIEs and REEs must be concerned with the exchange rate, foreign capital flows and net payments to the rest of the world, but only the latter must be concerned with the accumulation of foreign currency assets, as their local currencies do not circulate abroad.

Our notion of international monetary asymmetries implies two interdependent but different effects: the quantity effect and the price effect. The first implies that in REEs there is a strong policy-induced connection between the amount of foreign reserve assets, the rate of growth of fiscal expenditures, and the short-term interest rate: within a range, the fact that reserve earning central banks must target a minimum stock of foreign assets affects interest rate targeting rules and the growth rate of government expenditures.

The quantity effect also implies that the balance sheet structure of the central bank in REEs is characterized by the predominance of foreign reserves, on the asset side, and bank reserves, government deposits, central bank bills, and other cash substitutes on the liability side. This, clearly, contrasts with the balance sheet structure of reserve issuing central banks characterized by the predominance of T-Bills and cash, respectively.

The second effect derives from the first; in particular, from the fact that in REEs two forms of monetary reserves coexist: local currency base money reserves which are elastic and foreign currency reserves which are not. The price of the former is the interest rate and that of the latter the exchange rate.

The price effect implies that in REEs the connection between the foreign exchange rate and the short-term rate weakens as foreign currency reserves increase. This is because the larger such a stock is, the greater the capacity of the central bank to limit the impact of interest rate changes (and capital flows) upon the exchange rate.

For instance, as long as foreign reserves can vary sufficiently, an interest rate reduction (increase) that leads to foreign currency outflows (inflows) might be compensated by an equivalent reduction (increase) in the stock of foreign reserves, limiting the impact upon the exchange rate (García and Mata, forthcoming). This, along with the authorities' bias against currency appreciations, explains why REEs are often willing to accumulate relatively large stocks of foreign reserves, provided (as it is the case) sterilization (seignorage) costs are relatively small (García and Mata, forthcoming).

Thus, international monetary asymmetries imply different balance sheet structures, economic policy reactions and institutional behaviors that depend on whether or not the economy issues an international reserve currency − i.e. whether it is a RIE or a REE. Monetary policy, for instance, is found to be more flexible in RIEs than in REEs where the need to accumulate foreign currency assets implies cash substitutes must predominate to endogenously compensate exchange rate interventions (García, Mata and Nell, 2008).

Notice, on the contrary, that the fact that RIEs need not accumulate (target) a minimum stock of foreign currency reserves implies that their exchange rates against the currencies of REEs largely depend on the accumulation of foreign reserves on the part of the latter (e.g. the yuan/dollar exchange rate).

For this reason, we have also sustained that the dominant reserve issuing central bank (e.g. the FED) cannot engineer a depreciation of its own currency (e.g. the US dollar) against the currencies of REEs by means of a reduction of its short-term rate of interest. This is because, by definition, it is not used to allow its stock of foreign currency assets (e.g. of yuans) increase sufficiently so as to be able to impose a target (or given) price (this is mainly because the FED does not need foreign currency at all in the first place); but, above all, because even if it increased its stock of foreign currency (e.g. of yuans), the REE whose currency is being purchased (e.g. China) could always neutralize the effect of such purchases upon the (e.g. yuan/dollar) exchange rate by intervening as well; thus, rather, such adjustment requires international coordination (or political pressure).

Yet, notice, this is not the case of the foreign exchange rates between reserve currencies (e.g. the dollar/euro rate), which instead are largely determined by market forces and interest rate differentials (private holdings).

Further, we have sustained the above postulates regarding both RIEs and REEs are completely consistent with the endogenous theory of money, as in both economies it is the central bank, not the market, which determines the short-term rate; but, above all, because they imply that money or, specifically, international monetary asymmetries play a main role in determining motives, portfolios, economic policy and behavior.

Notice that our definition of international monetary asymmetries is complementary to Thirlwall's law (Thirlwall, 1979). Both notions are concerned with economic growth sustainability, although in that respect the latter is much more precise. Thirlwall's law tells us that international payments imbalances can have relevant implications for economic growth, but its focus is on the real sphere while ours is on the financial one. Hence, whether or not money is a real commodity in fixed supply is immaterial to Thirlwall's law.

Yet, for our argument, the presence of international reserve currencies in elastic supply is fundamental. Therefore, our approach can explain certain phenomena which cannot be explained by Thirlwall's law; for instance, why only REEs must be concerned with the accumulation of foreign currency assets, and, hence, why monetary and fiscal policies depend on whether or not the economy issues an international reserve currency.

In short, our notion explains why Thirlwall's law is mainly applicable to REEs, as RIEs, by definition, can always expand their supply of local currency in face of ever growing payments imbalances (current account deficits) with the rest of the world. That is to say, our approach explains why RIEs (like the US, the EU, etc.) might experience credit crises but never currency crises, in the sense that there is always at least one exchange rate (regardless of its level) at which their currencies are accepted abroad. This existence (non-existence) condition mathematically defines the presence of such asymmetries.

This paper relies on the above arguments and findings of García and Mata (forthcoming) and García, Mata and Nell (2008) − Chapter II. But extends the argument applied to the central bank to all other institutional sectors − i.e. international monetary asymmetries,

here it is argued, affect the motives, portfolios, and decisions of all institutional sectors. The focus here, however, is on the study of REEs on the basis of a Post Keynesian stock-flow consistent approach (PK-SFC) that closely follows the influential work of Godley and Lavoie (2007).

Nevertheless, the number of equations here is much larger, as they must reflect a financial structure and set of policy choices which are far more complex. Firms (F), households (H), banks (B), the central bank (CB), the government (G) and the rest of the world (ROW) are studied by means of simulations, so as to understand how changes in parameters affect REEs[48].

The paper is organized as follows: the next two sections set out the core equations that characterize REEs, namely those that determine monetary and fiscal policies, interest rate targeting rules, the growth rate of government expenditures, exchange rate interventions, foreign reserve accumulation, compensation (sterilization) policies, the issue of local and foreign currency debt, etc. The equations for all remaining institutional sectors are set out in the Appendix, where the literature on stock-flow consistency is reviewed; section four presents the results from simulations and, finally, section five concludes.

III.2 The government sector

$$T = T_F + T_H + T_B \qquad \text{Tax receipts;} \qquad (1)$$

$$G = pd \cdot g \qquad \text{Nominal pure govt. expenditure;} \qquad (2)$$

[48] Further, opposed to the Growth model (Chapter 11) of Godley and Lavoie (2007), the model here exhibits a non-interest-rate-elastic-investment function, implying here it is assumed that interest rate fluctuations are fully passed on to final consumers by affecting the mark-up price and income distribution at the cost of a loss of price-competitiveness (Petri, 2004) − i.e. a loss of foreign reserves, or an exchange rate fluctuation.

$g = g_{-1} \cdot (1 + gr^G)$ Real pure govt. expenditure; (3)

$gr^G = gr^{G*} \cdot [1 + (z_1 + \frac{1}{2} \cdot z_2 - \frac{1}{2} \cdot z_3 - z_4 - 1) \cdot z_{10}]$ Growth rate of real govt. exp.; (4)

$z_1 = 1$ iff $\rho_G > NIRR_{-1} \vee NIRR_{-1} \geq \rho_{G\&PS}$
$z_2 = 1$ iff $\rho_G + 3/4 \cdot FP \leq NIRR_{-1} \prec \rho_{G\&PS}$
0 iff $\rho_G + 1/2 \cdot FP \leq NIRR_{-1} \prec \rho_G + 3/4 \cdot FP$ Fiscal policy dummies; (5-8)
$z_3 = 1$ iff $\rho_G + 1/4 \cdot FP \leq NIRR_{-1} \prec \rho_G + 1/2 \cdot FP$
$z_4 =$ iff $\rho_G \leq NIRR_{-1} \prec \rho_G + 1/4 \cdot FP$

$FP = \rho_{G\&PS} - \rho_G$ Fiscal policy activist zone; (9)

$PSBR = G - T - NRT_G$ Nominal government deficit; (10)

$NRT_G = F_{CB} - [r_{BG-1} \cdot B_{G,s-1} + BL_{G,s-1} + xr \cdot \$BL_{G,s-1}]$ Government net rent transfers; (11)

$B_{G,s} = B_{G,s-1} + PSBR + \Delta GD^G_{CB,d} + \Delta M1^G_{B,d}$
$- pbl_G \cdot \Delta BL_{G,s} - xr \cdot \$pbl_G \cdot \Delta \$BL_{G,s}$ New issues of T-bills; (12)

$BL_{G,s} = BL^H_{G,d}$ Supply of government bonds; (13)

$r_{BLG} = r_{BG} + \Omega_{BLG}$ Rate on government bonds; (14)

$pbl_G = 1/r_{BLG}$ Price of government bonds; (15)

$TD_G = LCD_G + FCD_G$ Nominal government debt; (16)

$LCD_G = [Cash_{CB,s} + B\,\mathrm{Re}\,s_{CB,s}]$
$+ (B_{G,s} + B_{CB,s} - B^{CB}_{G,h}) + pbl_G \cdot BL_{G,s}$ Nominal *lc* government debt; (17)

$\$FCD_G = xr \cdot \$pbl_G \cdot \$BL_{G,s}$ Nominal *fc* government debt; (18)

$$SR = \frac{[Cash_{CB,s} + B\,\mathrm{Re}\,s_{CB,s}]}{(B_{G,s} + B_{CB,s} - B^{CB}_{G,h}) + pbl_G \cdot BL_{G,s}}$$ Seignorage rate; (19)

$CG^G = -\Delta pbl_G \cdot BL_{G,s-1}$
$- \$BL_{G,s-1} \cdot [\Delta xr \cdot \$pbl_G + \Delta \$pbl_G \cdot xr_{-1}]$ Capital gains of the govt.; (20)

$$GD^{G}_{CB,h} = [GD^{G}_{CB,h-1} - \Delta M1^{G}_{B,h} - PSBR\,] \cdot z_5 + [\,pbl_G \cdot \Delta BL_{G,s} + xr \cdot \$\,pbl_G \cdot \Delta \$BL_{G,s}\,] \cdot z_5 + [\lambda_{GD} \cdot GIR] \cdot (1 - z_5)$$ Government deposits at CB; (21)

$$M1^{G}_{B,h} = [\lambda_{M1} / (1 - \lambda_{M1})] \cdot M1^{H}_{B,h}$$ Government deposits at banks; (22)

$$\mathrm{z}_5 = 1 \;\text{ iff }\; PSBR + \lambda_{GD} \cdot GIR - GD^{G}_{CB,h-1} + \Delta M1^{G}_{B,d} - pbl_G \cdot \Delta BL_{G,s} - xr \cdot \$\,pbl_G \cdot \Delta \$BL_{G,s} < 0$$ Government deposits dummy; (23)

$$\mathrm{z}_6 = 1 \;\text{ iff }\; NIRR_{-1} \geq \rho_{G\&PS}$$ Relative abundance of NIR; (24)

$$r_{BG} = r^{T}_{BG} + \mathrm{z}_7 \cdot \varsigma_{BG}$$ Interest rate on treasury bills; (25)

$$\mathrm{z}_7 = 1 \;\text{ iff }\; \rho_G \leq NIRR_{-1} \prec \rho_{G\&PS}$$ Relative scarcity of NIR; (26)

$$\mathrm{z}_8 = 1 \;\text{ iff }\; NIRR_{-1} \prec \rho_G$$ Flexible exchange rate dummy; (27)

$$NIRR = \frac{NIR}{M + RT_{row}}$$ Net intl. reserves ratio; (28)

$$\varsigma_{BG} = \varsigma^{*}_{BG} \cdot \frac{M_{-1}}{pd_{-1} \cdot (c_{-1} + g_{-1} + i_{-1})}$$ Pass-through motive elasticity; (29)

$$\varsigma_{BG} = \varsigma^{*}_{BG} \cdot \frac{RT_{row-1}}{py_{-1} \cdot y_{-1}}$$ Repatriation motive; (29-A)

$$\$BL_{G,s} = \$BL_{G,s-1} - [\mathrm{z}_7 \cdot \mathrm{z}_9 \cdot \mathrm{z}_{10}] \cdot \frac{CA_{row} + FA^{PS}_{row} + MA_{row}}{xr \cdot \$\,pbl_G} + [\mathrm{z}_7 \cdot (1 - \mathrm{z}_9) \cdot \mathrm{z}_{10}] \cdot \frac{\rho^{PA}_{\$BLG-\max} \cdot X \cdot Y}{xr \cdot \$\,pbl_G \cdot [\Phi \cdot Y + (1 - \Phi) \cdot X]} - [\mathrm{z}_7 \cdot (1 - \mathrm{z}_9) \cdot \mathrm{z}_{10}] \cdot \$BL_{G,s-1}$$ New issues of sovereign debt; (30)

$$\$B^{CB}_{G-row,h} = \$B^{CB}_{G-row,h_{-1}} + (\mathrm{z}_7 \cdot \mathrm{z}_9 \cdot \mathrm{z}_{10}) \cdot$$
$$\chi^{CB} \cdot \left[\rho_{G\&PS} \cdot \frac{(M + RT^{row})}{xr} - \$B^{CB}_{G-row,h-1} \right]$$
$$+ [\mathrm{z}_7 \cdot (1 - \mathrm{z}_9) \cdot \mathrm{z}_{10}] \cdot \quad \text{GIR variations;} \qquad (31)$$
$$\left\{ \begin{array}{l} \dfrac{CA_{row} + FA^{PS}_{row} + \dfrac{[\rho^{PA}_{\$BLG-\max} \cdot X \cdot Y]}{[\Phi \cdot Y + (1-\Phi) \cdot X]}}{xr} \\ -\$pbl_G \cdot \$BL_{G,s-1} \end{array} \right\}$$
$$+ (\mathrm{z}_{'6} \cdot \mathrm{z}_{'10}) \cdot \frac{CA_{row} + FA^{PS}_{row}}{xr}$$

$$\chi^{CB} = [\chi^{CB}_{-1} + \chi^{CB-T}] \cdot (\mathrm{z}_7 \cdot \mathrm{z}_9 \cdot \mathrm{z}_{10}) \quad \text{Speed of adj. to NIR target;} \qquad (32)$$

$\mathrm{z}_9 = 1$ iff

$$\frac{\left[\begin{array}{l} \chi^{CB} \cdot [\rho_{G\&PS} \cdot (M + RT^{row})] \\ -\chi^{CB} \cdot [xr \cdot \$B^{CB}_{G-row,h_{-1}}] \\ -[CA_{row} + FA^{PS}_{row}] \\ +xr \cdot \$pbl_G \cdot \$BL_{G,s-1} \end{array} \right]}{X \cdot Y / [\Phi \cdot Y + (1-\Phi) \cdot X]} \leq \rho^{PA}_{\$BLG-\max} \quad \text{Sovereign debt-GIR dummies;} \qquad (33)$$

$$\$SDR = \frac{[xr \cdot \$pbl_G \cdot \$BL_{G,s}] \cdot [\Phi \cdot Y + (1-\Phi) \cdot X]}{X \cdot Y} \quad \text{Sovereign debt ratio;} \qquad (34)$$

$$xr = xr_{-1} \cdot (\mathrm{z}_{'6} + \mathrm{z}_{'7}) \cdot (\mathrm{z}_{10})$$
$$+ xr_{endog} \cdot [\mathrm{z}_{'8} + (1 - \mathrm{z}_{'8}) \cdot (1 - \mathrm{z}_{10})] \quad \text{Exchange rate determination;} \qquad (35)$$

$$xr_{endog} \Rightarrow CA_{row} + FA^{PS}_{row} = 0 \quad \text{Flexible exchange rate;} \qquad (36)$$

$\mathrm{z}_{10} = 1$ iff $(X_{-1} + M_{-1}) \succ Op^{\circ} \cdot Y_{-1}$ Openness (Trade/GDP ratio); (37)

$$GIRR = GIR / (M + RT_{row}) \quad \text{GIR ratio;} \qquad (38)$$

$$GIR = xr \cdot \$B^{CB}_{G-row,h} \quad \text{Gross Intl. Reserves (GIR);} \qquad (39)$$

$$\$BL^{row}_{G,d} = \$BL_{G,s} \quad \textit{fc} \text{ T-bonds market equilibrium;} \qquad (40)$$

$$\$\Omega_{BLG} = \$r_{BLG} - \$r_{BLG-row} \qquad \text{Endog. premium } fc \text{ govt. bonds;} \quad (41)$$

$$\$r_{BLG} = (1/\$Pbl_G) \qquad \text{Endog. rate of } fc \text{ govt. bonds;} \quad (42)$$

The balance sheet, transaction and revaluation matrices of the reserve earning economy (Tables III.1-III.3) are in the Appendix, as well as the meaning of all variables and parameters (Tables III.4-III.6)[49].

Equation (1) defines the total tax revenue of the government (T) which, for simplicity, here is assumed, to come entirely from direct taxes paid by firms (T_F), households (T_H) and banks (T_B). Nominal pure government expenditures (G−equation 2) depend on the domestic price level (pd) and the level of real current expenditures (g). The latter are, in turn, assumed to grow at a rate which depends on the availability of foreign reserves (gr^G − equations 3 and 4) − for simplicity, again, government capital expenditures are assumed away. In particular, government expenditures are assumed to grow at the exogenously given normal rate under three conditions (e.g. $gr^G = gr^{G*} = 3\%$ annually)[50].

The first is when the value of the trade/GDP ratio is so low ($z_{10} = 0$ − equation 37) that the authorities' concern with foreign reserve accumulation and exchange rate fluctuations

[49] Financial variables are indexed as follows. In the case of stocks, superscripts refer to asset holders and subscripts to debt issuers ($X^{Asset\ holder}_{debt\ issuer}$), although to avoid cluttering references to the latter are omitted whenever unnecessary. In the case of interest rates and financial prices ($r_{instrument-issuer\ or\ price\ setter}$), the first characters of the subscripts refer to the type of instrument and the following to the debt issuer or price setter. Finally, the superscript is used only to indicate interest rates set abroad ($r^{row}_{instrument-issuer\ or\ price\ setter}$), and the "$" symbol stands for foreign currency asset/liability.

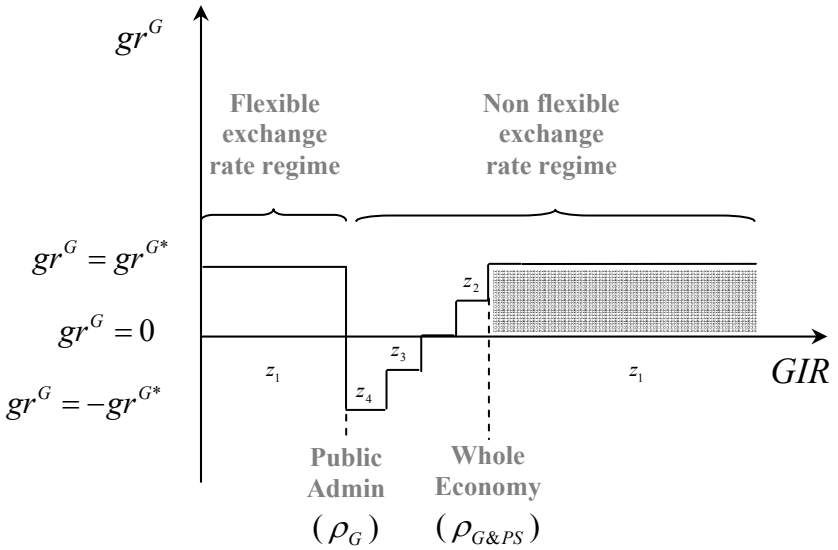
[50] This rate, if endogeneized, might be considered the natural rate of growth of fiscal expenditures. That is, the rate that guarantees full employment in REEs, under a constant steady-sate fiscal surplus to GDP ratio and non-negative current account balance which, by definition, must be matched by a zero (or negative) counterpart balance on the part of RIEs.

is minor. The second is when the exchange rate system is non-flexible, and the beginning-of-period net foreign reserves are sufficiently large to cover both public and private sector commitments ($NIRR_{-1} \geq \rho_{G\&PS}, z_1 = 1$); that is, the economy's minimum (e.g. $\rho_{G\&PS} = 0.75$ implies 9 months of reserves to cover all type of commitments). Finally, the third is when reserves are so small that they are not even sufficient to cover public sector commitments ($\rho_G > NIRR_{-1}, z_1 = 1$), a circumstance under which the authorities are (soon or later) forced to let the foreign exchange rate float (equation 5).

But, for a range of foreign reserves for which all public sector commitments are expected to be fulfilled but not all private sector commitment are ($FP-$ equation 9), fiscal policy becomes activist in that the rate of growth of public expenditures gets adjusted discretely as reserves fluctuate. Equations (6)-(8) assume when all public sector commitments are secured but less than 100% of all private sector commitments are, expenditures grow at half the normal rate ($z_2 = 1$); when reserves cover ½ to ¾, the rate becomes 0 ($z_1 = z_2 = z_3 = z_4 = 0$); ¼ to ½, it equals the negative of half the normal rate ($z_3 = 1$); and, finally, below ¼, it equals the negative of the normal rate ($z_4 = 5$).

Notice, any adequate specification of equation (4) would work. For what matters is that, for a given region ($FP = \rho_{G\&PS} - \rho_G$), fiscal policy in REEs becomes dependent on the availability of foreign reserves, if the economy exhibits a relatively large trade/GDP ratio and, both, access to foreign currency and exchange rate fluctuations are a policy concern.

Graph III.2.1. Growth rate of government expenditures as foreign reserves fluctuate



The accumulation of foreign currency assets requires, therefore, an initial sacrifice in terms of a reduced flexibility of fiscal policy until the target level of reserves is reached − i.e. within certain region, government expenditures must necessarily diminish or grow below the normal rate (e.g. here, below 3%/year) until a minimum stock is built; but once that level is reached, fiscal (and, as shall soon be seen, interest rate targeting) policy becomes as flexible as in RIEs. Graph II.2.1 illustrates the behavior of the rate of growth of real pure government expenditures.

Regarding the government deficit/surplus ($PSBR$), its value is defined by equation (10) as the difference between the value of pure government expenditures (G) and the sum of the tax revenue (T) and net rent transfers (NRT_G). Government net rent transfers are defined by equation (11) as the sum of central bank profits (F_{CB}) minus interest payments on T-bills ($B_{G,s}$), and local and foreign currency ($) government bonds ($BL_{G,s-1}$; $\$BL_{G,s-1}$).

New issues of T-bills are determined in line with equation (12). Money endogeneity guarantees fiscal monetary expansions (contractions) arising from government deficits (surpluses) $-PSBR-$ must always be absorbed (compensated); otherwise, the interest rate or the exchange rate would have to fluctuate. The latter shall soon be explained in detail when the buffer stock role played by foreign reserves, government deposits, and local and foreign currency debt (including bank reserves, and central bank bills) is analyzed.

Here it suffices to argue that the above process requires simultaneous and coordinated actions on the part of the central bank and the treasury. For in order to accommodate liquidity needs and make the chosen rate of interest effective the government must adjust its new issues of bills ($\Delta B_{G,s}$) and bonds ($\Delta BL_{G,s}$; $\$\Delta BL_{G,s}$), or it may move back and forth part of its deposits within private banks ($\Delta M1^{G}_{B,h}$) and the central bank ($\Delta GD^{G}_{CB,h}$). Precisely, with respect to local currency government bonds, equation (13) tells us that the treasury supplies the exact amount that accommodates demand, so that it is able to set the long-term rate of interest (r_{BLG}) above the short one ($\Omega_{BLG} > 0$) at the level of its choice (the yield, r_{BLG}, and price, pbl_G, of public bonds is policy-determined − equations 14-15).

Equation (16) defines the nominal debt of the government (and the central bank − TD_G) as the sum of its local and foreign currency debts ($LCD_G; FCD_G$); as shown by equations (17) and (18), the former includes base money held in the form of cash and bank reserves ($Cash_{CB,s} + B\,\mathrm{Re}s_{CB,s}$), T-bills ($B_{G,s}$), T-bonds ($BL^{H}_{G,s}$), and central bank bills held by banks ($B^{B}_{CB,s}$) net of central bank holdings of T-bills ($B^{CB}_{G,h}$), while (here) the latter includes only foreign currency sovereign bonds ($\$BL_{G,s}$).

The seignorage rate (SR − equation 19) can, thus, be computed as the (local currency) ratio of non-interest debt to total interest-bearing debt. Equation (20) defines the capital gains of the government (CG^G) as the revaluation of local currency and foreign currency government bonds, the latter also affected by exchange rate fluctuations (Δxr). Equations (21) to (22) describe the asset management decisions of the treasury which follow stabilization rather than speculative purposes.

Here, it is assumed the treasury holds deposits at private banks ($M1^G_{B,h}$ − equation 22) keeping constant its share in total current account deposits (λ_{M1}) − $M1^H_{B,h}$ is the amount of current account deposits held by households. Further, it is assumed treasury deposits at the central bank ($GD^G_{CB,h}$ − equation 21) are kept in proportion (λ_{GD}) to foreign reserve holdings (GIR) when the budget is in deficit ($z_5 = 0$ − equation 23), but when in surplus ($z_5 = 1$), government deposits at the central bank become a buffer stock that compensates foreign exchange interventions and reduces sterilization costs. The banks' balance sheet constraint implies that the transfer of deposits from banks to the central bank reduces the former's demand for T-bills and central bank bills, reducing, thus, sterilization costs.

The findings of García, Mata and Nell (2008) and García and Mata (forthcoming) − Chapter II − suggest the fraction of treasury deposits held within commercial banks is much smaller in REEs than in RIEs, and also much smaller in oil exporting countries than in non-oil exporting ones − the best example being that of Norway, where government deposits at the central bank (including the deposits from the Oil fund) represent 89% of all liabilities of the central bank.

Notice, the latter compensation (or sterilization) mechanism brings about the same effects of an equivalent adjustment in the rate of bank reserve requirements. Both mechanisms are exogenous in nature, and substitute the issue of new bonds, offering the treasury the possibility to economize on interest payments while avoiding exchange rate appreciations or collapses in the interest rate. Yet, the fact that the rate of interest is exogenously fixed implies that the overall sterilization process is ultimately endogenous, as it is always the case that the demand for bank reserves must be accommodated by the central bank (Godley and Lavoie, 2007).

Equation (25) determines the government's interest rate reaction function and, therefore, the economy's reference rate of interest (r_{BG} − the rate on T-bills). It depends on the target rate (r_{BG}^{T}) and the relative scarcity of foreign reserves (when $z_7 = 1$, equation 26). The target rate is the rate the authorities set under a forced-floating exchange rate regime (i.e. when reserves are so scarce that the exchange rate must adjust − $z_8 = 1$ equation 27), or when foreign reserves are deemed to be relatively abundant ($z_6 = 1$ − equation 24) that external restrictions do not bind. Put differently, the target rate is that rate which REEs would always choose if their local currencies circulated abroad.

The target rate of interest "r_{BG}^{T}" is, here, given, but it may be set following the so-called Taylor rule or some Post Keynesian alternative, so that the long-term interest rate is parked in accordance with the Smithin rule (i.e. real rate set to zero), the Kansas City-rule (i.e. with the nominal interest rate set to zero − Mosler and Forstater, 2004; Wray, 2007), or in line with the Pasinetti's fair rate rule, advocated by Lavoie and Seccareccia (1999)

and Gnos and Rochon (2007) − i.e. with the real rate set equal to the rate of growth of labor productivity (Rochon and Setterfield, 2007).

Yet, what matters is that, for a given range of foreign reserves ($z_7 = 1$), the reference rate in REEs depends on the beginning of period value of the stock of foreign currency assets: the so-called *quantity effect* (García and Mata, forthcoming). But, notice that how much the rate of interest is actually increased in order to accumulate foreign currency reserves (i.e. the spread between the target rate and the actual reference rate) depends on the authorities' concern for the stability of the exchange rate, as fluctuations in relative prices tend to affect the domestic price inflation rate, rent payments and foreign currency flows, (ς_{BG} − equations 29 and 29-A). This is a consequence of the so-called *price effect* (García, Mata and Nell, forthcoming).

Equation (25) tells us that, when governments in REEs deem to have sufficient reserves ($z_6 = 1 \Rightarrow z_7 = 0$ − equations 24 and 26), they choose to set the short term rate at the target level (r_{BG}^T). In such a situation, monetary policy exhibits the same freedom that characterizes RIEs, namely because REEs can always print (and sterilize/compensate) base money injections in line with foreign currency inflows.

But they also set the short-term rate at the target level (r_{BG}^T) when foreign reserves are below the minimum level that guarantees the payment of public sector commitments ($z_8 = 1 \Rightarrow z_7 = 0$). Notice, though, that in this case the rationale is somehow the opposite: foreign currency outflows are so large that the government is forced to devalue or allow the foreign exchange rate float (to adjust the system).

Nonetheless, soon or later, the authorities will have to resort to interest rate increases (recall expenditure cuts are also required) to restore a minimum stock of foreign reserves ($\rho_{G\&PS}$), namely that level deemed sufficient to satisfy the needs of the government and the private sector, including the payment of imports and the service of debts ($M + RT^{row}$).

The above implies that the government sets its short term rate above the desired level only within a particular threshold ($\rho_G \leq NIRR_{-1} \prec \rho_{G\&PS}\,; z_7 = 1$): that along which its foreign reserve assets (NIR) are sufficient to satisfy the needs of the government (ρ_G) but insufficient to satisfy the needs of the whole economy ($\rho_{G\&PS}$). The government is, therefore, always monitoring its net international reserves ratio ($NIRR$ − equation 28).

Equation (25) also tells us that, when the government sets its short-term rate, it does so taking into account its concern for the stability of the exchange rate (ς_{BG} − equation 29). Here, two alternatives are offered. First, it may be assumed the authorities are concerned with the pass-trough from exchange rate depreciations into the domestic price inflation rate, whenever the weight of imports is considered to be large or, second, it may be assumed they are concerned with the repatriation of dividends and interest payments to the ROW.

Notice, however, that in the short-run the government counts on an alternative option: it may be able to stabilize its foreign reserves and the foreign exchange rate by issuing (supplying) foreign currency sovereign debt ($\$BL_{G,s}$ − equation 30) at a price which is determined internationally ($\$pbl_G$). But, this only takes place when: the exchange rate

regime is non-flexible, the value of the trade/GDP ratio is that large that exchange rate fluctuations are very influential ($z_{10} = 1-$ equation 37), when foreign reserves are below the tolerated minimum ($z_7 = 1$), and when the option to place additional sovereign debt in international markets (in part, $z_9 = 0$, or in full, $z_9 = 1$ − equation 33) does exist.

Notice, here, again, stock-flow norms play a significant role, as the foreign currency sovereign debt of the government cannot exceed some weighted average ratio ($\rho^{PA}_{\$BLG-\max}$) over GDP (Y) and exports (X).

In equations (30)-(33), CA_{row} , FA^{PS}_{row}, MA^{PS}_{row}, $\$B^{CB}_{G-row,h}$, xr , χ^{CB} and Φ are, respectively, the local currency value of the current account, private sector account, monetary account, the foreign currency value of foreign reserves held by the central bank as foreign T-bills, the exchange rate expressed as units of local currency per one unit of foreign currency, the parameter determining the speed with which foreign reserves adjust towards the minimum target, and the importance of exports, as assigned by international markets. Finally, χ^{CB-T} is the inverse of the average time required for foreign reserves to reach the minimum target ($\rho_{G\&PS} \cdot (M + RT^{row}) \big/ xr$).

Notice that, here, two cases can arise. In the first case, the government is able to place the amount of sovereign debt that supports the desired level of foreign reserves ($z_9 = 1$), while, in the second ($z_9 = 0$), it is only able to place up to an amount that depends on the international market's willingness, and, hence, is inferior to the desired level ($z_9 = 1$).

Notice also in the first case sovereign debt acts as the unique buffer stock, while in the second foreign reserves (equation 31) are not fully brought back to the minimum level, and, hence, both foreign reserves and sovereign debt act as buffer stocks. Notice, also, that two additional circumstances remain to be explained. Firstly, it must be explained what governments do under the presence of growing foreign currency inflows ($z_6 = 1$). Evidence from García, Mata and Nell (2008), and García and Mata (forthcoming), suggests most of them tend to intervene in order to avoid currency appreciations, implying they must keep accumulating foreign reserves, and stop issuing foreign currency debt. Yet, given money endogeneity, they must also compensate their interventions through new issues of bonds and bills, increases in the rate of bank reserve requirements and transfers of government deposits from banks to the central bank, the latter two options in order to reduce sterilization costs.

Second, it must be explained what happens when the level of foreign reserves is so low that the exchange rate must be allowed to float or change ($z_6 = z_7 = 0$). In this latter case, foreign currency reserve variations and new issues of foreign currency debt must be null, as captured by equation (36) − here not explicitly presented due to space constraints − which endogenously determines the (flexible-market) exchange rate (xr_{endog}) that makes the sum of the current account and the private sector account equal to zero.

Equation (35) describes the foreign exchange rate regime switching mechanism, so that the exchange rate floats (fluctuates) whenever foreign currency reserves are insufficient (i.e. when the authorities are forced to do so − $z_8 = 1 \Rightarrow z_6 = z_7 = 0$), but also whenever

the value of the trade/GPD ratio is that low that foreign exchange rate fluctuations are deemed to be not that influential (i.e. when the authorities choose to do so $-\ z_{10} = 0$).

The model can be modified so as to capture the fact that exchange rate regimes are often neither purely fixed nor purely flexible, but that would not necessarily contribute to illustrate the main idea, namely that economic behavior (and economic policy) in REEs depends on the accumulation of foreign reserves (international monetary asymmetries), as that affects the balance sheet structure and interdependencies among the government, the central bank, and all other institutional sectors; and it reduces the flexibility, and increases the influence, of monetary and fiscal policies, and the exchange rate regime, while creating a need for endogenous compensation (sterilization): central banks in REEs tend to replace their holdings of T-Bills with foreign reserves, and their cash liabilities with larger reserve requirements, central bank bills and government deposits, a process that exacerbates as the trade/GDP ratio increases (García and Mata, forthcoming).

Finally, equations (34), (38), (39), (40), (41) and (42) are, respectively, the actual value of the sovereign debt to GDP and exports ratio ($\$SDR$), the gross international reserves ratio to total imports and rents paid to foreigners ($GIRR$), the local currency value of the stock of foreign reserves (GIR), the equilibrium condition in the international market for foreign currency sovereign debt, the country risk premium on foreign currency government bonds ($\$\Omega_{BLG}$), and, finally, the interest rate paid on the latter ($\$r_{BLG}$).

Graphs III.2.1 to III.2.3 illustrate the behavior of fiscal and monetary policies in REEs (including foreign currency debt policies). Intuitively, in those economies, the authorities feel comfortable when foreign reserves are sufficiently large to cover all commitments

($NIRR_{-1} \succ \rho_{G\&PS}$), a circumstance under which they often keep accumulating reserves, fix interest rates low at the target level, repay public foreign debts, and maintain government expenditures growing at the normal rate (e.g. China before the global crisis).

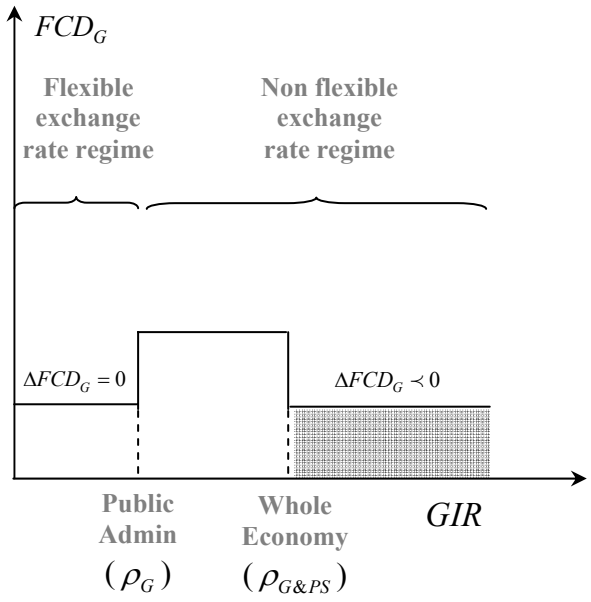
Notice, in REEs, there is no economic mechanism responsible for accelerating the pace of real government expenditures so as to keep constant the level of foreign reserves; rather, the latter can grow indefinitely, although at a constant rate. This implies that the current account to GDP ratio of REEs (the current account deficit to GDP ratio of RIEs) must eventually converge, even in the absence of global economic crises, policy choices or political forces (internal and external) causing the increase of government expenditures or the reduction of interest rates − e.g. eventually, the current account deficit/GDP ratio of the US must converge, although this may occur faster if peso/dollar exchange rates are revalued (e.g. the yuan/dollar) or REE governments boost the pace of their expenditures.

Yet, apart from domestic (and foreign) political pressures, there is no incentive in REEs to let the exchange rate float, limit interventions, reduce interest rates below target, or increase expenditures above the normal rate − i.e. in REEs, there is no incentive to let the market work nor to contribute to the stabilization of the world economy. Notice, instead, that if foreign reserves diminish for long periods, times of tranquility end: the authorities know they must react soon or later, reducing the growth rate of fiscal expenditures, raising interest rates, issuing foreign debt, while waiting for better external conditions.

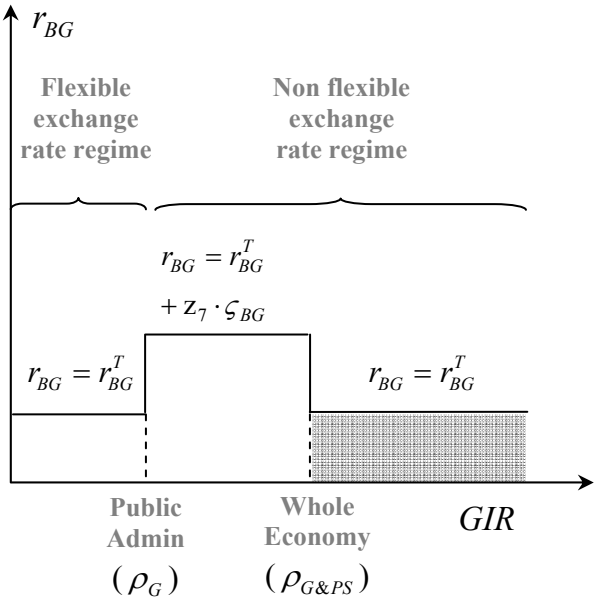
But if external conditions do not improve soon enough, they must tighten fiscal policy even further, implying they must actually reduce the growth rate of fiscal expenditures

until the latter diminish in real terms, a situation that often occurs while foreign reserves collapse below the minimum, forcing the authorities to devalue or let the exchange float.

Graph III.2.2. Foreign currency debt as foreign reserves fluctuate



Graph III.2.3. Interest rate setting as foreign reserves fluctuate



III.3 The central bank (CB):

$$F_{CB} = r_{BG-1} \cdot B^{CB}_{G,h-1} - r_{BCB-1} \cdot B_{CB,s-1} + r^{CB}_{L-1} \cdot L^{CB}_{B,s-1} + xr \cdot [\$r_{BG,row-1} \cdot \$B^{CB}_{G-row,h-1}]$$ CB profits; (43)

$$Cash_{CB,s} = Cash^{H}_{CB,d}$$ CB's supply of cash; (44)

$$B\,\mathrm{Re}\,s_{CB,s} = B\,\mathrm{Re}\,s^{B}_{CB,d}$$ CB's supply of reserves; (45)

$$\rho^{B\mathrm{Re}s}_{M1} = \rho^{B\mathrm{Re}s^*}_{M1} \cdot [1 + (z_6 - \tfrac{1}{4} \cdot z_8) \cdot z_{10} \cdot adj^{B\mathrm{Re}s}_{M1}]$$ Res. rate on current accounts; (46)

$$\rho^{B\mathrm{Re}s}_{M2} = \rho^{B\mathrm{Re}s^*}_{M2} \cdot [1 + (z_6 - \tfrac{1}{4} \cdot z_8) \cdot z_{10} \cdot adj^{B\mathrm{Re}s}_{M2}]$$ Res. rate on saving accounts; (47)

$$\rho^{B\mathrm{Re}s}_{B_B} = \rho^{B\mathrm{Re}s^*}_{B_B} \cdot [1 + (z_6 - \tfrac{1}{4} \cdot z_8) \cdot z_{10} \cdot adj^{B\mathrm{Re}s}_{B_B}]$$ Res. rate on bank CDs; (48)

$$GD_{CB,s} = GD^{G}_{CB,h}$$ Govt. deposits credited by CB; (49)

$$B^{CB}_{G,s} = B^{CB}_{G,h}$$ CB buys T-bills it holds; (50)

$$B^{'H}_{G,s} = B^{H}_{G,d}$$ Supply of T-bills to households; (51)

$$\begin{aligned} B^{CB}_{G,h} &= (z_6 + z_7)\cdot[B^{CB}_{G,h-1} + (1-\rho^{BG}_{BM})\cdot \Delta GIR/GIR_{-1}] \\ &[1-(z_6+z_7)]\cdot[Cash_{CB,s} + B\,\mathrm{Re}\,s_{CB,s} + B_{CB,s}] \\ &+[1-(z_6+z_7)]\cdot[GD_{CB,s} - GIR - L^{CB}_{B,s}] \end{aligned}$$ CB's demand for treasury bills; (52)

$$\rho^{BG}_{BM} = \frac{X_{-1} + M_{-1}}{Y_{-1}}$$ CB's T-bills (Trade/GDP) ratio; (53)

$$\begin{aligned} B_{CB,s} &= B_{CB,s-1} + [z_6 + z_7]\cdot[\Delta GIR + \Delta B^{CB}_{G,h} + \Delta L^{CB}_{B,s}] \\ &-(z_6+z_7)\cdot[\Delta Cash_{CB,s} + \Delta B\,\mathrm{Re}\,s_{CB,s} + \Delta GD_{CB,s}] \end{aligned}$$ CB's supply of certificates; (54)

$$r_{BCB} = r_{BG}$$ Rate on CB certificates; (55)

$$L^{CB}_{B,s} = L^{CB}_{B,d}$$ CB's supply of loans to banks; (56)

$$r^{CB}_{L} = r_{BG} + \Omega^{CB}_{L}$$ CB discount rate; (57)

Central bank profits (F_{CB}) are assumed to be entirely distributed to the government (equation 43), and are composed of beginning of period net interest income from T-bills ($B^{CB}_{G,h-1}$), central bank certificates ($B^{B}_{CB,s-1}$), discount operations ($L^{CB}_{B,s-1}$) and net holdings of international reserves − which are here reduced to foreign treasury bills ($\$B^{CB}_{G-row,h-1}$). Therefore, here, the net balance of the central bank can only vary in accordance with foreign exchange rate fluctuations (Δxr) which affect the local currency valuation of foreign reserves.

The central bank accommodates the demand for cash and bank reserves in line with equations (44) and (45). However, the rates on bank reserve requirements applicable to

current account deposits ($\rho_{M1}^{B\,\mathrm{Res}}$), saving account deposits ($\rho_{M2}^{B\,\mathrm{Res}}$) and bank CDs ($\rho_{BB}^{B\,\mathrm{Res}}$) are assumed to be established by law and adjusted in line with equations (46) to (48). When trade matters ($z_{10}=1$) and the regime is non-flexible, reserve requirement rates are increased ($z_6=1$) and decreased ($z_8=1$) asymmetrically ($adj_{M1}^{B\,\mathrm{Res}}$, $adj_{M2}^{B\,\mathrm{Res}}$, $adj_{BB}^{B\,\mathrm{Res}}$), depending on sterilization needs: changes in non-remunerated reserve requirements help compensate/sterilize foreign exchange interventions without incurring sterilization costs. This is why reserve rates are subject to discrete changes as the process of foreign reserve accumulation evolves (García, Mata and Nell, 2008; García and Mata, forthcoming).

Equation (49) implies that the central bank of a REE accommodates government deposits (which also play a fundamental role in sterilization) by crediting/debiting the treasury's account when required. Equations (50) and (51) imply the central bank also intervenes to make the short-term rate effective by accommodating its own demand ($B_{G,h}^{CB}$) and the households' demand for T-bills ($B_{G,d}^{H}$).

Notice, though, that opposed to reserve issuing central banks, the latter is mainly done on the liability side through changes in the supply of central bank CDs ($B_{CB,s}^{B}$ − equation 54), which become the buffer stock of the central bank. This is because the demand for T-bills on the part of reserve earning central banks is rather small (sometimes even negligible), either because of domestic regulation, law, or self-imposed restrictions.

In line with this stylized fact (Chapter II; García, Mata and Nell, 2008), the central bank is assumed to hold T-bills ($B_{G,h}^{CB}$ − equation 52) in proportion (ρ_{BM}^{BG} − equation 53) to total assets when foreign reserve accumulation takes place ($z_6+z_7=1$), the latter proportion

varying in line with the trade/GDP ratio so that the more inflexible the regime, the smaller the central bank's demand for T-bills. Yet, if the stock of foreign reserves becomes small, and the exchange rate regime becomes flexible ($z_6 + z_7 = 0$) (for any reason), compensation occurs through changes in the stock of T-bills, so that the latter becomes the buffer stock (just as in RIEs), while central bank CDs stop varying. This, however, is understood as a non-permanent circumstance, as soon or later, the central bank is expected to start again accumulating foreign reserves.

But, in general, what matters is that, in REEs, base money tends to be injected mostly through the increase in foreign reserves on the asset side, and destroyed (extracted) through reductions in foreign reserves (asset side) and increases in central bank own bills, bank reserve requirement rates, and government holdings of deposits (liability side). Monetary policy is, therefore, less elastic but more influential in REEs than in RIEs (García, Mata and Nell, 2008).

Regarding the short-term rate, equation (55) tells us that the central bank sets its rate equal to the T-bills rate ($r_{BCB} = r_{BG}$), implying the two assets are perfect substitutes and leave private bankers indifferent. But, from time to time, banks may have to resort to the discount window, a situation under which the authorities cannot do anything else but accommodate their demand (equation 56). Finally, equation (57) determines the so-called discount rate (r_L^{CB}) as a large mark-up (Ω_L^{CB}) over the short-term rate.

Equations (1) to (57) are the fundamental equations that characterize REEs, namely those that determine monetary and fiscal policies, interest rate targeting rules, the growth rate of government expenditures, exchange rate interventions, foreign reserve accumulation,

compensation (sterilization) policies, the issue of local and foreign currency debt, etc. The equations of all remaining institutional sectors (firms, households, banks, and ROW) are set out in the Appendix, where the literature on stock-flow consistency is reviewed; next section presents the results from simulations[51].

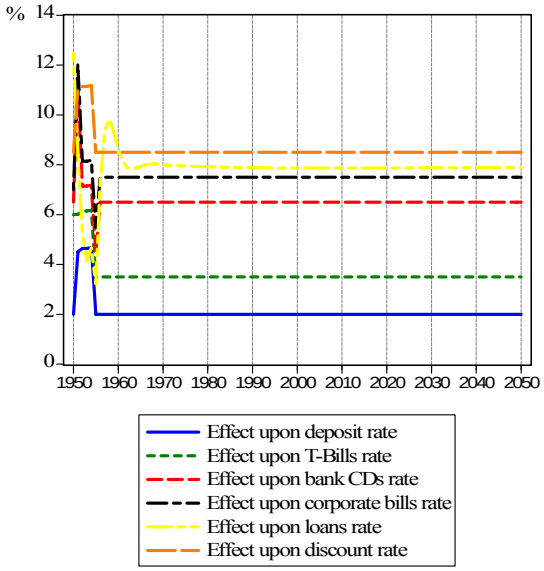
III.4 Results from simulations

III.4.1 Baseline scenario

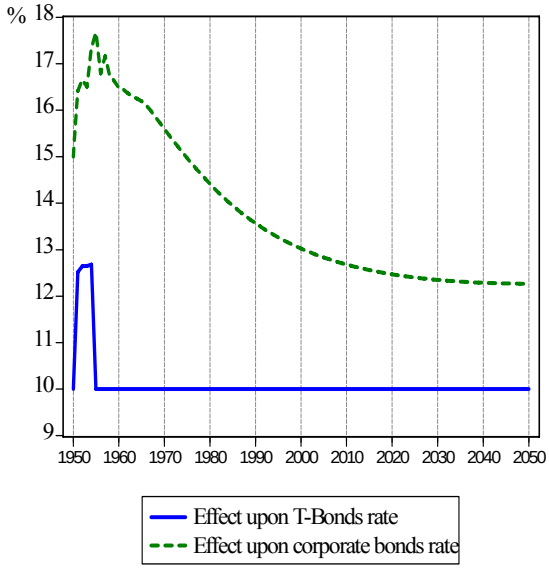
All simulations run from "year" 1950 to "year" 2050. The baseline scenario starts with the net international reserve ratio below target ($NIRR \approx 0.40 \prec \rho_{G\&PS} = 0.75$) in order to describe the initial process of foreign reserve accumulation. Initially, for the first 5 years (1950-1954), the reference interest rate remains above normal ($r_{BG} \approx 6.0\% \succ r_{BG}^{T} = 3.5\%$), affecting all other public, and private, short and long-term rates until policy actions and portfolio adjustments lead them toward their steady-state values (Graphs III.4.1, III.4.2).

[51] For those readers interested in replicating the results from the simulations, the programs of both the baseline scenario and all 21 experiments are available for Eviews version 5.0 and 6.0, at the following site: www.angelgarciabanchs.com.

Graph III.4.1: Effect upon short-term rates (Baseline)



Graph III.4.2: Effect upon long-term rates (Baseline)



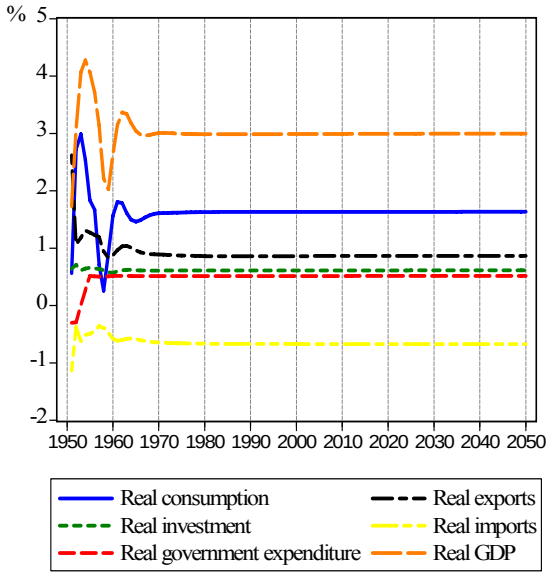
Further, the growth rate of real government expenditures becomes negative during the first three "years" ($gr^G = -1.50\%$ − Graph III.4.3), zero in the forth ($gr^G = 0.00\%$), positive in the fifth ($gr^G = 1.50\%$) and returns to the normal rate in the sixth onwards ($gr^G = gr^{G*} = 3.00\%$). These reductions (along with the rate hikes) allow the government to accumulate reserves, surpassing the target in "1955" ($NIRR \approx 0.757 \succ \rho_{G\&PS} = 0.75$).

In the process, real output grows initially below trend (2% < 3%) in the first two years, then it oscillates above trend (4% > 3%) from 1953 to 1956 and below it in 1958-1959, returning, after a couple of more oscillations, to its trend in 1965. The behavior of the employment rate is quite similar once lags are taken into account: it first falls below the full employment level in 1951-1953, and then oscillates and converges slightly above the full-employment level in the long-run, causing a moderate pressure upon wage inflation (see Graph III.4.3 and III.4.4).

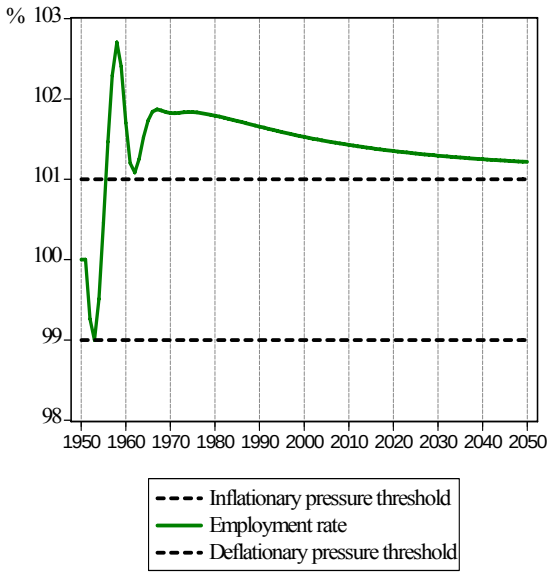
Not surprisingly, avoiding appreciations, at the cost of having to accumulate reserves, might prove to be a good strategy, as long as: the ROW (i.e. the world economy) grows, sterilization costs are low (e.g. if government deposits replace bills), and wage-inflation remains stable − notice that, commodity inflation may, actually, benefit REEs, and exacerbate the process of reserve accumulation (e.g. as in the case of OPEC members).

The initial increase in real net exports, which raises households' real disposable income, is the engine of economic growth in the short-run, as, initially, negative wealth effects upon consumption arise from interest rate hikes (falls in the price of bonds and equities), reducing the growth rate of output, until it recovers after interest rate readjustments (favorable wealth effects) take place, and then returns to its steady-state value (e.g. 3%). In the long-run all GDP components grow at the same rate (3.00%), implying their contribution to GDP growth remains steady: consumption (1.65%), investment (0.63%), government (0.53%), exports (0.86%) and imports (-0.67%). The steady-state equilibrium implies all flows grow at the same rate (i.e. nominal flows at 6% and real flows at 3%). Therefore, both, the rate of inflation and economic growth stabilize at 3%, mimicking the behavior of their counterparts in the ROW (see Graphs III.4.3 and III.4.4).

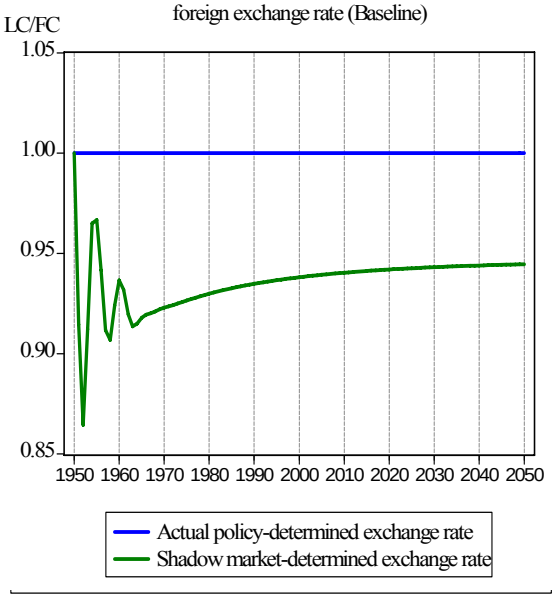
Graph III.4.3: Contribution to real GDP growth (Baseline)



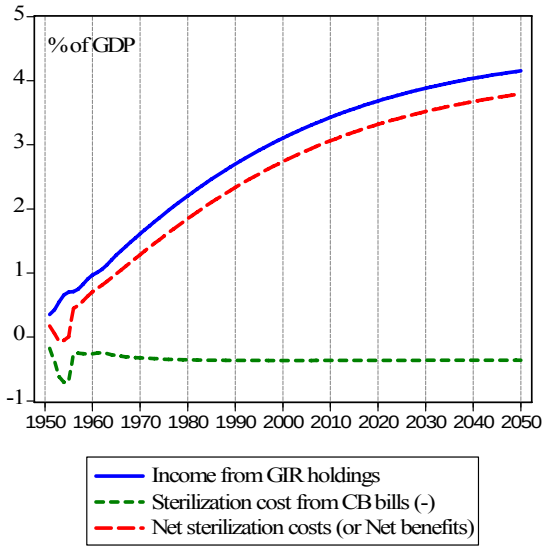
Graph III.4.4: Evolution of employment rate (Baseline)



Graph III.4.5: Shadow market-determined foreign exchange rate (Baseline)



Graph III.4.6: Net sterilization costs and net benefits from foreign reserve accumulation (Baseline)



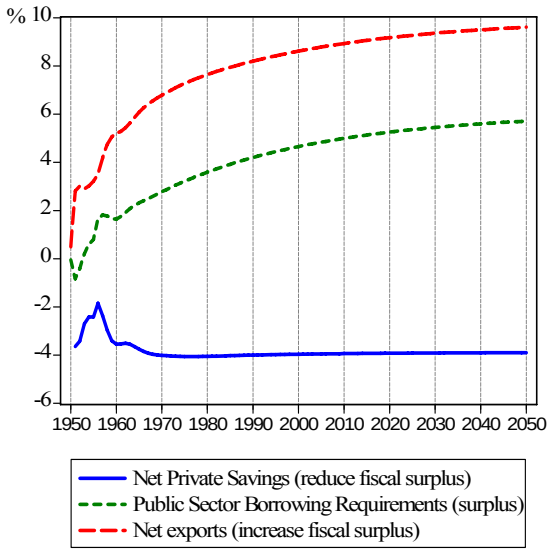
The shadow exchange rate of year "t" is here defined as the rate that would prevail if the regime became flexible (starting in year "t") − e.g. the foreign exchange rate that ensures the sum of the current account and the private account is 0 in year "t", in the absence of fluctuations in foreign reserves and foreign currency debt.

Initially, the shadow rate falls from 1 to around 0.86, remaining below 1 until it gradually converges (in steady-state) towards 0.94. This reflects the effort to avoid appreciations and limit exchange rate risk. In the process (see Graphs III.4.6-III.4.8), sterilization costs increase in nominal terms, although not as a percentage of GDP. Indeed, sterilization costs are more than offset by the interest income from foreign reserve holdings. That is, as long as the authorities allow bank reserves and government deposits at the central bank grow enough, the government will be able to profit in net terms from foreign reserve accumulation, as sterilization costs arising from interest payments on central bank bills grow slower than interest receipts from holding reserves.

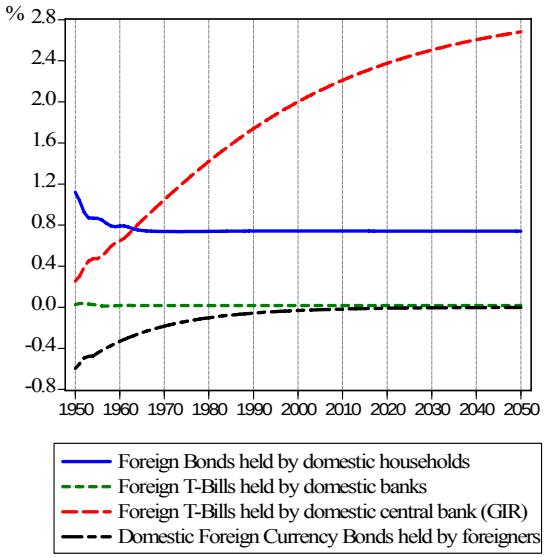
The current account/GPD ratio, which starts at 0%, gradually converges towards 9.60%. The public surplus/GPD ratio goes from 0% to 5.71%, while net private savings/GDP go from 0% to 3.90%. The result is, therefore, a process of foreign reserve accumulation that can go on forever, as long as the GDP of the ROW (the world economy) keeps growing. However, the current account deficit to GDP ratio of the ROW converges, and, therefore, so does its debt to GDP ratio. Here, the REE is assumed to be small relative to the ROW.

Graph III.4.8 shows the debt owed to REEs by RIEs is mainly held by reserve earning central banks (2.68% of the GDP of the ROW), followed by reserve earning households (0.74%) and banks (0.02%); and that the debt owed to RIEs by REEs converges to 0% as a percentage of the ROW's GDP. Furthermore, T-Bills (Graph III.4.10), which initially reach up to 14% of domestic GPD, converge to 0% in 2050, while foreign reserves (Graph III.4.9) go from 10% to about 120% of GDP, implying cash substitutes grow from 10% to 100%, mainly due to the evolution government deposits (which imply no interest − e.g. sterilization costs) which go from 1.5% to 98.75%.

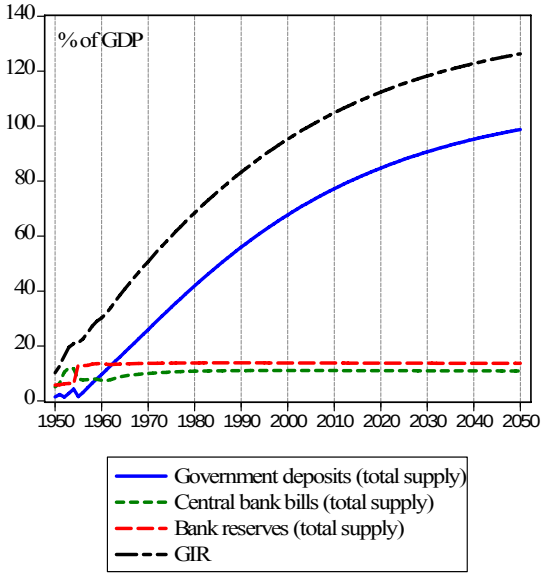
Graph III.4.7: Evolution of Government surplus
PSBR (Baseline)



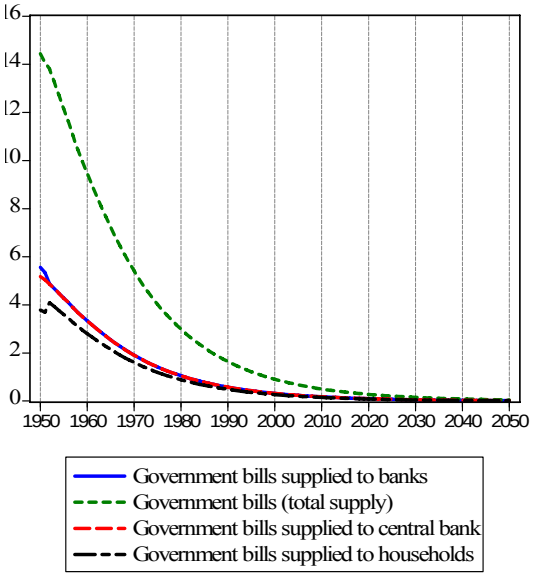
Graph III.4.8: Evolution Intl. Invest. Position
(ratios over GDP of ROW - Baseline)



Graph III.4.9: Evolution of cash substitutes (Baseline)



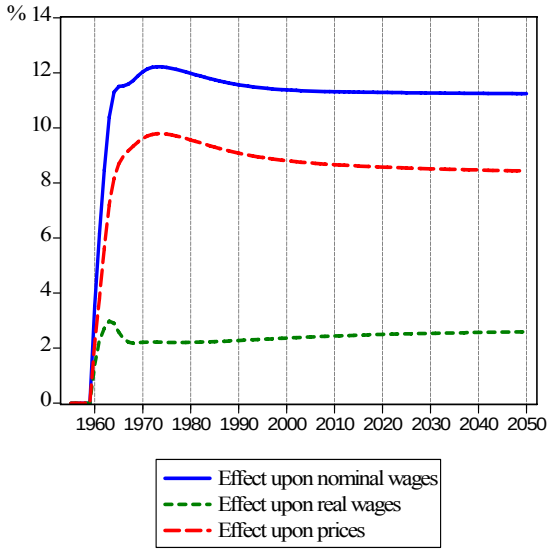
Graph III.4.10: Evolution of Government bills (Baseline)



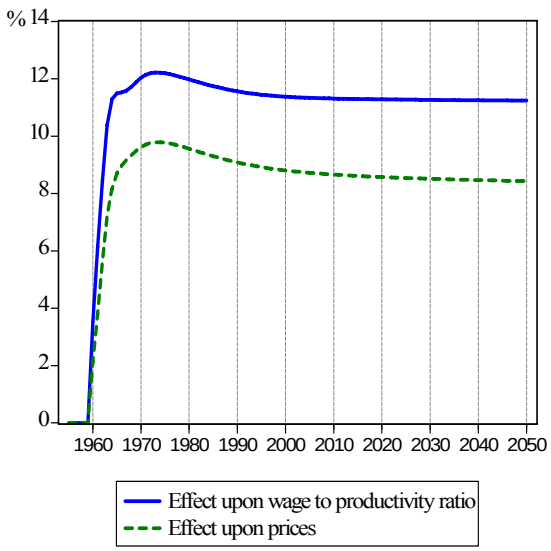
III.4.2 An autonomous increase in the target real wage rate (wage inflation)

In all experiments, shocks are to take place on "year 1960", unless indicated otherwise. The first consists of a rise in the target real wage rate (Ω_0 goes from -0.25 to -0.185), which, as shown by Graphs III.4.11 and III.4.12, has a permanent effect upon prices (+8.43%), as well as on nominal (+11.24%) and real wages (+2.59%).

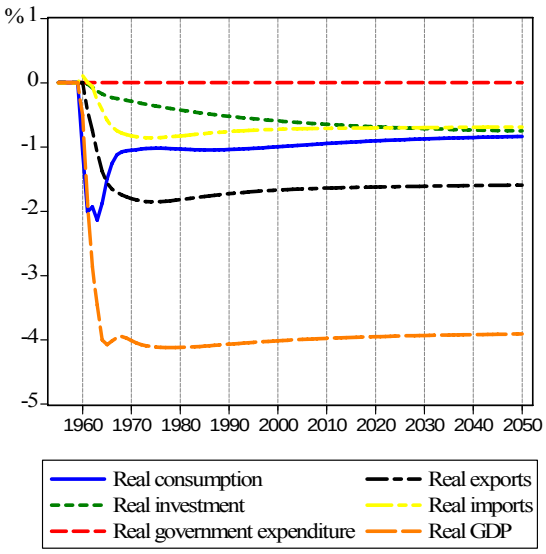
Graph III.4.11: Effect upon real wage rate, following an autonomous increase in wage inflation



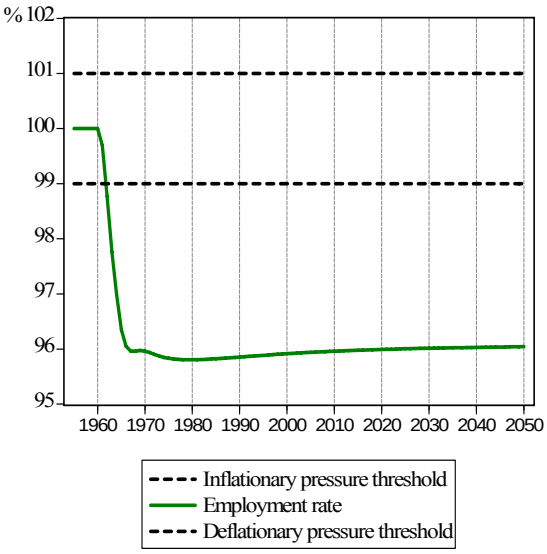
Graph III.4.12: Inflationary effect, following an autonomous increase in wage inflation



Graph III.4.13: Contribution to real GDP growth of an autonomous increase in wage inflation



Graph III.4.14: Evolution of employment rate, following an autonomous increase in wage inflation

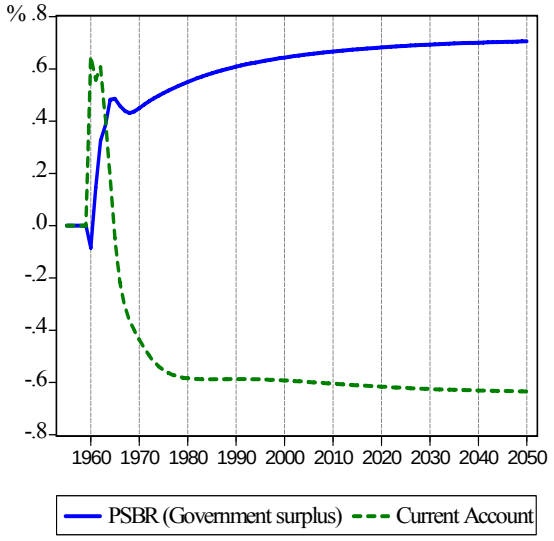


Yet, the effects upon real output and employment are severe (Graphs III. 4.13, III.4.14). GDP falls and converges to a steady-state value which is below the baseline in 3.91%, mostly due to the fall in the positive contribution of exports (1.60%), consumption (0.85%) and investment (0.77%), and the increase in the negative contribution of imports (0.69%).

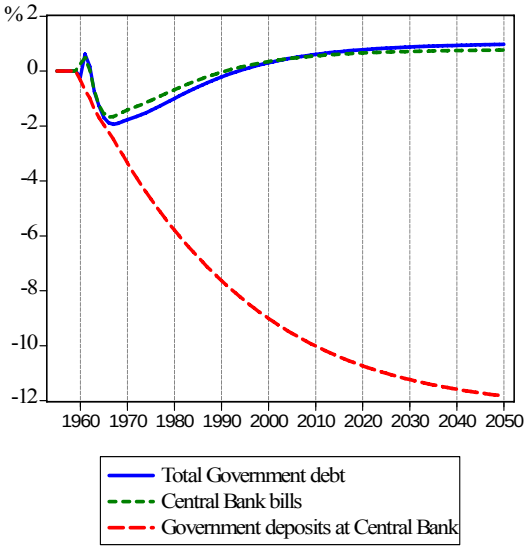
The effects upon the employment rate are clearly devastating: the REE moves from a situation characterized by full-employment to a position where the unemployment rate is close to 4%. Investment falls 2.40%, consumption 1.53%, exports 5.51%, while imports increase 3.09%.

The government surplus to GDP ratio diminishes 0.71%, passing from 5.71% to 5.00%; and this occurs mainly due to a decrease in the current account/GPD ratio of 0.63%, passing from 9.60% to 8.97% (i.e. the net private savings/GDP ratio increased 0.08%). The government debt increases around 0.97% above the baseline, as government deposits at the central bank absorb the shock and decrease 11.83%, while central bank bills increase just 0.76% (Graphs III.4.15 and III.4.16).

Graph III.4.15: Evolution of PSBR and CA to GDP ratios, following an autonomous increase in wage inflation



Graph III.4.16: Evolution of govt. debt, cb bills, and govt. dep. at CB, following an autonomous increase in wage inflation

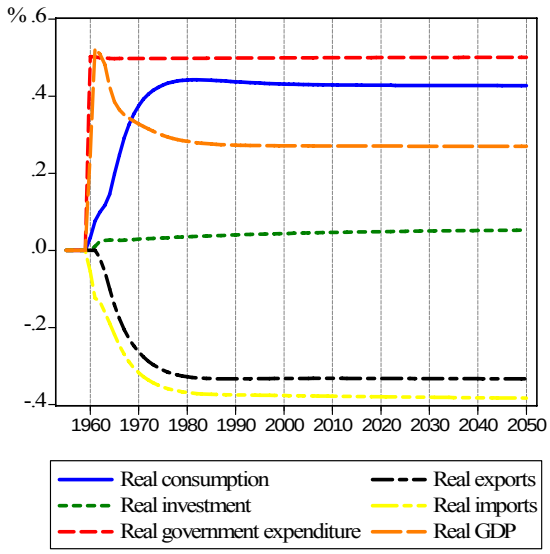


III.4.3 A one-period increase in the growth rate of government expenditures

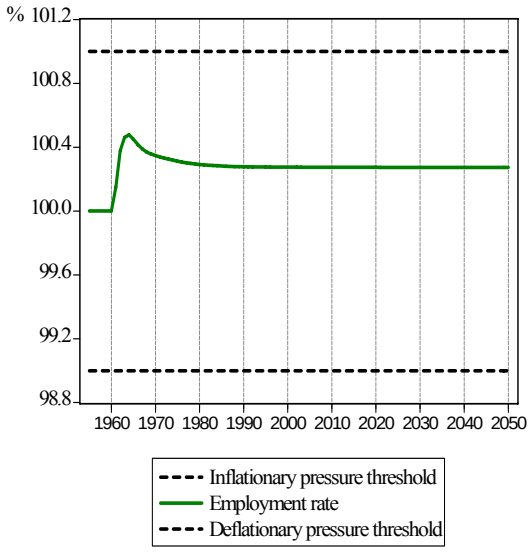
Fiscal policy in the form of a one-year increase in gr^G from 3% to 6% has favorable permanent effects upon real output and employment. Yet, the effects here are smaller than those reached by Godley and Lavoie (2007) in their (closed-economy) growth model (Chap. 11), the main reason being the only possible leakages in their model come from private savings, while here, apart from private savings, leakages also arise from increases in imports and decreases in exports.

The fiscal policy described above increases the steady-state value of real output with respect to the baseline in 0.27%, due to positive contributions from fiscal expenditures (0.50%), consumption (0.43%) and investment (0.06%), which more than offset the unfavorable contributions from exports and imports (-0.33%, -0.38%). Real consumption increases 0.78%, government expenditures 2.91%, investment 0.59%, while imports increase 1.72%, and exports decrease (-1.15%).

Graph III.4.17: Contribution to real GDP growth of a one-period increase in the growth rate of govt expenditures

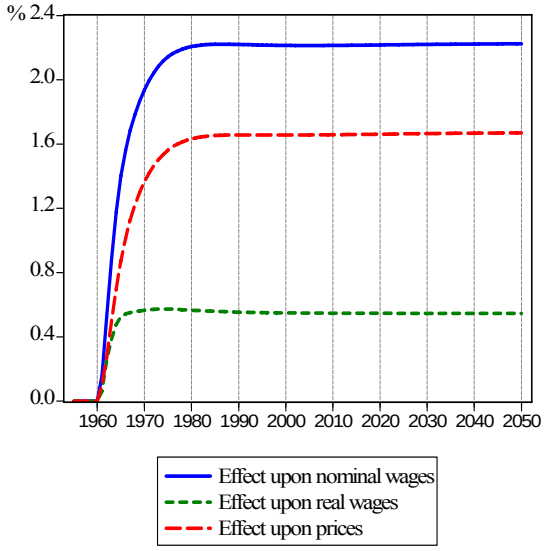


Graph III.4.18: Evolution of employment rate, following a one-period increase in the growth rate of govt expenditures

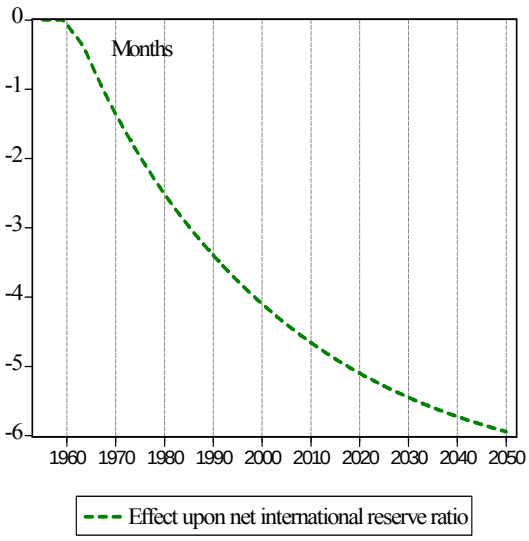


Thus, doubling the rate of government expenditures in one year raises permanently the employment rate in about 0.27% (Graphs III.4.17, III.4.18). It also increases real wages around 0.55%, as nominal wages increase 2.22% and prices 1.67% (Graph III. 4.19). However, fiscal policy implies a cost for REEs: foreign reserves diminish with the growth rate of government expenditures, as confirmed by the fall in the net international reserves ratio (of -0.50%, or 6 months of reserves), which passes from 4.76%, or 57 months, to 4.27%, or 51 months (Graph III.4.20). Fiscal policy in REEs is, thus, costly, but effective both in the short-run, medium-run and the long-run.

Graph III.4.19: Effect upon real wage rate, following a one-period increase in the growth rate of govt expenditures

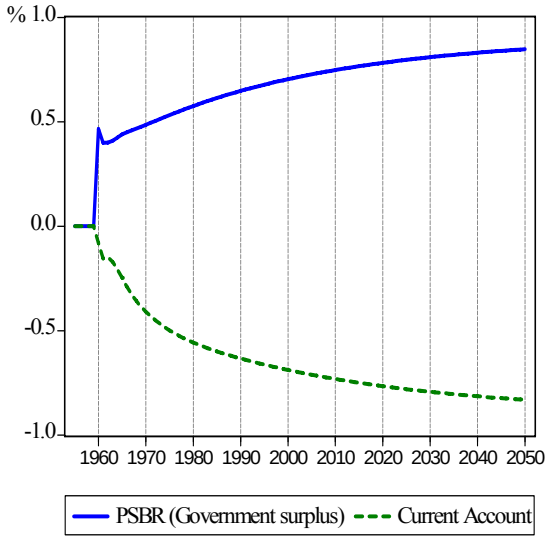


Graph III.4.20: Change in net international reserves ratio, following a one-period increase in the growth rate of govt expenditures

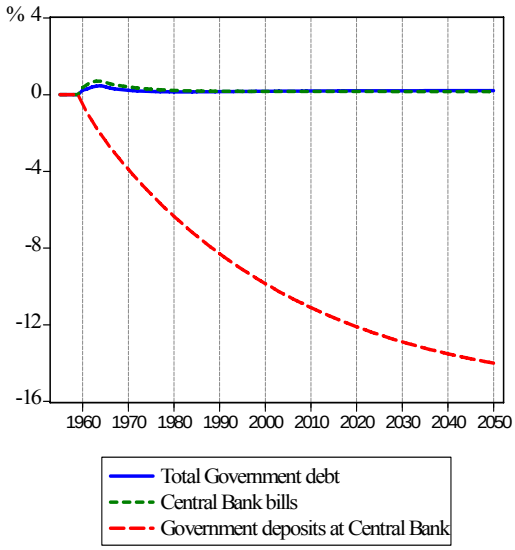


Indeed, the government surplus/GDP ratio falls with respect to the baseline in 0.85% (from -5.71% to -4.86%), due to an equivalent decrease in the current account/GDP ratio (-0.83%). The government debt/GDP ratio rises only 0.21%, as the government deposits at central bank/GDP ratio decreases 14.00%, while the central bank bills/GDP ratio increases 0.16% (Graphs III.4.21 and III.4.22). Thus, government deposits held at the central bank act as a buffer stock.

Graph III.4.21: Evolution of PSBR and CA to GDP ratios, after a one-period increase in the growth rate of govt expenditures



Graph III.4.22: Evolution of govt debt, cb bills, and govt deposits at CB, after a one-period increase in the growth rate of govt expenditures



Other fiscal policy experiments are undertaken, including a permanent decrease in the income tax rate and the corporate tax rate, and a permanent increase in the growth rate of government expenditures (from 3% to 3.5%). The results all point to the same outcome: fiscal policy is extremely effective to increase output, employment, and real wages, although it is costly in that it implies large losses of foreign reserves, as well as increases in domestic government debt.

For instance, in the case in which the growth rate of government expenditures is raised permanently from 3% to 3.5%, employment increases 1.85% (with respect to baseline), while output increases 1.10% mostly due to the contribution of consumption (3.99%), government expenditures (2.46%) and investment (0.84%), which offset the leakages arising from the decrease of exports (-2.88%) and the increase of imports (-3.37%). Further, real wages increase 4.14%, but all benefits come at the cost of a sharp reduction in the stock of foreign reserves: the net international reserve ratio decreases from 4.76, or 57 months, to 0.73, or 9 months.

Indeed, in the last years, the authorities are constrained (by the model) to increase interest rates and reduce the rate of growth of expenditures (from 3.5% to 1.75%). Fiscal policy is effective but costly in terms of foreign reserves, implying the flexibility of fiscal policy depends on the stock of foreign currency assets.

Yet, a permanent decrease in the income tax rate (e.g. from 22.5% to 20%) seems to offer the same degree of effectiveness at a lower cost in terms of reserve losses. In this case, employment increases 1.12%, while output increases 1.11%, mostly due to the contribution of consumption (3.68%) and investment (0.23%) which more than offset decreasing exports (-1.27%) and growing imports (-1.54%). From 4.76 (or 57 months), the net international reserve ratio diminishes to 2.84 (or 34 months).

Thus, from the viewpoint of output and foreign reserve losses, a permanent decrease in the income tax rate outperforms a permanent increase in the growth rate of expenditures, while from the viewpoint of employment alone, the opposite is true. The results from a permanent decrease in the corporate tax rate (e.g. from 25% to 20%) are not as effective or costly in terms of foreign reserves. Output and employment increase 0.36% with respect to the baseline, while the net international reserve ratio diminishes 3 months.

III.4.4 A five-period permanent increase in the rate of interest on T-Bills

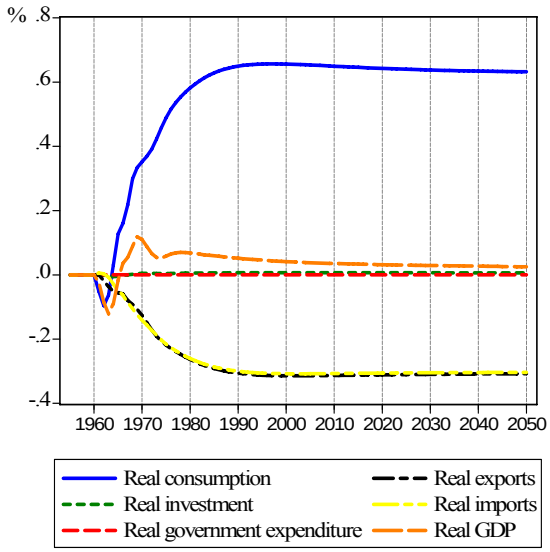
The decision to increase the reference rate of interest during six years from 3.5% to 4%, from 4% to 4.5%, and so on until it reaches and remains thereafter at 6% has a short-run and medium-run negative impact upon output and employment, but a positive effect in the long-run.

The latter is due to various reasons: (i) interest payments cause no leakages here because they involve payments to residents who exhibit the same propensities to consume out of income and wealth (i.e. distributional effects are null), (ii) the investment function here is inelastic to interest rate changes, as interest costs are assumed to be entirely passed on to final consumers, and (iii) government expenditures (households' income) increase with interest payments (Godley and Lavoie, 2007).

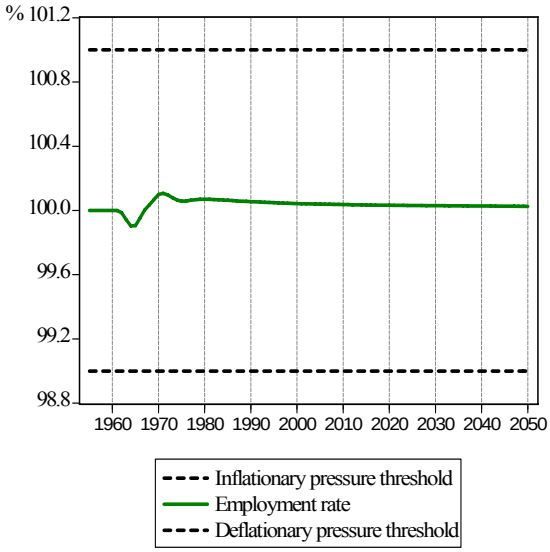
Indeed, in the long-run output increases 0.02% above the baseline, mostly due to the positive contribution of consumption (0.63%), and investment (0.01), which offsets the negative contribution of decreasing exports (-0.31%) and increasing imports (-0.31%), resulting from the increase in wages and prices (1.59% and 1.54%), as well as employment (0.03%). Further research should allow for the possibility of having one fraction of households who are net creditors (i.e. that receive interest income), and another fraction who are net debtors (i.e. that must pay interest). Further, Post Keynesian interest rate rules and their effects upon income distribution should be considered.

Foreign reserves decrease 4 months (0.37%) from 57 to 53, while the fiscal surplus to GDP ratio decreases 0.68% (from -5.71% to -5.02%) mainly due to negative effects upon the current account, whose ratio to GDP decreases 0.61% from 9.60% to 9.00%. Therefore, the government deposits to GDP ratio deteriorates from 98.76% to 87.82%, implying the government's debt to GDP ratio increases only in 0.88%, namely from 37.12% to 38.00% (see Graphs III.4.23 to III.4.28).

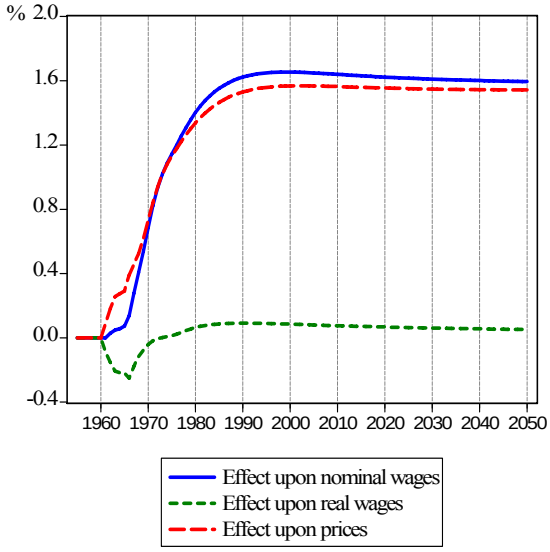
Graph III.4.23: Contribution to real GDP growth of a permanent increase in the rate of interest on T-Bills



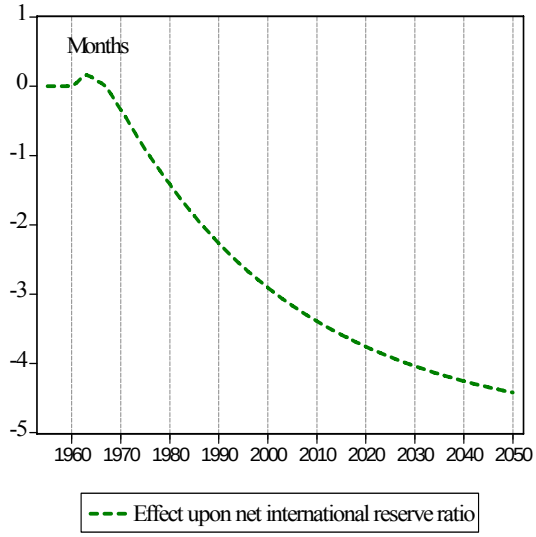
Graph III.4.24: Evolution of employment rate, following a permanent increase in the rate of interest on T-Bills



Graph III.4.25: Effect upon real wage rate, following a permanent increase in the rate of interest on T-Bills

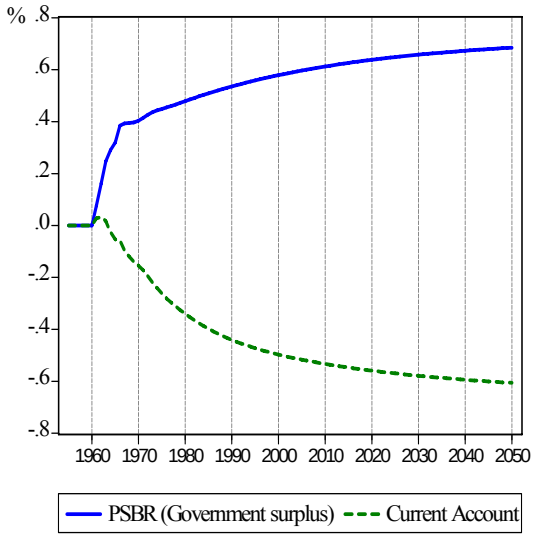


Graph III.4.26: Change in net international reserves ratio, following a permanent increase in the rate of interest on T-Bills

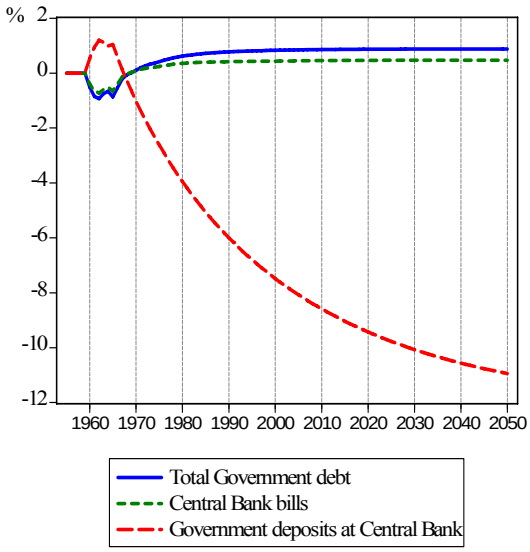


Notice, the above results do not necessarily imply monetary policy is not effective. Recall, REEs rely on foreign reserve accumulation and, hence, on monetary and exchange rate policies to grow in a sustainable way. Nevertheless, as shown (next) below, the effects of exchange rate policy only operate in the short and medium-run.

Graph III.4.27: Evolution of PSBR and CA to GDP ratios, following a permanent increase in the rate of interest on T-Bills



Graph III.4.28: Evolution of govt. debt, cb bills, and govt. dep. at CB, following a permanent increase in the rate of interest on T-Bills



III.4.5 A one-period switch to a market-determined exchange rate

The decision to let the foreign exchange rate float during year 1960 and then return to a fixed regime thereafter implies a permanent change in the exchange rate from 1 to 0.94. That is to say, it implies a 6.0% appreciation from then on. The short-run (1 year after) effect upon output (+0.41%) and employment (+0.32%) is positive due to favorable effects upon consumption and investment.

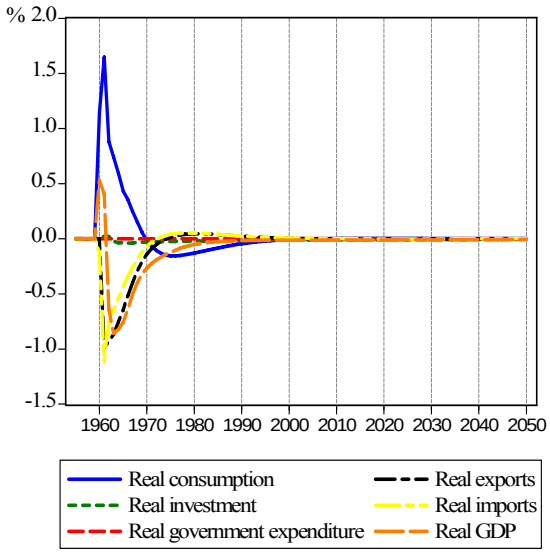
However, in the medium-run (5 years after), the effects upon output (-0.76%) and employment (-0.75%) are extremely adverse, while in the long-run they fade away. Indeed, the steady-state values of output and employment do not change significantly, nor does the current account and fiscal surplus to GDP ratios, the international reserves ratio, or the government debt to GDP ratio. Furthermore, the steady-state value of real wages does not change either, as the decrease in nominal wages (and the foreign exchange rate) leads to an equivalent decrease in prices (see Graphs III.4.29 to III.4.34).

Notice, nevertheless, that the extremely adverse effects of a currency appreciation upon output and employment observed in the medium-run are sufficient to justify the authorities' concern with avoiding exchange rate fluctuations, explaining why the latter keep accumulating foreign reserves even after they have accumulated an amount they would otherwise deem to be sufficient − i.e. why they keep accumulating foreign reserves even after they have surpassed the minimum target. The authorities of REEs are not interested in letting the foreign exchange market work; that is why they usually intervene to exogenously set the exchange rate so as to avoid the medium-run uncertainty that is associated with market forces.

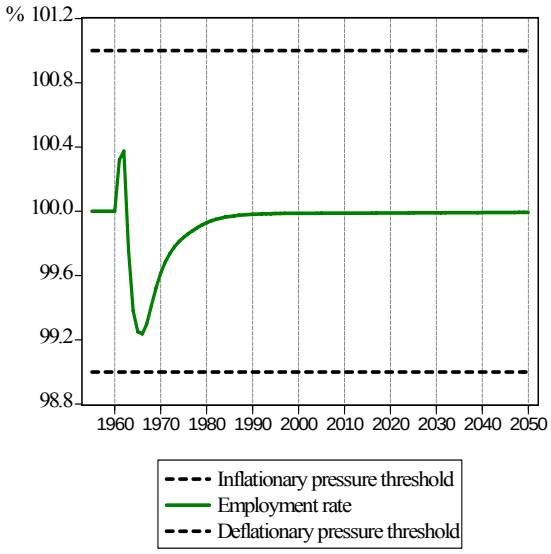
Finally, notice that the foreign debt of RIEs (like the US) might decrease in the short-run and medium-run due to exchange rate appreciations allowed by the authorities of REEs. But, that in the long-run their foreign debt depends on the values of parameters such as their propensity to import out of income, their imports' demand exchange rate elasticity coefficient, and the corresponding parameters that affect their exports to REEs and RIEs. This is confirmed by further experiments, and also by the fact that currency appreciations (depreciations) do not change significantly the steady-state value of the net international reserves ratio, and the current account and fiscal surplus/GDP ratios.

In the long-run, it is income fluctuations, not exchange rate fluctuations, which are responsible for determining both the amount and distribution of debts worldwide. That is, the effect of exchange rate fluctuations upon the international distribution of income, employment, and debt, can only be significant in the short-run and medium-run, at least, as long as the rate of growth of the world economy is treated as an exogenous variable − i.e. as long as international monetary asymmetries do not constrain the growth of RIEs.

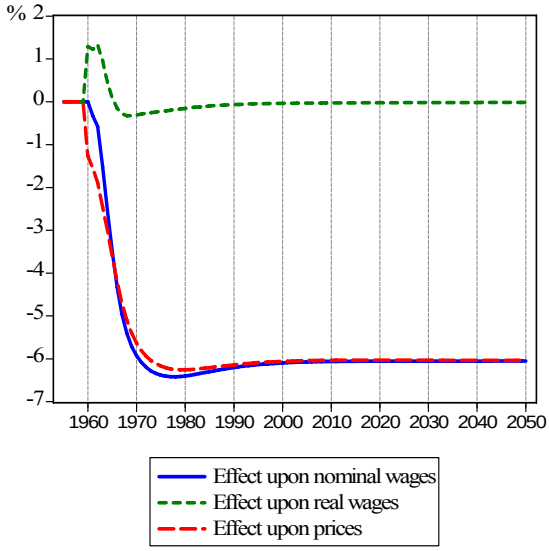
Graph III.4.29: Contribution to real GDP growth of a one-period switch to a market-determined exchange rate



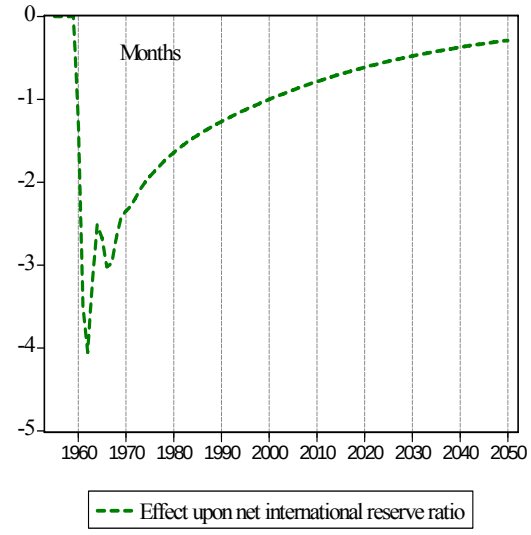
Graph III.4.30: Evolution of employment rate, following a one-period switch to a market-determined exchange rate



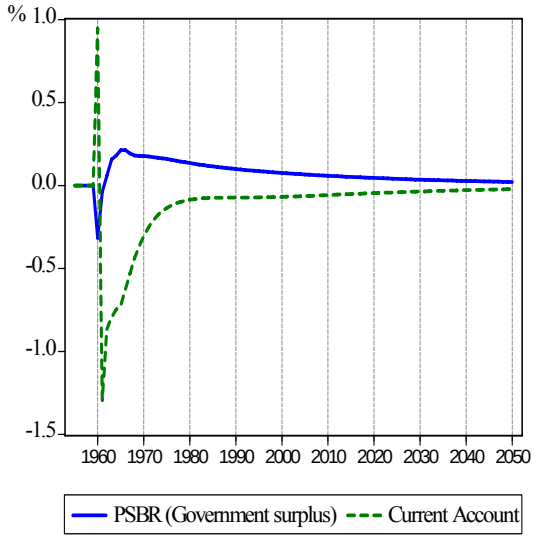
Graph III.4.31: Effect upon real wage rate, following a one-period switch to a market-determined exchange rate



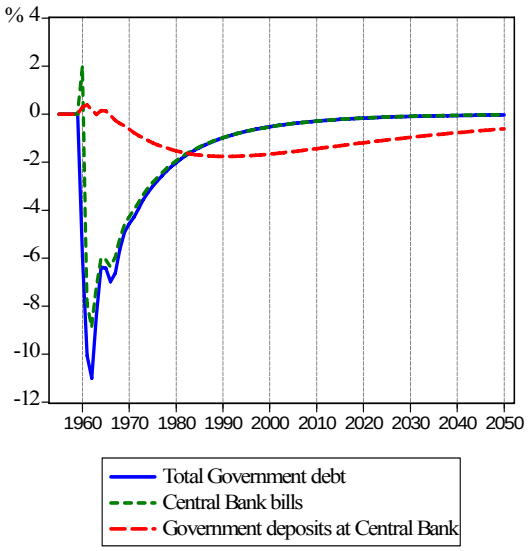
Graph III.4.32: Change in net international reserves ratio, following a one-period switch to a market-determined exchange rate



Graph III.4.33: Evolution of PSBR and CA to GDP ratios, following a one-period switch to a market-determined exchange rate



Graph III.4.34: Evolution of govt. debt, cb bills, and govt. dep. at CB, after a one-period switch to a market-determined exchange rate



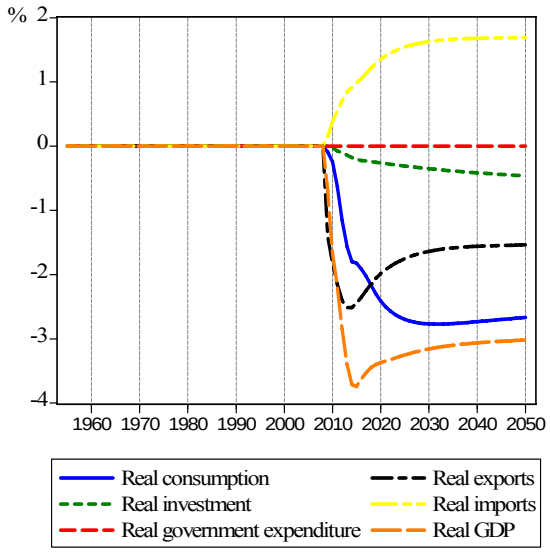
III.4.6 A global economic crisis with and without domestic fiscal stimulus

What happens to the REE if the rate of growth of the ROW (e.g. the world economy) becomes negative during, say, year 2009 (-2.00%), and then returns to a positive value during 2010-2013 (1.50%, 1.50%, 2.00%, 2.50%) to finally return in year 2014 to its long-term value of 3.00%? Further, what happens if fiscal authorities do not react or, instead, if they increase the growth rate of expenditures from 3.00% to 17.5% in 2010, 4.00% in 2011 to finally adjust it to its long-term value of 3.00% from 2012 onwards?

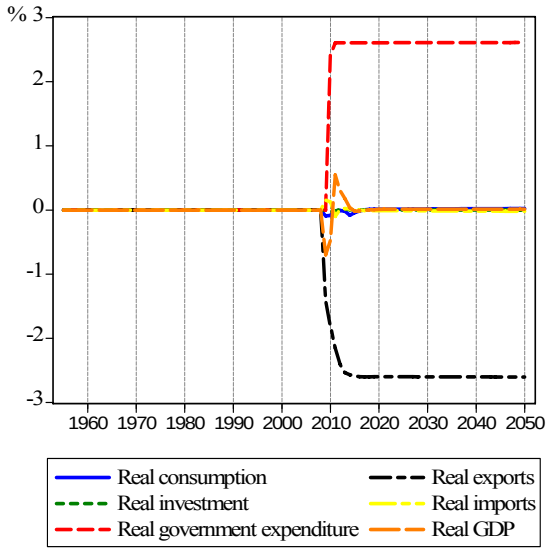
Graphs III.4.35 to III.4.46 show the behavior of the system in both cases. In the first case (orthodox case), output drops initially (i.e. with respect to the baseline scenario) 3.78% until 2014, although it later recovers slightly in the long-run, implying a long-run negative impact of 3.00%. While in the second case (Keynesian case), output initially falls around 0.50% below the baseline scenario, and then recovers slightly (0.04%) to finally face no change in the long-run with respect to the benchmark.

Evidently, in the second case, fiscal policy is capable of stabilizing the REE (e.g. China) in the short, medium and long-run, mostly by compensating the reduction in real exports (-2.60%) with an increase in fiscal expenditures (2.60%). While in the first, the absence of a fiscal stimulus package implies the contribution to GDP growth of all components (except imports) becomes negative both in the short, medium and long-run: consumption (-2.67%), exports (-1.54%), investment (-0.48%) and imports (+1.69%).

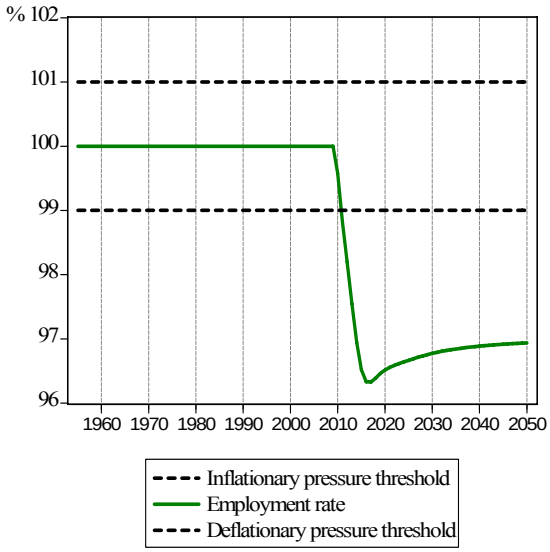
Graph III.4.35: Contribution to real GDP growth of a global economic crisis w/o domestic fiscal stimulus (orthodox)



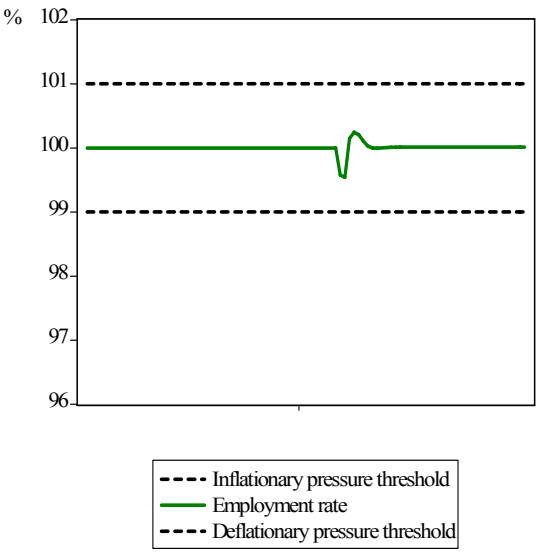
Graph III.4.36: Contribution to real GDP growth of a global economic crisis with domestic fiscal stimulus (Keynesian)



Graph III.4.37: Evolution of employment rate, following a global economic crisis w/o domestic fiscal stimulus (orthodox)

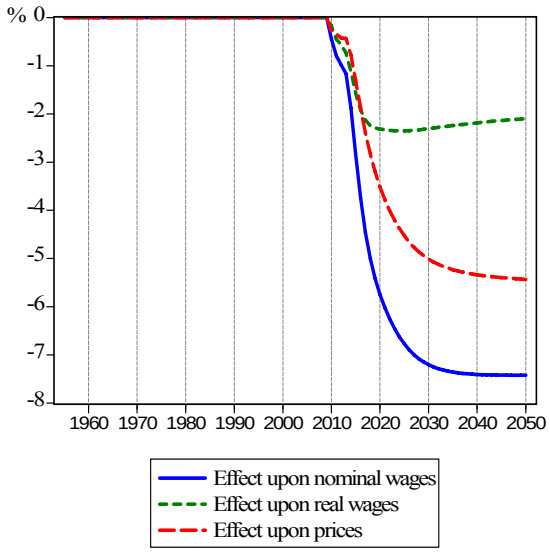


Graph III.4.38: Evolution of employment rate, following a global economic crisis with domestic fiscal stimulus (Keynesian)



Graph III.4.37 shows very clearly the large impact that a global economic crisis has upon the employment rate in the first case, both in the short, medium and long-run, as it falls to a steady-state value which is 3.06% below the baseline scenario. While Graph III.4.38 shows that in the second case the effect is small and temporary. Further, Graphs III.4.39 and III.4.40 describe what happens with prices and wages. In the first case, real wages end up falling 2.10%, as nominal wages fall 7.42% and prices fall 5.43%. While in the second case, nominal wages and prices increase slightly so that real wages remain roughly unchanged.

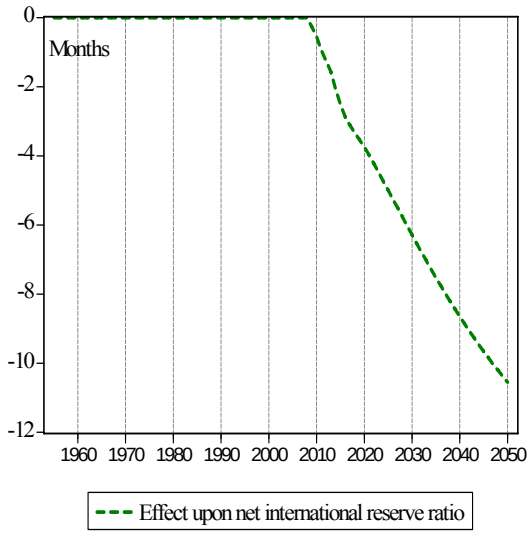
Graph III.4.39: Effect upon real wage rate, following a global economic crisis w/o domestic fiscal stimulus (orthodox)



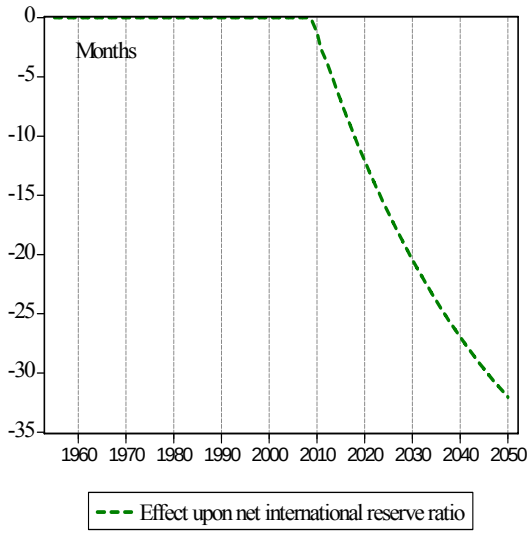
Graph III.4.40: Effect upon real wage rate, following a global economic crisis with domestic fiscal stimulus (Keynesian)

Graphs III.4.41 and III.4.42 are fundamental. They show that the effect of the crisis upon the net international reserves ratio is significant in the long-run − i.e. it implies a decrease of 0.88 from 4.76 to 3.89, or around 10 months of foreign reserves; but, above all, that the effect of the fiscal stimulus implies an even larger loss of foreign reserves.

Graph III.4.41: Change in net international reserves ratio, following a global economic crisis w/o domestic fiscal stimulus (orthodox)



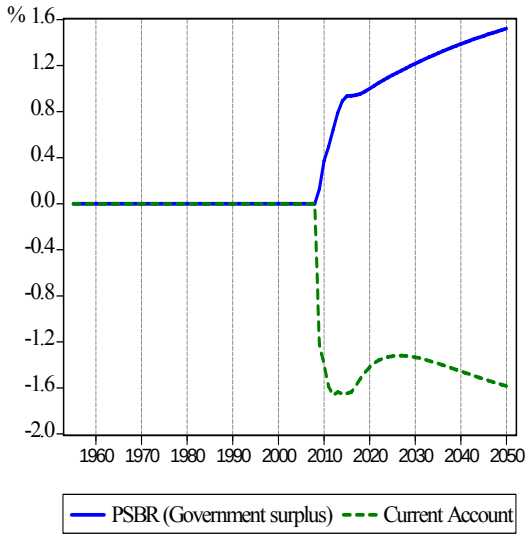
Graph III.4.42: Change in net international reserves ratio, following a global economic crisis with domestic fiscal stimulus (Keynesian)



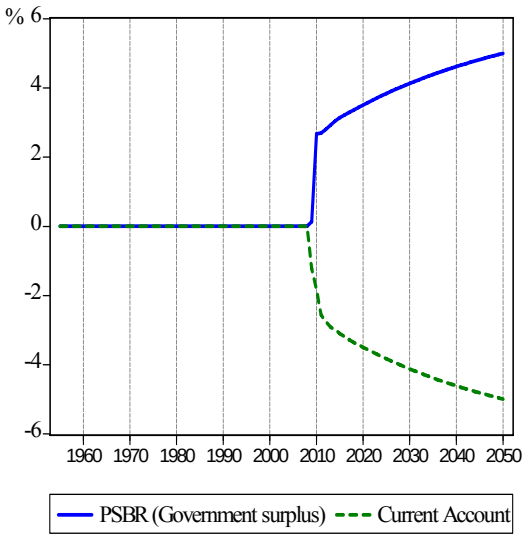
The cost of fiscal policy, as previously argued, implies a quite large reduction in the stock of foreign reserves held by the authorities. In the medium-run, after the fiscal stimulus, reserves fall from 49 months to 43 months, but in the long-run the impact is even larger, falling from 57 months (in the baseline scenario) to around 25 months. Fiscal policy, thus, is effective both in the short-run, medium-run and the long-run. But it is very costly in terms of foreign reserve losses.

Put differently, in REEs, relatively large foreign reserve holdings are fundamental to fiscal flexibility. REEs lacking sufficient foreign reserves usually require access to international credit lines (e.g. the IMF) in order to undertake fiscal stimulus packages aimed at surpassing a global economic crisis. Moreover, notice that, by definition, the fall in the stock of foreign reserve holdings of REEs must be equivalent to the fall in the stock of foreign debt of RIEs. Thus, global economic crises play a role in reducing the current account deficit/GDP ratio of RIEs and, hence, their foreign debt with REEs.

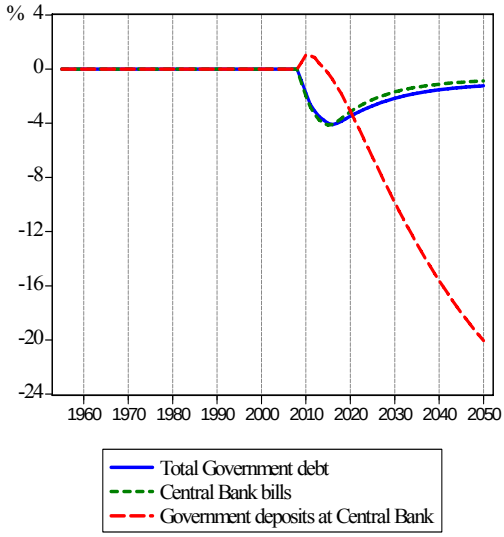
Graph III.4.43: Evolution of PSBR and CA to GDP ratios, following a global economic crisis w/o domestic fiscal stimulus (orthodox)



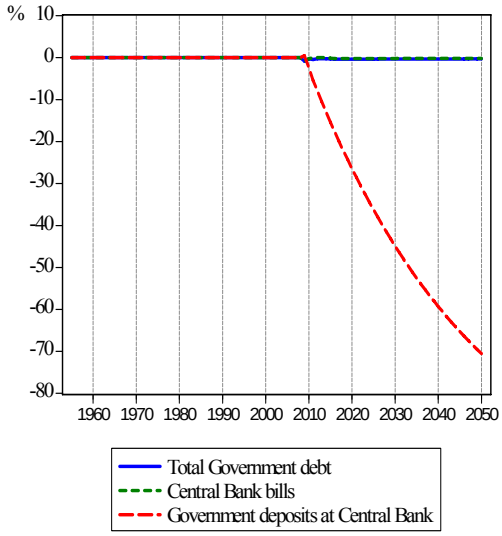
Graph III.4.44: Evolution of PSBR and CA to GDP ratios, following a global economic crisis with domestic fiscal stimulus (Keynesian)



Graph III.4.45: Evolution of govt. debt, cb bills, and govt. dep. at CB, following a global economic crisis w/o domestic fiscal stimulus (orthodox)



Graph III.4.46: Evolution of govt. debt, cb bills, and govt. deposits at CB, following a global economic crisis with domestic fiscal stimulus (Keynesian)



Graphs III.4.45 and III.4.46 depict what happens to government debt, central bank bills and government deposits at the central bank. In particular, the latter largely fall due to the fiscal stimulus package and the resulting effect upon foreign reserves. They act as the buffer stock of the government, implying the fiscal stimulus package partially depletes both the stock of foreign reserves and its counterpart: the stock of government deposits held at the central bank. The compensation/sterilization process is, hence, guaranteed, without any effect upon the rate of interest and the foreign exchange rate.

III.4.7 Other experiments

Table III.6 in the Appendix summarizes the positive (+) and negative (-) short-run (S), medium-run (M), and long-run (L) effects associated with previous experiments, and other experiments not previously described. It includes: (1) a permanent increase in the target real wage rate; (2) a one-period rise in the growth rate of government expenditures; (3) a permanent increase in the growth rate of government expenditures; (4) a permanent decrease in the income tax rate.

It also includes: (5) a permanent decrease in the corporate tax rate; (6) a permanent decrease in the bank tax rate; (7) a one-period increase in the rate of interest on T-Bills; (8) a five-period increase in the rate of interest on T-Bills; (9) a one-period switch to a market-determined exchange rate; (10) a permanent increase in the propensity to consume out of income and wealth (11); (12) a decrease in the ROW's rate of inflation; (13) a permanent fall in the ROW's propensity to import out of income; (14) a permanent rise in the ROW's imports demand-real exchange rate elasticity.

Further, (15) a permanent increase in the real exchange rate elasticity of the domestic demand for imports; (16) a permanent decrease in the propensity to import out of income; (17) a permanent increase in foreign currency liquidity preference due to an equivalent decrease in the preference for local currency bonds; (18) a permanent rise in the preference for liquidity due to an equivalent decrease in the preference for equities; further, (19) a decrease in the rate of bank reserve requirements; (20) a global crisis without domestic fiscal stimulus; and (21) a global crisis with domestic fiscal stimulus.

Two of the experiments whose results have not been previously discussed are experiments (10) and (11); they deal with permanent increases in the propensity to consume out of income and wealth. Both cause positive short-run and medium-run effects upon output, employment, real wages, consumption, and the fiscal balance; and negative short-run and medium-run effects upon net exports of goods, as well as the current account balance. However, their long-run effects upon output, real wages, employment, net exports of goods, the current account and the fiscal balance is negative, implying the positive short-run and medium-run effects upon the latter variable are mostly determined by the decrease in net private savings as a proportion of GDP.

Regarding experiment (12), which deals with a decrease in the ROW's rate of inflation, the effect upon real wages, consumption, the net international reserves ratio, as well as the fiscal balance is positive in the short, medium, and the long-run. Yet, the effect upon output and employment is positive only in the short-run, and it is always negative upon net exports of goods, implying the positive effect upon the fiscal balance mainly depends on the decrease in net private savings as a proportion of GDP, as the negative effect upon the current account balance tends to vanish only in the long-run.

Experiments (13) and (14) deal, respectively, with a permanent decrease in the ROW's propensity to import out of income, and a permanent rise in the ROW's imports-demand real exchange rate elasticity. In the first case, the short-run, medium-run and long-run effects upon output, real wages, employment, consumption, the current account balance, the fiscal balance, as well as the net international reserves ratio are negative. While in the second case the opposite occurs.

Equivalent results are obtained from experiments (15) and (16), both of which deal with changes in parameters related to the domestic economy, namely: a permanent increase in the real exchange rate elasticity of the demand for imports, and a permanent decrease in the propensity to import out of income. In both cases, the reduction of external leakages implies the short, medium and long-run effects upon output, employment, consumption, real wages, net exports of goods, the fiscal and current account balance are all positive. Experiments (17) and (18) study the effect of a permanent rise in foreign currency liquidity preference followed by an equivalent decrease in the preference for holding local currency bonds, as well as a permanent rise in the preference for liquidity held in local currency due to an equivalent decrease in the preference for holding equities.

In both cases, the effect upon output and consumption is negative both in the short-run, medium-run and the long-run, while the effect upon employment and real wages is null in the short-run, although negative in the medium and the long-run. Therefore, in the second case, the impact upon net exports of goods is positive in the short, medium and long-run, while in the first case it is positive only in the short and medium-run.

Notice, nevertheless, that the fiscal deficit diminishes in the first case, because the demand for local currency government bonds decreases in the short-run, medium-run and the long-run. While in the second-case, it increases in the short-run and the medium-run, but diminishes in the long-run. The current account balance increases in both cases, implying the short-run and medium-run increase of the fiscal deficit in the second case largely depends on the increase in the net private savings to GDP ratio due to the increase in local currency liquidity preference (e.g. the preference for current account deposits).

Finally, experiment (19) deals with the fundamental effect of a permanent decrease in the rate of bank reserve requirements. The results reflect no major effects upon output, employment, real wages, consumption, and net exports of goods in the short-run. However, in the medium-run and the long-run, the effect upon such variables is slight but significant.

For instance, cutting the reserve requirement rate on current account deposits from 12.50% to 6.25%, the rate on saving account deposits from 12.00% to 6.00%, and the rate on bank CDs from 10.00% to 5.00%, implies a 0.31% long-run increase in output and employment, and a 0.26% decrease in the current account and fiscal surplus.

Lower reserve requirements lead to a lower spread and rate of interest on loans, and, hence, to lower prices and consumption; certainly, these are important effects which must be taken into account at the time of computing total sterilization costs. Nevertheless, these adverse effects are directly offset by the larger net international reserves ratio and the reduction in interest payments resulting from larger bank reserve requirements.

III.5 Conclusions

This paper is based on the Post Keynesian stock-flow consistency approach (PK-SFC) and previous findings regarding the implications of international monetary asymmetries (García and Mata, forthcoming; García Mata and Nell, 2008). It models the behavior of, what we have labeled elsewhere as, reserve earning economies (REEs) − i.e. those whose local currencies do not circulate abroad.

The model captures the role of international monetary asymmetries in determining the balance sheet structure, policy choices and behavior of all institutional sectors in the economy (García and Mata, forthcoming). In so doing, it reflects the relevance of various buffer stocks and stock-flow norms affecting the real and financial spheres, as well as how the relative availability of foreign reserves determines fiscal and monetary policies, the growth rate of public expenditures, the issue of foreign and local currency debt, interest rate targeting procedures, exchange rate intervention and switching mechanisms, and compensation instruments. Many different simulations were performed to understand the system, including a fiscal policy response (ala Chinese) to a global economic crisis like that of 2009. Finally, the results confirm the effectiveness of both monetary and fiscal policies, as well as the importance of accumulating sufficient foreign reserves.

III. Appendix

The Appendix deals with the remaining institutional sectors (equations), and presents the balance sheet, revaluation and transaction matrices of all institutional sectors associated with the PK-SFC approach. Previous to that, though, section A.1 starts by reviewing the orthodox and heterodox approaches to stock-flow consistent macroeconomic modeling.

III.A.1 Orthodox versus heterodox stock-flow consistent models

Recently, there has been a renewed interest in the so-called stock-flow consistency approach to macroeconomics, a methodology which was simultaneously developed by two independent schools of thought: the New Haven School, led by James Tobin at Yale University, in the US, and the Cambridge School, led by Wynne Godley, in the UK.

In spite of sharing the same method, the two views differ in that they prescribe closures and causalities which are often opposed to each other, implying quite different behaviors for their models. Indeed, while the former approach is associated with the orthodox Keynesian view, the latter is associated with the heterodox Post Keynesian view.

The best recent example of the latter is Godley and Lavoie (2007). Yet, there are many other early and recent contributions such as Backus, Brainard, Smith and Tobin (1980), Tobin (1982), Godley and Cripps (1983), Turnovsky (1977), Fair (1984), Godley (1996, 1997, 1999a,b), Flaschel, Franke and Semmler (1997), Chiarella and Flaschel (2000), Flaschel, Gong and Semmler (2001), Godley and Shaikh (2002), Dos Santos (2002a,b, 2005, 2006), Izurieta (2003), Lavoie and Godley (2001-2), Lavoie (2003), Taylor (2004a,b), Foley and Taylor (2004) and Zezza and Dos Santos (2004).

Opposed to the case of orthodox stock-flow consistent models, Post Keynesian models based on stock-flow consistency are characterized, among many other factors, by: methodological structuralism and institutionalism, inventory adjustments, as well as a conflicting income distribution approach and a time-consuming production process.

But they are also characterized by the endogenous need for private credit money and the State's money, the presence of increasing (or constant) returns, imperfect competition, the role of stylized facts, the absence of a "natural tendency" towards full employment, the relevance of monetary, fiscal and incomes policies, non-ergodicity, uncertainty, and the impossibility to derive analytic solutions to describe how the aggregate economy evolves, as preferences and institutions change through historical, rather than logical, time. These are essential elements found in Godley and Lavoie (2007).

Their model is similar to Tobin's in many aspects. Firstly, it includes logical relationships among stocks and flows (Turnovsky, 1977), including the presence of stock-flow norms which may be self-imposed or inflicted by other institutional sectors, and there are also lagged dynamics that allow reflect the time sequences and effects of previous decisions.

Secondly, it incorporates several assets and rates of returns both, private and public, and short and long. Indeed, it does so following the Tobinesque approach originally found in the "pitfalls" article of Brainard and Tobin (1968)[52]. Third, the model considers financial and monetary policy as does Tobin, although money is treated exogenously by the latter. Finally, in Godley and Lavoie (2007), as in the Tobinesque approach, budget constraints and adding up constraints, both in regard to expectations and actual values, are essential.

[52] Moreover, Godley and Lavoie (2007: 14) acknowledge the presence of parameter instability as they do not expect asset demand functions to be "(stable enough to be) amenable to econometric treatment…".

There are no black holes; as put by Godley and Cripps (1983: 18): “the fact that money stocks and flows must satisfy accounting identities in individual budgets and in an economy as a whole provides a fundamental law of macroeconomics analogous to the principle of conservation of energy in physics”.

The latter implies that the evolution of the system depends on: (i) the initial values of assets and liabilities that reflect the balance sheet structure of the economy inherited from the past, and (ii), it also depends on the current period’s transactions and capital gains that arise from the holding of real and financial assets. Moreover, the logics of the accounting system associated with the stock-flow approach imply there will always be a redundant equation, the so-called system-wide consistency requirement.

There is, however, a fundamental difference among the two approaches which has to do with the behavior of the models *per se*. Here, as well as in Godley and Lavoie (2007), agents display procedural rationality but they do not maximize utility or profits, implying there is neither need nor room for the rational expectations hypothesis.

Thus, in opposition to the optimization principle of the neoclassical school, the principle of adjustment to disequilibrium is advocated, as in Duménil and Lévy (1995). Further, PK models do not require the perfect information assumption, as the norms and targets agents set determine their behavior. In PK models, characterized by generic uncertainty, agents attempt to predict the future using current values and knowledge from the past. But, the presence of stock-flow norms implies the way in which expectations are formed is not crucial, as any form of mistaken expectations end up leading to unanticipated variations in inventories, money balances and wealth, causing corrections in behavior.

PK models share diverse elements from Keynes (1930, 1936) and Kalecki (1944, 1971), such as the principle of effective demand, imperfect competition, and mark-up pricing, but also, fixed technical coefficients, a conflicting claims income distribution approach, the role of capacity utilization and retained profits, etc.

The above elements, and in particular the heterodox approach to income distribution is only consistent with the endogenous theory of money, for which the rate of interest is an exogenous (distributional) variable, which, rather than being determined by real forces like scarcity and productivity − as asserted by the neoclassical school − is fixed by the authorities and banks, as in Arestis (1992), Davidson (1972), Kaldor (1982), Lavoie (1992), Minsky (1957a), Moore (1988b), Nell (1998), Rochon (2001), Screpanti (1997), Wray (2004) and Fullwiler (2006), among others. Next subsections of the Appendix present the remaining institutional sectors (equations), and the balance sheet, revaluation and transaction matrices of the economy.

III.A.2 Firms

Production and Real Investment Decisions

$$y = s^e + (in^e - in_{-1}) - m^e$$ Real output; (58)

$$s^e = \beta \cdot s + (1 - \beta) \cdot s_{-1} \cdot (1 + gr_{pr})$$ Expected volume of sales; (59)

$$m^e = \theta \cdot m + (1 - \theta) \cdot m_{-1} \cdot (1 + gr_{pr})$$ Expected volume of imports; (60)

$$m = \mu_0 - \mu_1 \cdot (xr_{-1} \cdot pm_{-1} / py_{-1}) + \mu_2 \cdot y$$ Actual volume of imports (*logs*); (61)

$$in^T = \sigma^T \cdot s^e$$ Long-run inventory target; (62)

$$in^e = in_{-1} + \gamma \cdot (in^T - in_{-1})$$ Short-run inventory target; (63)

$in = in_{-1} + (y + m - s)$ Actual inventory volume; (64)

$s = c + g + i + x$ Actual volume of sales; (65)

$k = k_{-1} \cdot (1 + gr_k)$ Real capital stock; (66)

$gr_k = gr_0 + \gamma_u \cdot u_{-1}$ Growth of real capital stock; (67)

$u = y / k_{-1}$ Capacity utilization (proxy); (68)

$i = (gr_k + \delta) \cdot k_{-1}$ Real gross investment; (69)

$\pi = (pd - pd_{-1}) / pd_{-1}$ Rate of price inflation; (70)

$S = ps \cdot s$ Nominal value of sales; (71)

$IN = in \cdot UC$ Inventories at current cost; (72)

$I = pd \cdot i$ Nominal gross investment; (73)

$K = pd \cdot k$ Nominal value of fixed capital; (74)

$Y^{NIPA} = S - M + \Delta in \cdot UC$ Nominal GDP (NIPA); (75)

As before, all variables represent end of period-values except when followed by the subscript -1 which refers to beginning of period-values. The superscript e refers to expected (or planned) values.

Equations (58)-(64) concern the supply of goods. Particularly, equation (58) tells us that, based on their expectations regarding imports (m^e), firms produce (y) the volume they expect to sell (s^e) plus any planned addition to inventories ($in^e - in_{-1}$).

In accordance with equations (59), expected sales depend on some weighted average of current sales and past sales, the latter being augmented by an exogenous secular trend of

productivity growth (gr_{pr}). The same occurs with expected imports (equation 60). However, actual imports depend on a structural component (μ_0), the beginning of period-relative prices ($xr_{-1} \cdot pm_{-1} / py_{-1}$),the real income level (y), and the respective parameters (μ_1 ; μ_2).

Regarding equations (62) and (63), σ^T represents the desired ratio of inventories to expected real sales that firms target in the long-run, while in^T is the long-run target of inventory volume. Entrepreneurs know, though, that their expectations may be mistaken. Thus, they adjust their end of period-planned inventories in a partial, rather than a complete, fashion ($\gamma < 1$). Equation (64) defines the actual change in inventories as the difference between supply ($y + m$) and sales (s), the destiny of the latter (equation 65) being private and government consumption ($c + g$), investment (i) and exports (x).

Fixed assets come into existence to satisfy the demand for investment in capital goods required for production (k). For simplicity all investments in properties, durable private goods and public infrastructure are assumed away. Equation (66) tells us that the stock of capital goods (k) grows at the rate gr_k which, as indicated by equation (67) depends on an exogenous component (gr_0) and the rate of capacity utilization (u), here approximated by the ratio contained in equation (68). Equations (69) and (70) define, respectively, the level of real gross investment (i) and the rate of inflation (π); *pd* being the domestic price level and δ the rate of depreciation.

Finally, equations (71) to (75) are the nominal values of previously defined variables: total sales (equation 71); inventories valued at cost (equation 72); gross investment (equation 73); the overall stock of capital goods (equation 74), and the nominal value of GDP (equation 75), with ps, UC, and M defined later as the sales price, unit costs, and local currency value of imports[53].

Costs of Production

$$\omega^T = (W/pd)^T = \Omega_0 + \Omega_1 \cdot pr$$

$$+\Omega_2 \cdot [ER + z_{11} \cdot (1-ER) - z_{12} \cdot bandT + z_{13} \cdot bandB] \quad \text{Real wage aspirations (}logs\text{);} \quad (76)$$

$$ER = (N_{-1}/N_{fe}) \quad \text{Employment rate;} \quad (77)$$

$$z_{11} = 1 \ \text{ iff } \ (1-bandB) \le ER \le (1-bandT) \quad \text{Inelastic segment (Bargaining);} \quad (78)$$

$$z_{12} = 1 \ \text{ iff } \ ER \succ (1+bandT) \quad \text{Inflationary segment;} \quad (79)$$

$$z_{13} = 1 \ \text{ iff } \ ER \prec (1-bandB) \quad \text{Deflationary segment;} \quad (80)$$

$$W = W_{-1} + \Omega_3 \cdot (\omega^T \cdot pd_{-1} - W_{-1}) \quad \text{Nominal wage;} \quad (81)$$

$$pr = pr_{-1} \cdot (1 + gr_{pr}) \quad \text{Labor productivity;} \quad (82)$$

$$N^T = y/pr \quad \text{Desired employment;} \quad (83)$$

$$N = N_{-1} + \eta \cdot (N^T - N_{-1}) \quad \text{Actual employment;} \quad (84)$$

$$WB = N \cdot W \quad \text{Nominal wage bill;} \quad (85)$$

$$UC = [WB + M]/s \quad \text{Actual unit costs;} \quad (86)$$

[53] The nominal value of aggregate income, as defined in equation (75), follows national accounting rules because it excludes inventory revaluations.

$$TUC = \frac{W}{pr} \cdot \frac{y_{-1}}{y_{-1} + m_{-1}} + xr \cdot pm \cdot \frac{m_{-1}}{y_{-1} + m_{-1}} \qquad \text{Trend unit costs;} \qquad (87)$$

$$THUC = (1 - \sigma^N) \cdot TUC + \sigma^N \cdot (1 + r_{L-1}) \cdot TUC_{-1} \qquad \text{Trend historic unit costs;} \qquad (88)$$

Inflation is a conflicting-claims process (equations 76 to 80). Thus, workers aim at an average real wage rate-target ($\omega^T = (W/p_d)^T$) whose size varies continuously with average trend productivity (pr) and discontinuously with aggregate demand − particularly with the employment rate, defined as the beginning of period-employment over the full employment level ($ER = (N_{-1}/N_{fe-1})$).

For a range of the employment rate $(1 - bandB) \leq ER \leq (1 - bandT)$, wage aspirations vary just with productivity ($z_{11} = 1$), while outside that range they also increase ($z_{12} = 1$) or decrease ($z_{13} = 1$) with the employment rate. This sort of discontinuous Phillips curve with an inelastic segment ($z_{11} = 1$) has been suggested, among others, by Tobin (1995), Hein (2002), Palacio-Vera (2005) and Godley and Lavoie (2007), and has been found empirically significant by Eisner (1996), Filardo (1998) and Barnes and Olivei (2003), among others.

The nominal wage (W) reacts only gradually ($\Omega_3 \prec 1$) to the discrepancy between the target wage and the actual nominal wage (equation 81). For simplicity, the growth rate of trend labor productivity (gr_{pr}) is treated as an exogenous variable (equation 82)[54].

[54] This is for simplicity. Recall, in practice, the rate of technical progress ultimately depends on aggregate demand (Kaldor, 1960; Robinson, 1956; Setterfield, 2002; Lavoie, 2006d and Godley and Cripps, 1983).

As suggested by equation (83) the desired level of employment (N^T) is a function of trend productivity and output. Yet, as indicated by equation (84), actual employment (N) adjusts only partially ($\eta \prec 1$) towards the normal target level, reflecting the well-known tendency of labor productivity towards pro-cyclicality (Godley and Lavoie, 2007).

Equation (85) defines the economy's nominal wage bill. Yet, as defined by equation (86), actual unit costs of sales (UC) depend on the value of both the nominal wage bill (WB) and the imports bill (M), while trend unit costs of sales (TUC – equation 87) instead depend on trend productivity and the weight of domestic GDP ($y_{-1}/(y_{-1}+m_{-1})$) and imports ($m_{-1}/(y_{-1}+m_{-1})$) over total aggregate supply (pm is the price of imported goods). Finally, trend historic unit costs ($THUC$ – equation 88) differ from trend unit costs in that the former are determined by current and past values of unit sale costs, the normal inventories to sales target (σ^N) and the beginning of period-interest rate on loans (r_{L-1}).

Pricing

$ps = (1+\varphi)\cdot THUC$	Mark-up sales price;	(89)
$pd = (S-X)/(s-x)$	Domestic sales price;	(90)
$px = pd = ps$	Export price;	(91)
$px = xr \cdot pm$	Export price;	(91-A)
$py = Y^{NIPA}/y$	GDP deflator;	(92)
$\varphi = \varphi_{-1} + \varepsilon_f \cdot (\varphi_{-1}^T - \varphi_{-1})$	Actual mark-up;	(93)
$\varphi^T = \frac{F_F^T}{HC^e}$	Ideal mark-up;	(94)

$$HC^{e} = \sigma_{se} \cdot (1 + r_{L-1}) \cdot s^{e} \cdot UC_{-1} + (1 - \sigma_{se}) \cdot s^{e} \cdot UC \quad \text{Expected historical unit costs;} \quad (95)$$

$$\sigma_{se} = in_{-1} \big/ s^{e} \quad \text{Opening inv to exp. sales ratio;} \quad (96)$$

$$F_{F}^{T} = \frac{[FU_{F}^{T} - \theta_{F} \cdot DepA] + FD_{F}^{H}}{[1 - \theta_{F}]} + RT_{F} - r_{L-1} \cdot NPL \quad \text{Target net profits;} \quad (97)$$

$$FU_{F}^{T} = \psi_{U} \cdot I_{-1} \quad \text{Planned retained earnings;} \quad (98)$$

$$FD_{F}^{H} = \psi_{FD} \cdot NF_{F-1} \quad \text{Firms' dividends;} \quad (99)$$

Prices (ps) are determined as a mark-up ($1+\varphi$) over trend historic unit costs rather than current unit costs (equation 89). Equation (90) defines the domestic price level (pd), while equation (91) defines the level of export prices (px) assuming two alternatives: they might be domestically or internationally determined. The former (equations 91-A) may suit that of small reserve earning economies (e.g. Argentina), while the latter fits that of a large reserve earning economy (e.g. China) − i.e. one capable of affecting prices at the international level. Equation (92) defines the GDP deflator (py).

Notice, though, the actual mark-up (φ − equation 93) adjusts partially ($\varepsilon_{f} \prec 1$) towards the ideal mark-up (φ^{T} − equation 94), the latter defined as the one which exactly generates the amount of net profits required by firms (F_{F}^{T} − equation 97) to satisfy their planned amount of retained earnings (FU_{F}^{T} − equation 98) and dividend payments (FD_{F}^{H} − equation 99) when sales expectations are fulfilled. The reason is when realized and planned sales become equal ($s = s^{e}$), so become realized and planned inventories (equation 96) and, hence, realized and expected historic unit costs (equation 95).

Finally, dividends are determined as a fraction ($\psi_{FD} \prec 1$) of the previous period net after tax and depreciation-profits (NF_{F-1}) and retained earnings as a proportion ($\psi_U \prec 1$) of the beginning of period investment (I_{-1}). Finally, in F_F^T (equation 97), θ_F and $DepA$ are, respectively, the corporate tax rate and the value of capital depreciation, so that $\theta_F \cdot DepA$ is the tax gain from depreciation allowances. Further, RT_F and NPL correspond to firms' rent payments and corporate defaults on loans.

Financial Considerations and portfolio decisions

$$F_F = S - M + \Delta IN - WB - r_{L-1} \cdot IN_{-1}$$ Actual entrepreneurial profits[55]; (100)

$$BTF_F = F_F - RT_F + r_{L-1} \cdot NPL$$ Before tax profits; (101)

$$RT_F = r_{BF-1} \cdot B_{F-1} + BL_{F-1} + r_{L-1} \cdot (L_{Fd-1}^B - IN_{-1})$$ Firms' rent payments; (102)

$$NPL = npl \cdot L_{Fd-1}^B$$ Non-performing loans default; (103)

$$NF_F = BTF_F - T_F$$ Realized net profits of firms; (104)

$$T_F = \theta_F \cdot (BTF_F - DepA)$$ Corporate Tax; (105)

$$DepA = \delta \cdot pd \cdot k_{-1}$$ Depreciation allowances; (106)

$$FU_F = NF_F - FD_F^H$$ Retained earnings of firms; (107)

$$YD_r^F = FU_F$$ Nom. reg. disposable income; (108)

$$CG^F = \Delta pd \cdot k_{-1} - \Delta pbl_F \cdot BL_{F,s-1} - \Delta pe_F \cdot e_{F,s-1}$$ Capital gains; (109)

[55] From equation (19), it can be shown that:

$$Y^{NIPA} + \Delta UC \cdot in_{-1} - WB - r_{L-1} \cdot IN_{-1} = S - M - WB + \Delta in \cdot UC + \Delta UC \cdot in_{-1} - r_{L-1} \cdot IN = S - M - WB + \Delta IN - r_{L-1} \cdot IN_{-1}$$

$$YD^F_{hs} = YD^F_r + CG^F$$ Haig-Simons disp. income; (110)

$$V^F = V^F_{-1} + YD^F_{hs} + NPL$$ Firms' net value; (111)

$$L^B_{Fd} = L^B_{Fd-1} + [I + \Delta IN] - FU_F - \Delta OD\,\&\,E_{F,s} - NPL$$ Firms' demand for loans; (112)

$$OD\,\&\,E_{F,s} = OD\,\&\,E_{F,s-1} + \Delta B_{F,s} + pbl_F \cdot \Delta BL_{F,s} + pe_F \cdot \Delta e_{F,s}$$ Firms' other debt & equity; (113)

$$B_{F,s} = B^H_{F,d}$$ Supply of commercial paper; (114)

$$pbl_F \cdot BL_{F,s} \big/ [(1-\psi_U)\cdot I_{-1} - \Delta B_{F,s}] = pbl_F \cdot BL_{F,s-1} \big/ [(1-\psi_U)\cdot I_{-1} - \Delta B_{F,s}] + \psi^F_{1,0} + \psi^F_{1,1}\cdot r_{BLF-1} + \psi^F_{1,2}\cdot r_{K-1}$$ Supply of corporate bonds; (115)

$$pe_F \cdot e_{F,s} \big/ [(1-\psi_U)\cdot I_{-1} - \Delta B_{F,s}] = pe_F \cdot e_{F,s-1} \big/ [(1-\psi_U)\cdot I_{-1} - \Delta B_{F,s}] + \psi^F_{2,0} + \psi^F_{2,1}\cdot r_{BLF-1} + \psi^F_{2,2}\cdot r_{KF-1}$$ Supply of corporate equities; (116)

$$r_{BF} = r_{BB} + \Omega_{BF}$$ Rate on corporate bills; (117)

$$\Omega_{BLF} = (1/pbl_F) - (1/pbl_G)$$ Premium on corporate bonds; (118)

$$r_{BLF} = r_{BLG} + \Omega_{BLF}$$ Rate on corporate bonds; (119)

$$BL^H_{F,d} = BL_{F,s}$$ Equilibrium corporate bonds; (120)

$$r_K = FD^H_F \big/ (pe_{F-1}\cdot e_{F,s-1})$$ Dividend yield of firms (121)

$$e^H_{F,d} = e_{F,s}$$ Equilibrium for equities; (122)

Equation (100) defines actual entrepreneurial profits (F_F) as sales (S) net of imports (M), and the wage bill (WB), plus the change in value of inventories (ΔIN), excluding its financing costs ($r_{L-1}\cdot IN_{-1}$). Before tax profits (BTF_F −equation 101) are the difference

between realized gross entrepreneurial profits and firms' rent payments (RT_F), including savings in interest payments due to defaulting loans (NPL).

Firms pay interest (equation 102) on the bills ($r_{BF-1} \cdot B_{F,s-1}$) and bonds ($BL_{F,s-1}$) they issue, but also on the loans they obtain from banks ($r_{L-1} \cdot (L^B_{Fd-1} - IN_{-1})$). Yet, there is always an aggregate stock of non-performing loans from the past ($NPL-$ equation 103).

Equation (104) defines realized profits (NF_F) net of corporate tax (T_F- equation 105) and depreciation allowances ($DepA-$ equation 106), where θ_F is the corporate tax rate and depreciation is computed at the current domestic price (pd), in line with the rate of physical depreciation (δ). Known in advance the amount of dividends to distribute (FD_F- equation 99), any windfalls in profits end up increasing the actual amount of retained earnings (FU_F- equation 107), the value of which is equal to the so-called nominal regular disposable income of firms (YD^F_r- equation 50).

To obtain the Haig-Simons disposable income of firms, their net capital gains from financial liabilities and real assets (CG^F- equation 109) is considered (equation 110). The net value of firms (V^F- equation 111) evolves, thus, in line with their Haig-Simons disposable income and their amount of non-performing loans.

For firms, the role played by inventories on the real sphere is played by credit on the financial one. Indeed, loans act as a buffer stock, absorbing any unexpected fluctuations in their financial needs. The demand for new loans ($\Delta L^B_{Fd}-$ equation 112) diminishes with any windfalls in profits ($FU_F \succ FU^T_F$), the issue of additional debt and equities

($\Delta OD \,\&\, E_{F,s} \succ 0$), and the default on previous loans (NPL). Yet, it rises with increases in inventories (ΔIN) and in real investment (ΔI^F), in line with Keynes' revolving fund. This occurs in average when actual and target retained earnings are equal ($FU_F = FU_F^T$), so that equation (112) becomes: $L_{Fd}^B = L_{Fd-1}^B + [\Delta I + \Delta IN] - NPL$.

Regarding other liabilities, it must be mentioned that, although the beginning of period investment is mostly financed by retained earnings (see equation 98 − e.g. $\psi_U \geq 90\%$), new issues of other debt and equity ($OD \,\&\, E_F$ − equation 113) are required to finance the remaining part ($1-\psi_U$). Moreover, firms structure their portfolio of other debt and equity taking into account their preference for liquidity (i.e. their preference for longer periods) and the corresponding interest rates they pay. This is captured by equations (114) to (116) which determine the supply of commercial paper ($B_{F,s}$), corporate bonds ($BL_{F,s}$) and equities ($e_{F,s}$).

Commercial paper is supplied on demand, implying qualified firms are able to set their rates (r_{BF}) above the bank CD's rate ($\Omega_{BF} \succ 0$) but below the loans rate. Yet, the yield on corporate bonds (r_{BLF-1}), and equities (r_{K-1}), is determined by liquidity preference. Therefore, firms set quantities and take prices. The usual adding up constraints apply to determine the best mix of long-term corporate liabilities, implying: $\psi_{1,0}^F + \psi_{2,0}^F = 1$, and $\psi_{1,j}^F + \psi_{2,j}^F = 0$ for $j = 1,2$.

All coefficients accompanying the yields are positive except in the particular case of the liability's own rate of interest ($\psi_{i,j}^F \succ 0$ for all $i \neq j = 1,2$) in which case are negative

($\psi^{F}_{i,j} \prec 0$ for all $i = j$), implying the supply of a particular liability decreases with its own rate of interest and increases with the rate paid on the substitute.

Finally, equations (118) to (122) define the gross risk premium, rates of interests and equilibrium conditions in the markets for corporate bonds (equations 118 to 120) and equities (equations 121 to 122).

Notice, short-term and long-term interest rates are exogenous, as the price of T-bills and T-bonds are set by the authorities through coordination of monetary and fiscal policies. Yet, private long-term interest rates involve premiums which are market-determined by liquidity preference for local and foreign currency. In short, money is endogenous because all major interest rates are fixed by the authorities, but still liquidity preference and uncertainty have a significant role to play.

III.A.3 Households

Consumption and Real Investment Decisions

$$YP^{H} = WB + FD^{H}_{F} + FD^{H}_{B} + RT^{H} \qquad \text{Households' personal income;} \quad (123)$$

$$\begin{aligned} RT^{H} = {} & r_{M-1} \cdot M2^{H}_{d-1} + r_{BG-1} \cdot B^{H}_{G,d-1} + r_{BB-1} \cdot B^{H}_{B,d-1} \\ & + r_{BF-1} \cdot B^{H}_{F,d-1} + BL^{H}_{G,d-1} + BL^{H}_{F,d-1} \\ & + xr \cdot [\$BL^{H}_{G-row,d-1}] \end{aligned} \qquad \text{Households' rent receipts;} \quad (124)$$

$$T_{H} = \theta_{H} \cdot YP^{H} \qquad \text{Households' income tax;} \quad (125)$$

$$YD^{H}_{r} = YP^{H} - T_{H} \qquad \text{Regular disposable income;} \quad (126)$$

$$YD^{H}_{hs} = YD^{H}_{r} + CG^{H} \qquad \text{Haig-Simons disp. income;} \quad (127)$$

$$CG^H = \Delta pbl_G \cdot BL^H_{G,d-1} + \Delta pbl_F \cdot BL^H_{F,d-1} + \Delta pe_F \cdot e^H_{F,d-1} + \Delta OF^H_B + \$BL^H_{G-row,d-1} \cdot [\Delta xr \cdot \$pbl_{G-row} + \Delta\$pbl_{G-row} \cdot xr_{-1}]$$ Capital gains of households; (128)

$$V^H = V^H_{-1} + YD^H_{hs} - C$$ Households' nominal wealth; (129)

$$v^H = V^H \big/ pd$$ Household's real wealth; (130)

$$C = pd \cdot c$$ Nominal consumption; (131)

$$c = \alpha_{1,c} \cdot yd^e_r + \alpha_{2,c} \cdot v^H_{-1}$$ Real consumption; (132)

$$yd^e_r = \varepsilon_H \cdot yd^H_r + (1-\varepsilon_H) \cdot yd^H_{r-1} \cdot (1+gr_{pr})$$ Exp. real regular disp. income; (133)

$$yd^H_r = (YD^H_r \big/ pd) - (\pi \cdot V^H_{-1} \big/ pd)$$ Real regular disp. income; (134)

Equation (123) defines households' personal income (YP^H) as the sum of wage bill (WB), corporate and bank dividends (FD^H_F, FD^H_B − equations 99 and 169) and rents (RT^H − equation 124) from holdings of saving account deposits ($M2^H_d$), T-bills ($B^H_{G,d}$), bank CDs ($B^H_{B,d}$), commercial paper ($B^H_{F,d}$), T-bonds ($BL^H_{G,d}$), corporate bonds ($BL^H_{F,d}$) and foreign government bonds ($\$BL^H_{G-row,d}$).

For simplicity, it is assumed households' income tax payments (T_H) are a fraction of personal income (θ_H − equation 125). Their nominal regular disposable income (YD^H_r) is given by equation (126), a value to which capital gains (CG^H − equation 128) must be added in order to obtain the Haig-Simons income of households (YD^H_{hs} − equation 127).

Revaluations are due to price changes of local and foreign currency bonds and equities, currency depreciations/appreciations (Δxr), and changes in bank own funds (ΔOF_B^H).

As indicated by equation (129), households' nominal wealth evolves in line with savings ($YD_{hs}^H - C$). Households' consumption and investment decisions are taken in real terms. Real consumption (c), as indicated by equation (132) depends on the expected regular disposable income of households (yd_r^e) and the real value of their beginning of period stock of wealth (v_{-1}^H).

The real stock of wealth of households is given by equation (130) and the nominal value of consumption by equation (131). Households' expected real regular disposable income is a weighted average of past and current values, the former augmented by the secular trend in the growth rate of productivity (equation 133).

Equation (134) defines households' real regular disposable income (yd_r^H) as the deflated value of their nominal regular disposable income (YD_r^H / pd) minus the capital loss resulting from price inflation ($\pi \cdot V_{-1}^H / pd$).

Financial Considerations and portfolio decisions

$$\left\{ \begin{array}{l} \overbrace{M1_{B,d}^H}^{\text{inactive}}; M2_{B,d}^H; B_{G,d}^H; B_{B,d}^H; B_{F,d}^H; BL_{G,d}^H; BL_{F,d}^H; \mathrm{e}_{F,d}^H; \\ \$BL_{G-row,d}^H \end{array} \right\} \quad \text{Asset eqs. (Appendix 2);} \quad (135\text{-}142)$$

$$\begin{aligned} M1_h^H = {} & V_{mfa}^H - M2_{B,d}^H - B_{G,d}^H - B_{B,d}^H - B_{F,d}^H \\ & - pbl_G \cdot BL_{G,d}^H - pbl_F \cdot BL_{F,d}^H - pe_F \cdot \mathrm{e}_{F,d}^H \\ & - xr \cdot [\$pbl_{G-row} \cdot \$BL_{G-row,d}^H] \end{aligned} \quad \text{CA deposits as a residual;} \quad (143)$$

$$Cash^{H}_{CB,d} = \lambda^{H}_{Cash} \cdot C \qquad \text{Households' demand for cash;} \quad (144)$$

$$V^{H}_{mfa} = V^{H} - Cash^{H}_{CB,d} - OF^{H}_{B} \qquad \text{Marketable financial assets;} \quad (145)$$

Equations (135) to (142), described below, are the asset management equations of households. In line with equation (143), actual holdings of current account deposits often differ from the desired level demanded by households ($M1^{H}_{B,h} - M1^{H}_{B,d}$). This is because, in practice, the expected income of households is never equal to their actual income. Thus, current account deposits act as a buffer stock, absorbing any discrepancies between the two values (equation 143). Instead, households' demand for cash (equation 144) and other assets is always realized. Indeed, cash holdings are assumed to be a fixed fraction of nominal consumption (λ^{H}_{Cash}), and the value of households' marketable financial assets a residual: that part of households' assets (V^{H}) not invested in cash or retained by banks (equation 145).

Asset Management Decisions

It is assumed government and central bank decisions only respond to concerns regarding economic growth, stability and welfare. But, for the private sector, speculative motives and liquidity preference play a crucial role, affecting their choices among diverse marketable financial assets.

Households hold all sort of marketable financial assets except for central bank bills ($B^{H}_{CB} = 0$). Notice that if *i* and *j* represent, respectively, rows (marketable financial assets)

and columns (yields), then the coefficients of the λ_{exog} vector ($\lambda^{H}_{i,o}$) represent the exogenous component in the households' demand function for a particular asset.

All other coefficients ($\lambda^{H}_{i,j} \neq \lambda^{H}_{i,0}$) represent endogenous components. In particular, the coefficients on the diagonal of the 9x9 λ_{endog} matrix ($\lambda^{H}_{i,j} \succ 0$ for $i = j \leq 9$) are all positive and reflect the effect caused by the asset's own yield, while all the off-diagonal coefficients ($\lambda^{H}_{i,j} \prec 0$ for $9 \geq i \neq j \leq 9$) are negative and reflect the effect caused when the yields of substitute assets change. Finally, the last vector of coefficients ($\lambda^{H}_{i,10}$) reflects the sensitivity of the asset demand functions to changes in the sector's disposable income[56].

Notice the set of equations reflects the exogenous and endogenous components that affect the preference for moneyness (rows 1 and 2), but also the preference for liquidity in both local currency (rows 1 to 8) and foreign currency (row 9), or what accounts to the same, here, the preference for local and foreign assets (e.g. the country risk, political risk, etc.).

[56] For instance, take the households' second asset demand function, $M2^{H}_{B,d}$. $\lambda^{H}_{2,0}$ is the exogenous component reflecting household preferences for liquidity that in the form of saving account deposits they wish to hold. $\lambda^{H}_{2,1}$ reflects how much the households' demand for saving account deposits changes when the rate of interest paid on that type of deposits (r_M) changes, $\lambda^{H}_{2,3}$ reflects how much it varies when the rate paid on government (treasury) bills (r_{BG}) is modified and, finally, $\lambda^{H}_{2,19}$ is the transactional demand for saving account deposits.

$$\begin{bmatrix} M1^H_{B,d}/V^H_{mfa-1} \\ M2^H_{B,d}/V^H_{mfa-1} \\ B^H_{G,d}/V^H_{mfa-1} \\ B^H_{B,d}/V^H_{mfa-1} \\ B^H_{F,d}/V^H_{mfa-1} \\ pbl_G \cdot BL^H_{G,d}/V^H_{mfa-1} \\ pbl_F \cdot BL^H_{F,d}/V^H_{mfa-1} \\ pe_F \cdot e^H_{F,d}/V^H_{mfa-1} \\ \dfrac{xr_{-1} \cdot \$pbl_{G-row} \cdot \$BL^H_{G-row,d}}{V^H_{mfa-1}} \end{bmatrix} = \begin{bmatrix} \lambda^H_{1,0} \\ \lambda^H_{2,0} \\ \lambda^H_{3,0} \\ \lambda^H_{4,0} \\ \lambda^H_{5,0} \\ \lambda^H_{6,0} \\ \lambda^H_{7,0} \\ \lambda^H_{8,0} \\ \lambda^H_{9,0} \end{bmatrix} + \begin{bmatrix} \lambda^H_{1,1} \dots \lambda^H_{1,9} \\ \lambda^H_{2,1} \dots \lambda^H_{2,9} \\ \lambda^H_{3,1} \dots \lambda^H_{3,9} \\ \lambda^H_{4,1} \dots \lambda^H_{4,9} \\ \lambda^H_{5,1} \dots \lambda^H_{5,9} \\ \lambda^H_{6,1} \dots \lambda^H_{6,9} \\ \lambda^H_{7,1} \dots \lambda^H_{7,9} \\ \lambda^H_{8,1} \dots \lambda^H_{8,9} \\ \lambda^H_{9,1} \dots \lambda^H_{9,9} \end{bmatrix} \times \begin{bmatrix} 0 \\ r_{M-1} \\ r_{BG-1} \\ r_{BB-1} \\ r_{BF-1} \\ r_{BLG-1} \\ r_{BLF-1} \\ r^F_{K-1} \\ \left[\dfrac{xr^e \cdot (1+\$r_{BLG-row-1})}{xr_{-1}} - 1\right] \end{bmatrix} + \begin{bmatrix} \lambda^H_{1,10} \\ \lambda^H_{2,10} \\ \lambda^H_{3,10} \\ \lambda^H_{4,10} \\ \lambda^H_{5,10} \\ \lambda^H_{6,10} \\ \lambda^H_{7,10} \\ \lambda^H_{8,10} \\ \lambda^H_{9,10} \end{bmatrix} \times \frac{YD^H_r}{V^H_{mfa-1}}$$

$$\underset{[9\times 1]}{A} \qquad \underset{[9\times 1]}{\lambda_{exog}} \qquad \underset{[9\times 9]}{\lambda_{endog}} \qquad \underset{[9\times 1]}{\rho} \qquad \underset{[9\times 1]}{\tau}$$

III.A.4 Commercial Banks

Monetary and credit aggregates

$$B\,\mathrm{Res}^B_{CB,d} = \rho^{B\,\mathrm{Res}}_{M1} \cdot M1_{B,s} + \rho^{B\,\mathrm{Res}}_{M2} \cdot M2_{M,s} + \rho^{B\,\mathrm{Res}}_{B,s} \cdot B_{B,s}$$ Bank reserve requirements; (146)

$$M1_{B,s} = M1^H_{B,h} + M1^G_{B,d}$$ CA dep. supplied on demand; (147)

$$M2_{B,s} = M2^H_d$$ SA dep. supplied on demand; (148)

$$B_{B,s} = B^H_{B,d}$$ CDs supplied on demand; (149)

$$B^B_{G,s} = B_{G,s} - B^H_{G,s} - B^{CB}_{G,s}$$ Supply of T-bills to banks; (150)

$$B^B_{G,s} = B^B_{G,h}$$ The redundant equation; (150-A)

$$B^B_{G,h} = OF_B + M1_{B,s} + M2_{B,s} + B_{B,s} + L^{CB}_{B,d} - B\,\mathrm{Res}^B_{CB,d} - L^B_{F,s} - B^B_{CB,h} - xr \cdot \$B^B_{G-row,h}$$ Holding of T-bills (residual); (151)

$$B^B_{CB,h} = B^B_{CB,s}$$ Holding of CB bills (CDs); (152)

$$\$B^B_{G-row,h} = \rho\$^B_{\max} \cdot OF_B / xr$$ Holding of foreign T-bills; (153)

$$OF_{mfaB} = OF_B + M1_{B,s} + M2_{B,s} + B_{B,s} + L^{CB}_{B,d} - B\,\mathrm{Re}s^{B}_{CB,d} - L^{B}_{F,s}$$ Banks' speculative assets; (154)

$$r_M = r_{BG} - \Omega_M$$ Interest rate on SA deposits; (155)

$$r_{BB} = r_{BG} + \Omega_{BB} + \varsigma_{BB} \cdot (\mathrm{z}_{14} - \mathrm{z}_{15})$$ Interest rate on CDs; (156)

$$\mathrm{z}_{14} = 1 \;\text{ iff }\; NBSR_{-1} \prec \rho^{B}_{bottom}$$ CDs' rate reaction dummies; (157)

$$\mathrm{z}_{15} = 1 \;\text{ iff }\; NBSR_{-1} \succ \rho^{B}_{top}$$ CDs' rate reaction dummies; (158)

$$NBSR = (B^{B}_{G,h} + B^{B}_{CB,h} - L^{CB}_{B,d}) \big/ (M1_s + M2_s + B_{B,s})$$ Net secondary reserves ratio; (159)

$$L^{CB}_{B,d} = [\rho^{B}_{bottom} \cdot (M1_{B,s} + M2_{B,s} + B_{B,s})] \cdot \mathrm{z}_{16} - [(B^{B}_{G,h} + B^{B}_{CB,h} - L^{CB}_{B,d})] \cdot \mathrm{z}_{16}$$ Discount operations function; (160)

$$\mathrm{z}_{16} = 1 \;\text{ iff }\; NBSR \prec \rho^{B}_{bottom}$$ Discount operation dummy; (161)

$$BSR = (B^{B}_{G,h} + B^{B}_{CB,h}) \big/ (M1_{B,s} + M2_{B,s} + B_{B,s})$$ Gross secondary reserves ratio; (162)

$$L^{B}_{F,s} = L^{B}_{F,d}$$ Corporate loans on demand; (163)

Banks hold base money reserves ($B\,\mathrm{Re}s^{B}_{CB,d}$) against current account deposits ($M1_{B,s}$), saving account deposits ($M2_{B,s}$), and deposit certificates ($B_{B,s}$), at the rates required by the central bank ($\rho^{B\mathrm{Re}s}_{M1}$; $\rho^{B\mathrm{Re}s}_{M2}$; $\rho^{B\mathrm{Re}s}_{B}$ – equation 146). But, money is endogenous because banks accommodate the demand for both types of deposits (equations 147-148) and CDs (equation 149).

Here, it is assumed banks purchase all central bank bills exogenously supplied by the monetary authority (equation 152), although the overall process of compensation and

absorption of base money is endogenous due to the banks' balance sheet constraint, explained below (not only private money, but also the State's money is endogenous).

Banks' speculative/marketable assets (OF_{mfaB} − equation 154) are composed of T-bills ($B^B_{G,h}$), central bank bills ($B^B_{CB,h}$), and foreign government bills ($\$B^B_{G-row,h}$), the latter assumed to be legally constrained (by capital controls) and, hence, held in proportion to bank's own funds (e.g. $\rho\$^B_{\max}$ is set relatively low by the authorities).

Banks set the rate of interest on saving account deposits (r_M − equation 155) as a fixed mark-down (Ω_M) below the T-bills rate (r_{BG}). In addition to base money reserves, they hold secondary reserves of T-bills and central bank bills, so as to preserve a minimum net (of central bank advances) liquidity ratio ($NBSR \approx \rho^B_{bottom}$ − equation 159).

They cannot control directly the amount of bills they hold, as the latter is a balance-sheet residual/buffer stock (equation 151) the central bank accommodates once the demand from other sectors is satisfied (equation 150). Yet, the amount of T-bills held by banks is exactly equal to the amount supplied to them without there being an extra (or redundant) equation (such as 150-A) guaranteeing the equilibrium between the demand and supply. This is implied by the logical structure of our PK-SFC model, and confirmed by the results from our simulations: T-bills (base money substitutes) are endogenously supplied without there being any explicit equation. From the viewpoint of the PK-SFC methodology (Godley and Lavoie, 2007), this confirms that there are no black holes in the model.

Notice, however, banks do have an indirect influence upon the amount of bills they hold. In the short-run, when their holdings are below the minimum ($z_{16}=1$ − equation 161), banks resort to discount operations ($L^{CB}_{B,d}$ − equation 160), while, in the long-run, they adjust their rates on CDs above or below the T-bills rate (equations 156 to 158).

Resembling the case of the central bank and its foreign reserve holdings, banks increase the mark-up ($\Omega_{BB}+\varsigma_{BB}\cdot(z_{14}-z_{15})$) on the CD's rate ($r_{BB}$) (above the T-bills rate − r_{BG}) when their net liquidity ratio is below the minimum ($z_{14}=1$), while the opposite occurs when it is above target ($z_{15}=1$). Equation (162) defines the gross liquidity ratio of banks (BSR), as the latter accommodate the firms' demand for credit (equation 163), and set average rates on loans in line with a variable spread explained below.

Spreads and lending rates

$$r_L = r_M + spread$$ Interest rate on loans; (164)

$$OF^T_B = NCAR\cdot L^B_{s-1}$$ Long-run own funds target; (165)

$$OF^e_B = OF_{B-1}+\beta_B\cdot(OF^T_B - OF_{B-1})$$ Short-run own funds target; (166)

$$FU^T_B = (OF^e_B - OF_{B-1}) + npl^e\cdot L^B_{s-1}$$ Banks' retained earnings target; (167)

$$npl^e = \varepsilon_B\cdot npl^e_{-1}+(1-\varepsilon_B)\cdot npl_{-1}$$ Exp. non-performing loans; (168)

$$FD^H_B = \lambda_B\cdot Y_{-1}$$ Dividends of banks; (169)

$$F^T_B = (FU^T_B + FD_B)$$ Net target profits of banks; (170)

$$F_B = BTF_B - T_B$$ Bank's net profits; (171)

$$BTF_B = r_{BG-1} \cdot B^B_{G,d-1} + r_{BCB-1} \cdot B^B_{CB,h-1} + xr \cdot [\$r_{BG-row-1} \cdot \$B^B_{G-row,h-1}] + r_{L-1} \cdot (L^B_{s-1} - NPL) - [r_{M-1} \cdot M2_{B,s-1} + r_{BB-1} \cdot B_{B,s-1} + r^{CB}_{L-1} \cdot L^{CB}_{B,d-1}]$$ Banks's gross profits; (172)

$$T_B = \theta_B \cdot BTF_B$$ Banks' income tax payments; (173)

$$\{spread\}$$ Spread (See below); (174)

$$FU_B = F_B - FD_B$$ Actual retained earnings; (175)

$$YD^B_{hs} = FU_B + \Delta xr \cdot \$B^B_{G-row,h-1}$$ Haig-Simons disp. income; (176)

$$OF_B = OF_{B-1} + YD^B_{hs} - NPL$$ Own funds of banks; (177)

$$CAR = \frac{OF_B}{L^B_s}$$ Actual capital adequacy ratio; (178)

Loan-Deposit spread

Spread; (174)

$$spread = \frac{[F^T_B / (1-\theta_B)] - [r_{BG-1} \cdot B^B_{G,d-1} + r_{BCB-1} \cdot B^B_{CB,h-1}] - xr^e \cdot [\$r_{BG-row-1} \cdot \$B^B_{G-row,h-1}] + r_{M-1} \cdot [(M2_{B,s-1} - L^B_{s-1} \cdot (1-npl^e)] + r_{BB-1} \cdot B_{B,s-1} + r^{CB}_{L-1} \cdot L^{CB}_{B,d-1}}{(1-npl^e) \cdot L^B_{s-1}}$$

Banks set the interest rate on loans (r_L − equation 164) in line with the spread ($spread$) they require to accumulate sufficient funds so as to absorb credit losses arising from defaulting loans (npl^e − equation 168) as well as to comply with capital adequacy ratios (CAR − equation 178), which are usually imposed by the domestic central bank or the Basel Committee on Bank Supervision (BCBS). But also, banks must payoff "desirable" amounts of dividends (FD^H_B − equation 169) to their owners (Godley and Lavoie, 2007).

In compliance with the capital adequacy ratio requirement, equation (165) defines the long-run own funds-target of banks (OF_B^T). They accumulate at least a minimum fraction ($NCAR-$ e.g. 8%) of their total value at risk, including among risky assets their loans. However, here, as in Godley and Lavoie (2007), it is assumed banks do not attempt to reach the target ratio instantaneously, but in a partial manner ($\beta_B \prec 1$). This is captured by equation (166) which describes their short-run target (OF_B^e). To accumulate own funds, banks must retain part of their profits (FU_B^T- equation 167), while taking into account their expectations regarding the evolution of defaulting loans (npl^e- equation 168).

Equation (169) tells us that, once banks' retained profits target (FU_B^T) is known, they can calculate their target amount of total profits (F_B^T- equation 170), taking into account dividend payments (FD_B^H) and the tax rate (θ_B). For simplicity, it has been assumed banks' dividend payoffs depend on certain given fraction (λ_B) of the beginning of period-total product of the domestic economy (equation 169).

Equation (172) and (173) define, respectively, the before tax profits of banks (BTF_B) and their tax payments (T_B), the former depending on net interest from holdings of T-bills ($B_{G,h}^B$), central bank bills ($B_{CB,h}^B$), foreign government bills ($\$B_{G-row,h}^B$), and the issue of loans ($L_s^B - NPL$), deposits ($M2_{B,s}$), CDs ($B_{B,s}$), and discount window liabilities ($L_{B,d}^{CB}$). By equating their total expected profits with their profit targets, banks determine the spread between their loan and deposit rates, taking into account the interest receipts and payments from their asset holdings and liability issues (equation 174).

Equation (175) defines actual retained earnings as the difference between after tax profits (F_B − equation 171) and distributed profits. The banks' Haig-Simons disposable income (YD^B_{hs}), which also depends on exchange rate revaluations, is defined by equation (176). The actual own funds of banks (equation 177) increase in line with their Haig-Simons disposable income and diminish with the actual amount of defaulting loans (NPL). Finally, equation (178) defines the actual capital adequacy ratio (CAR).

III.A.5 Rest of the World

$$x = \varepsilon_0 - \varepsilon_1 \cdot (px_{-1} / (xr_{-1} \cdot py^{row}_{-1})) + \varepsilon_2 \cdot y_{row}$$ Volume of exports (*logs*); (179)

$$y_{row} = y_{row-1} \cdot (1 + gr_{y-row})$$ Growth in the ROW; (180)

$$py^{row} = py^{row}_{-1} \cdot (1 + \pi^{row})$$ Rate of price inflation ROW; (181)

$$X = px \cdot x$$ Value of exports; (182)

$$pm = py^{row}$$ Price of imports; (183)

$$M = xr \cdot pm \cdot m$$ Value of imports; (184)

$$TA_{row} = X - M$$ Trade Account; (185)

$$CA_{row} = TA_{row} + NRT_{row}$$ Current Account; (186)

$$NRT_{row} = xr \cdot [\$r_{BG-row-1} \cdot \$B_{G-row,s-1} + \$BL_{G-row,s-1}] - RT_{row}$$ Net rent transfers to ROW; (187)

$$RT_{row} = xr \cdot \$BL^{row}_{G,d-1}$$ Rents paid to ROW; (188)

$$\$B_{G-row,s} = \$B^{CB}_{G-row,h} + \$B^{B}_{G-row,h}$$ ROW's supply of *fc* govt. bills; (189)

$$\$BL^{H}_{G-row,s} = \$BL^{H}_{G-row,d}$$ ROW's supply *fc* govt. bonds; (190)

$$\$r_{BG-row} = \$r^{T}_{BG-row}$$ ROW's rate on treasury bills; (191)

$$\$r_{BLG-row} = \$r^{T}_{BLG-row}$$ ROW's rate on treasury bonds; (192)

$$\$pbl_{G-row} = (1/\$r_{BLG-row})$$ ROW's price of treasury bonds; (193)

$$\begin{aligned}\$pbl_{G} \cdot \$BL^{row}_{G,d} &= \$pbl_{G-1} \cdot \$BL^{row}_{G,d} \\ &+ [z_7 \cdot z_9 \cdot z_{10}] \times \\ &[\lambda^{row}_{1,0} + \lambda^{row}_{1,1} \cdot \$rbl_{G-1} + \lambda^{row}_{1,2} \cdot \$rbl_{G-row-1}] \times \\ &[py^{row}_{-1} \cdot y_{row-1} \cdot gr_{y-row}]\end{aligned}$$ ROW's demand for T-bonds; (194)

$$\begin{aligned}CG_{row} &= \Delta xr \cdot [\$B_{G-row,s-1}] \\ &- \$BL^{row}_{G,d-1} \cdot [\Delta xr \cdot \$pbl_{G} + \Delta\$pbl_{G} \cdot xr_{-1}] \\ &+ \$BL_{G-row,s-1} \cdot [\Delta xr \cdot \$pbl_{G-row} + \Delta\$pbl_{G-row} \cdot xr_{-1}]\end{aligned}$$ Capital gains from ROW; (195)

$$NIR = GIR$$ Net international reserves; (196)

$$\begin{aligned}FA^{PS}_{row} &= -xr \cdot \Delta\$B^{B}_{G-row,h} \\ &- xr \cdot \$pbl_{G-row} \cdot \Delta\$BL^{H}_{G-row,d}\end{aligned}$$ Private financial account; (197)

$$MA_{row} = -xr \cdot \Delta\$B^{CB}_{G-row,h}$$ Monetary account; (198)

$$xr^{e} = xr_{endog-1} \cdot (1 + rbl_{G-1}) \big/ (1 + \$rbl_{G-1})$$ Expected exchange rate (avg.); (199)

Equation (179) is the total volume of exports (x), which depends on an exogenous component (ε_0), relative prices ($px_{-1} \big/ (xr_{-1} \cdot py^{row}_{-1})$) and the level of real income of the rest of the world (y_{row}). For simplicity, real output (y_{row}) and prices (py^{row}) in the ROW are assumed to grow at exogenously given rates (gr_{y-row} and π^{row} − equations 180-181); that is, independently of the growth rate and inflation rate of the REE. Equations (182) and (183) are, respectively, nominal exports (X) and the price of imported goods (pm), while equation (184) is nominal imports (M − with the volume given by equation 4).

The trade account (TA_{row}) and current account (CA_{row}) balances are defined, respectively, by equations (185) and (186). Equation (187) defines net rent transfers received from abroad (NRT_{row}) as receipts of interest and income property rents from the rest of the world minus payments of interest and rents to the rest of the world (RT^{row} − equation 188). Thus, apart from the corresponding rates, receipts depend on holdings of foreign bills ($\$B_{G-row,s}$) and bonds ($\$BL_{G-row,s}$), while payments depend on the treasury's policy regarding foreign debt ($\$BL^{row}_{G,d}$). Recall, the authorities of REEs must choose between issuing additional foreign currency debt (if necessary, $z_7 \cdot z_{10} = 1$, and possible, $z_9 = 1$) and letting the exchange rate float ($z_{10} = 0$). Nonetheless, the price of foreign currency government bonds is determined ($\$pbl_G$ − equation 194) by international markets depending on exogenous factors ($\lambda^{row}_{1,0}$), interest rate differentials ($\$rbl_G$; $\$rbl_{G-row}$) and the nominal growth rate of the ROW ($py^{row}_{-1} \cdot y_{row-1} \cdot gr_{y-row}$).

Foreign government bills and bonds ($\$B^{CB}_{G-row,s}$; $\$BL^{H}_{G-row,s}$) are supplied on demand to the domestic economy (equations 189-190), at the exogenously administered rates paid by foreign governments ($\$r_{BG-row}$; $\$r_{BLG-row}$ − equations 191 and 192), with the price of foreign government bonds ($\$pbl_{G-row}$) being the inverse of their yield ($\$r_{BLG-row}$). Finally, equations (195) to (199) define, respectively, the capital gains with the ROW (CG_{row}), the net value of international reserve assets − (NIR −foreign reserve liabilities are null), the private account (FA^{PS}_{row}) and monetary account (MA^{PS}_{row}) of the BoP, and the expected exchange rate (xr^e − a function of interest rate differentials and the shadow rate, xr_{endog}).

Table III.1. The Balance Sheet Matrix of a REE

	Domestic Economy					**Relations with the Rest of the World**	**Balance**
	Firms	**Households**	**Banks**	**CB**	**Gov**	**F, H, B, CB, Gov**	
Real Assets							
Inventories	IN						IN
Fixed Capital	K						K
***Lc* Financial Assets**							
Cash		$Cash_{CB}^{H}$		$-Cash_{CB}^{H}$			0
Bank Reserves			$BRes_{CB}^{B}$	$-BRes_{CB}^{B}$			0
Government Dep. in CB				$-GD_{CB}^{G}$	GD_{CB}^{G}		0
Current Account Deposits		$M1_{B}^{H}$	$-M1_{B}$		$M1_{B}^{G}$		0
Saving Account Deposits		$M2_{B}^{H}$	$-M2_{B}^{H}$				0
Government Bills		B_{G}^{H}	B_{G}^{B}	B_{G}^{CB}	$-B_{G}$		0
Central Bank Bills, CDs			B_{CB}^{B}	$-B_{CB}^{B}$			0
Bank Bills, CDs		B_{B}^{H}	$-B_{B}^{H}$				0
Firm Bills, Comm. Paper	$-B_{F}^{H}$	B_{F}^{H}					0
Government Bonds		$BL_{G}^{H}*pbl_{G}$			$-BL_{G}^{H}*pbl_{G}$		0
Corporate (Firm) Bonds	$-BL_{F}^{H}*pbl_{F}$	$BL_{F}^{H}*pbl_{F}$					0
Credit Loans	$-L_{F}^{B}$		L_{F}^{B}				0
Lender of Last Resort			$-L_{B}^{CB}$	L_{B}^{CB}			0
Firm Equities	$-e_{F}*pe_{F}$	$e_{F}^{H}*pe_{F}$					0
Bank Capital		OF_{B}^{H}	$-OF_{B}^{H}$				0
***Fc* Financial Assets**							
Foreign Government Bills			$xr*\$B_{G\text{-}row}^{B}$	$xr*\$B_{G\text{-}row}^{CB}$		$-xr*\$B_{G\text{-}row}$	0
Foreign Government Bonds		$xr*\$BL_{G\text{-}row}^{H}$ $*\$pbl_{G\text{-}row}$				$-xr*\$BL_{G\text{-}row}^{H}$ $*\$pbl_{G\text{-}row}$	0
Domestic (Sovereign) Government Bonds					$-xr*\$BL_{G}$ $*\$pbl_{G}$	$xr*\$BL_{G}^{row}$ $*\$pbl_{G}$	0
Balance	V^{F}	V^{H}	0	V^{CB}	V^{G}	V^{row}	-(IN+K)
Sum	0	0	0	0	0	0	0

Table III.2. Revaluation Matrix of a REE

	Domestic Economy					Relations with the Rest of the World	Balance
	Firms	**Households**	**Banks**	**CB**	**Gov**	**F, H, B, CB, Gov**	
Real Assets							
Fixed Capital	$\Delta pd*k_{-1}$						$\Delta pd*k_{-1}$
***Lc* Financial Assets**							
Government Bonds		$\Delta pbl_G*BL_{G-1}^{H}$			$-\Delta pbl_G*BL_{G-1}^{H}$		0
Firm Bonds	$-\Delta pbl_F*BL_{F-1}^{H}$	$\Delta pbl_F*BL_{F-1}^{H}$					0
Firm Equities	$-\Delta pe_F*e_{F-1}^{H}$	$\Delta pe_F*e_{F-1}^{H}$					0
Bank Capital		$\{\Delta OF_B^{H}\}$	$\{-\Delta OF_B^{H}\}$				0
***Fc* Financial Assets**							
Foreign Gov Bills			$\Delta xr*\$B_{G-row-1}^{B}$	$\Delta xr*\$B_{G-row-1}^{CB}$		$-\Delta xr*\$B_{G-row-1}$	0
Foreign Gov Bonds		$\$BL_{G-row-1}^{H}$ * [$(\Delta xr*\$pbl_{G-row})$ + $(\Delta\$pbl_{G-row}*xr_{-1})$]				$-\$BL_{G-row-1}^{H}$ * [$(\Delta xr*\$pbl_{G-row})$ + $(\Delta\$pbl_{G-row}*xr_{-1})$]	0
Domestic (Sovereign) Government Bonds					$-\$BL_{G-1}^{row}$ * [$(\Delta xr*\$pbl_G)$ + $(\Delta\$pbl_G*xr_{-1})$]	$\$BL_{G-1}^{row}$ * [$(\Delta xr*\$pbl_G)$ + $(\Delta\$pbl_G*xr_{-1})$]	0

Table III.3. Transaction Matrix of a REE

	Domestic Economy										**Row**		**Balance**
	Firms		**Households**		**Banks**		**CB**		**Gov**		**F, H, B, CB, Gov**		
	Cur	**Cap**	**Cur**	**Cap**	**Cur**	**Cap**	**Cur**	**Cap**	**Cur**	**Cap**	**Cur**	**Cap**	
Income process													
Consumption	C		-C										0
Gov Expend.	G								-G				0
Fixed Investment	I	-I											0
Inventory Acc.	ΔIN	-ΔIN											0
Exports	X										-X		0
Imports	$-M$										M		0
GDP	$\boldsymbol{Y}$												**0**
Wages	$-WB$		WB										0
Inventory Financing Cost	$-r_{L-1}$ $*IN_{-1}$				r_{L-1} $*IN_{-1}$								0
Entrepreneurial Profits	$-F_F$	$\mathbf{FU_F^F}$	FD_F^H $+r_{BF-1}$ $*B_{F-1}^H$ $+BL_{F-1}^H$		$r_{L-1}*[L_{F-1}^B$ $- IN_{-1} - NPL]$				T_F				0
Bank profits			$FD_B^H + r_{M-1}$ $*M2_{B-1}^H$ $+r_{BB-1}$ $*B_{B-1}^H$		$-F_B$	$\mathbf{FU_B^B}$			T_B				0
CB profits							$-F_{CB}$	**0**	F_{CB}^G				0
CB net rent payments					$-r_{LCB-1}$ $*L_{B-1}^{CB}$ $+r_{BCB-1}$ $*B_{CB-1}^B$		r_{LCB-1} $*L_{B-1}^{CB}$ $-r_{BCB-1}$ $*B_{CB-1}^B$						0
Income Tax			$-T_H$						T_H				0

Table III.3. Transaction Matrix of a REE (Continued)

	Domestic Economy										Row		Balance
	Firms		Households		Banks		CB		Gov		F, H, B, CB, Gov		
	Cur	Cap	Cur	Cap	Cur	Cap	Cur	Cap	Cur	Cap	Cur	Cap	
Rent Transfers													
***Fc* Fin Assets**													
Government net rent payments			r_{BG-1} $*B_{G-1}^{H}$ $+BL_{G-1}^{H}$		r_{BG-1} $*B_{G-1}^{B}$		r_{BG-1} $*B_{G-1}^{CB}$		$-r_{BG-1}$ $*B_{G-1}$ $-BL_{G-1}^{H}$				0
Net rent payments to ROW			$xr*$ $\$BL_{G\text{-}row\text{-}1}^{H}$		xr $*\$r_{BG*-1}$ $*\$B_{G\text{-}row\text{-}1}^{B}$		xr $*\$r_{BG*-1}$ $*\$B_{G\text{-}row\text{-}1}^{CB}$		$-xr*$ $\$BL_{G-1}^{row}$		$-xr$ $*\$r_{BG*-1}$ $*[\$B_{G\text{-}row\text{-}1}^{CB}$ $+\$B_{G\text{-}row\text{-}1}^{B}]$ $-xr$ $*\$BL_{G\text{-}row\text{-}1}^{H}$ $+xr$ $*\$BL_{G-1}^{row}$		0

Table III.3. Transaction Matrix of a REE (Continued)

	Domestic Economy										**Row**		**Balance**
	Firms		**Households**		**Banks**		**CB**		**Gov**		**F, H, B, CB, Gov**		
	Cur	**Cap**	**Cur**	**Cap**	**Cur**	**Cap**	**Cur**	**Cap**	**Cur**	**Cap**	**Cur**	**Cap**	
Household savings			$-YDr^H$ +C	**YDr^H -C**									0
Government Deficit									PSBR	**-PSBR**			0
Current account											CA_{row}	**$-CA_{row}$**	0
Stock Variations													
***Lc* Fin Assets**													
Cash				$-\Delta Cash_{CB}^H$				$\Delta Cash_{CB}^H$					0
Bank Reserves						$-\Delta BRes_{CB}^B$		$\Delta BRes_{CB}^B$					0
Gov. Dep. in CB								ΔGD_{CB}^G		$-\Delta GD_{CB}^G$			0
CA Deposits				$-\Delta M1_B^H$		$\Delta M1_B$				$-\Delta M1_B^G$			0
Saving Deposits				$-\Delta M2_B^H$		$\Delta M2_B^H$							0
Government Bills				$-\Delta B_G^H$		$-\Delta B_G^B$		$-\Delta B_G^{CB}$		ΔB_G			0
Central Bank Bills, CDs						$-\Delta B_{CB}^B$		ΔB_{CB}^B					0
Bank Bills, CDs				$-\Delta B_B^H$		ΔB_B^H							0
Firm Bills, Comm. Paper		ΔB_F^H		$-\Delta B_F^H$									0
Government Bonds				$-\Delta BL_G^H * pbl_G$						$\Delta BL_G^H * pbl_G$			0
Corporate (Firm) Bonds		$\Delta BL_F^H * pbl_F$		$-\Delta BL_F^H * pbl_F$									0
Credit Loans		ΔL_F^B				$-\Delta L_F^B$							0
Loan defaults		NPL				-NPL							0
Lender of Last Resort						ΔL_B^{CB}		$-\Delta L_B^{CB}$					0
Firm Equities		$\Delta e_F * pe_F$		$-\Delta e_F^H * pe_F$									0

Table III.3. Transaction Matrix of a REE (Continued)

	Domestic Economy										Row		Balance
	Firms		Households		Banks		CB		Gov		F, H, B, CB, Gov		
	Cur	Cap	Cur	Cap	Cur	Cap	Cur	Cap	Cur	Cap	Cur	Cap	
***Fc* Fin Assets**													
Foreign Govt. Bills						-xr $*\Delta\$B_{G\text{-}row}{}^{B}$		-xr $*\Delta\$B_{G\text{-}row}{}^{CB}$				xr $*\Delta\$B_{G\text{-}row}$	0
Foreign Govt. Bonds				-xr $*\Delta\$BL_{G\text{-}row}{}^{H}$ $*\$pbl_{G\text{-}row}$								xr $*\Delta\$BL_{G\text{-}row}{}^{H}$ $*\$pbl_{G\text{-}row}$	0
Domestic Govt. Bonds										xr $*\Delta\$BL_{G}$ $*\$pbl_{G}$		-xr $*\Delta\$BL_{G}{}^{row}$ $*\$pbl_{G}$	0
Sum	0	0	0	0	0	0	0	0	0	0	0	0	0

Table III.4. Endogenous Variables

Variable	Definition	Variable	Definition
$B_B^H{}_d$	Households' demand for bank CDs	$\$r_{BLG}$	Rate on sovereign debt
$B_{B,s}$	Banks' supply of CDs	$\$r_{BLG\text{-}row}$	Rate on foreign T-Bonds
$B_{CB}^B{}_h$	Banks' holdings of central bank CDs	$SDR	Sovereign debt ratio to GDP and exports
$B_{CB,s}$	Central bank's supply of CDs	FD^H_B	Dividends of banks
$B_F^H{}_d$	Households' demand for commercial paper	FD^H_F	Dividends of firms
$B_{F,S}$	Firms' supply of commercial paper	FP	Fiscal policy activist zone
$B_G^H{}_d$	Govt. bills demanded by households	FU_B	Retained earnings of banks
$B_G^B{}_h$	Govt. bills held by banks	FU^T_B	Target retained earnings of banks
$B_G^{CB}{}_h$	Govt. bills held by central bank	FU_F	Retained earnings of firms
B_{Gs}	Total supply of govt. bills	FU^T_F	Target retained earnings of firms
B^B_{Gs}	Govt. bills supplied to commercial banks	G	Govt. expenditures
B^{CB}_{Gs}	Govt. bills supplied to central bank	g	Real govt. expenditures
B^H_{Gs}	Govt. bills supplied to households	$GD^G_{CB,h}$	Govt. deposits at CB
$BL_F^H{}_d$	Households' demand for corporate bonds	$GD_{CB,s}$	Govt. deposits credited by central bank
$BL_{F,S}$	Supply of corporate bonds	GIR	Gross International Reserves
$BL_G^H{}_d$	Households' demand for govt. bonds	GIRR	GIR ratio
$BL_{G,s}$	Supply of govt. bonds	gr^G	Growth rate of real govt. expenditures
$BRes^B{}_d$	Bank reserves required by central bank	gr_k	Growth rate of real capital stock
$BRes_{CB,s}$	Bank reserves supplied to banks	HC^e	Expected historic cost
BSR	Gross bank secondary reserve ratio	I	Gross investment
BTF_B	Before tax profits of banks	i	Gross investment in real terms
BTF_F	Before tax profits of firms	IN	Stock of inventories at current costs
c	Real Consumption	in	Real inventories
CA_{row}	Current account balance with ROW	in^e	Target level of real inventories
CAR	Capital adequacy ratio of banks	in^T	Expected real inventories
$Cash^H{}_d$	Households' (i.e total) demand for cash	K	Capital stock
$Cash_{CB,s}$	Cash supplied to households	k	Real capital stock
CG^F	Capital gains of firms	$L^{CB}_{B,d}$	Discount operations function
CG^G	Capital gains of the govt.	$L^{CB}_{B,s}$	Supply of loans to banks
CG^H	Capital gains of households	LCD_G	Local currency govt. debt
CG_{row}	Capital gains with the rest of the world	$L^B_{F,d}$	Demand for bank loans by firms
χ^{CB}	Speed of adjustment desired level of NIR	L_s	Supply of loans to firms
C	Consumption at current prices	M	Imports
depA	Capital depreciation allowances	m	Actual real imports
$e^H_{F,d}$	Equities demanded by households	m^e	Expected real imports
$e_{F,s}$	Equities supplied by firms	$M1^G_{B,h}$	Current account dep. held by govt.
ER	Employment rate	$M1^H_{B,h}$	Current account dep. held by households
F_B	Realized banks profits	$M1_{B,s}$	Current account dep. supplied by banks
F_B^T	Target profits of banks	$M2^H_d$	Demand for saving account deposits
F_{CB}	Central bank "profits" passed to the govt.	$M2_{B,s}$	Saving account deposits supplied by banks
F_F	Realized gross entrepreneurial profits	MA_{row}	Monetary account balance
F^T_F	Planned entrepreneurial profits of firms	N	Employment level
FA^{PS}_{row}	Private financial account balance	N^T	Desired employment level
$\$B_G^B{}_{row,h}$	Banks' effective holdings of foreign T-Bills	NBSR	Net secondary reserves ratio
$\$B_G^{CB}{}_{row,h}$	Central bank's holdings of foreign T-Bills	NF_F	Realized after tax profits of firms
$\$B_{G\text{-}row,s}$	ROW's supply of foreign reserves	NIR	Net International Reserves
$\$BL_G^{row}{}_d$	ROW's demand for sovereign debt	NIRR	Net International Reserves ratio
$\$BL_{G\text{-}row}{}^H{}_d$	Households' demand for foreign T-bonds	NPL	Non Performing Loans
$\$BL_{G\text{-}row,s}$	ROW's supply of foreign T-bonds	npl^e	Expected fraction of Non Performing Loans
$\$BL_{G,s}$	Supply of foreign currency sovereign debt	NRT_G	Govt. net rent transfers
FCD_G	Foreign currency govt. debt	NRT_{row}	Net rent transfers to ROW
$\$\Omega_{BLG}$	Endogenous country risk premium	$OD\&E_{F,s}$	Firms' other debt and equity
$\$pbl_G$	Price of sovereign debt	OF^H_B	Own funds of banks
$\$pbl_{G\text{-}row}$	Price of foreign T-Bonds	$OF^{H\ e}_B$	Short-run target for banks' own funds
$\$r_{BG\text{-}row}$	Rate on foreign T-Bills	$OF^{H\ T}_B$	Long-run target for banks' own funds

Table III.4. Endogenous Variables (Continued)

Variable	Definition	Variable	Definition
OF_{mfaB}	Banks' speculative assets	W	Wage rate
Ω_{BLF}	Premium on corporate bonds	WB	Wage bill
Ω^T	Target real wage of workers	X	Exports
pbl_F	Endogenous price of corporate bonds	x	Real exports
pbl_G	Price of govt. bonds	xr	Foreign exchange rate
pd	Domestic Price level	xr^e	Expected foreign exchange rate
pe_F	Price of equities	xr_{endog}	Endogenous foreign exchange rate
φ	Actual mark-up	Y	Output at current prices (nominal GDP)
φ^T	Ideal mark-up	y	Real output
Π	Price inflation	y_{row}	Growth of real output in the ROW
pm	Price of imports	YD_{hs}^B	Banks' Haig-Simons disposable income
pr	Labor productivity	YD_{hs}^F	Firms' Haig-Simons disposable income
ps	Mark-up sales price	YD_{hs}^H	Households' Haig-Simons disposable income
PSBR	Govt. deficit (borrowing requirements)	YD_r^F	Nominal regular disposable income of firms
px	Export price	YD_r^H	Nominal reg. disp. income of households
py	GPD deflator	yd_r^H	Households' regular real disposable income
py^{row}	GPD deflator ROW	$yd_r^{H\,e}$	Households' exp. regular real disp. income
r_{BB}	Interest rate on bank CDs	YP^H	Personal income
r_{BCB}	Interest rate on central bank CDs	Z_1	Fiscal dummy rate of growth of expenditures
r_{BF}	Interest rate on commercial paper	Z_2	Fiscal dummy rate of growth of expenditures
r_{BG}	Interest rate on govt. bills	Z_3	Fiscal dummy rate of growth of expenditures
r_{BLF}	Interest rate on corporate bonds	Z_4	Fiscal dummy rate of growth of expenditures
r_{BLG}	Interest rate on T-bonds	Z_5	Govt. deposits dummy
r_K	Dividend yield of firms	Z_6	Relative abundance of foreign reserves
r_L	Interest rate on loans	Z_7	Relative scarcity of foreign reserves
r_L^{CB}	Interest rate on discount operations	Z_8	Flexible exchange rate dummy
r_M	Interest rate on deposits	Z_9	Sovereign debt dummy
$\rho^{BRes}{}_{BB}$	Reserve requirements rate on bank CDs	Z_{10}	Openness (Trade/GDP) ratio dummy
ρ_{BG}	CB's govt. bills to total assets ratio	Z_{11}	First bargaining and employment dummy
$\rho^{BRes}{}_{M1}$	Reserve requirements rate on CA deposits	Z_{12}	Second bargaining and employment dummy
$\rho^{BRes}{}_{M2}$	Reserve requirements rate on SA deposits	Z_{13}	Third bargaining and employment dummy
RT_F	Firms' rent payments	Z_{14}	First dummy rate on bank CDs
RT^H	Households' rent receipts	Z_{15}	Second dummy rate on bank CDs
RT_{row}	Rents paid to ROW	Z_{16}	Discount operation dummy
S	Sales at current prices		
s	Real sales		
s^e	Expected real sales		
σ_{se}	Opening inventories to expected sales ratio		
spread	Spread between rate on loans and deposits		
SR	Seignorage rate		
ς_{BG}	Pass-through (or repatriation) motive		
T	Taxes		
T_B	Banks tax payments		
T_F	Corporate tax payments		
T_H	Income taxes from households		
TA_{row}	Trade account balance with ROW		
TD_G	Nominal govt. debt		
THUC	Trend historic unit cost		
TUC	Trend unit costs		
v_H	Real wealth of households		
$vfma_H$	Investible wealth of households		
u	Capital utilization proxy		
UC	Actual unit costs		
V_F	Wealth of firms		
V_H	Wealth of households		

Table III.5. Exogenous Variables and Parameters

Variable	Definition	Variable	Definition
bandB	Lower range of the flat Phillips curve	$\lambda_{80\text{-}810}$	Parameter in house. dem. for Corp-equities
bandT	Upper range of the flat Phillips curve	$\lambda_{90\text{-}910}$	Parameter in house. dem. for foreign-Bonds
ρ^{B}bottom	Bottom value for bank net liquidity ratio	λ_{B}	Parameter determining dividends of banks
$\$r_{BG\text{-}row}^{T}$	Target rate on foreign T-Bills	λ^{H}_{Cash}	Parameter in households demand for cash
$\$r_{BLG\text{-}row}^{T}$	Target rate on foreign T-Bonds	λ_{GD}	Parameter govt.'s dem. for CA dep. at CB
$gr^{G}*$	Natural growth rate of real govt. exp.	λ_{M1}	Parameter govt.'s dem. for CA dep. at banks
gr_{pr}	Growth rate of productivity	λ^{row}_{10}	Exog. comp. ROW's demand for sov. debt
$gr_{v\text{-}row}$	Exogenous rate of economic growth - ROW	λ^{row}_{11}	Param. ROW's dem. sov. debt w/r to returns
N_{fe}	Full Employment level	λ^{row}_{12}	Param. ROW's dem. sov. debt out of income
NCAR	Normal capital adequacy ratio of banks	μ_0	Exog. component in the demand for imports
npl	Proportion of Non Performing Loans	μ_1	Parameter dem. for imports (relative prices)
Ω_{BB}	Mark-up determining the rate on bank CDs	μ_2	Parameter dem. for imports (income)
Ω_{BF}	Premium on corporate bills	Ω_0	Exog. comp. target real wage of workers
Ω_{BLG}	Spread public long and short-term rates	Ω_1	Endog. comp. target real wage - productivity
Ω^{CB}_{L}	Exog. set premium on discount operations	Ω_2	Endog. comp. target real wage – agg. dem.
Ω_{M}	Exog. mark-down for rate on SA deposits	Ω_3	Speed of adjustment of wages to target value
Op°	Relatively large degree of trade openness	$\psi_{10\text{-}12}$	Parameter in the supply of corporate bonds
Φ	Weight of exports in sovereign debt ratio	$\psi_{20\text{-}22}$	Parameter in the supply of corporate equities
Π_{row}	Price inflation in ROW	ψ_{FD}	Ratio of dividends to net firm profits
r_{BG}^{T}	Exogenous target interest rate on bills	ψ_{U}	Ratio of retained earnings to investment
$\rho^{BRes}_{BB}{}^{*}$	Target rate of reserve req. on bank CDs	ς_{BB}	Parameter banks' liability management
$\rho\$^{B}$max	Max banks' own funds invested in *fc* assets	σ^{T}	Long-run target inventories to sales ratio
ρ_{G}	Min target level of NIR for public sector	ς_{BG}^{*}	Parameter concern for *fx* fluctuations
$\rho^{PA}_{\$BLG\text{-}max}$	Max sovereign debt ratio intl. markets	Θ	Parameter imports expectations
$\rho_{G\&PS}$	Min target level of NIR public + private	Θ_{B}	Banks tax rate
$\rho^{BRes}_{M1}{}^{*}$	Target rate of reserve req.on CA deposits	Θ_{F}	Corporate tax rate
$\rho^{BRes}_{M2}{}^{*}$	Target rate of reserve req. on SA deposits	Θ_{H}	Income tax rate
σ_{N}	Normal inventories to sales ratio	ε_0	Exog. component in the demand for exports
ρ^{B}top	Top value for bank net liquidity ratio	ε_1	Parameter dem. for exports (relative prices)
adj^{BRes}_{BB}	Parameter reserve req. rate on bank CDs	ε_2	Parameter dem. exports (ROW's income)
adj^{BRes}_{M1}	Parameter reserve req. rate on CA deposits		
adj^{BRes}_{M2}	Parameter reserve req. rate on SA deposits		
α_1	Propensity to Consume out of income		
α_2	Propensity to Consume out of wealth		
β	Parameter expectations real sales		
β_{B}	Speed of adjustment of banks own funds		
$\chi^{CB\text{-}T}$	Reciprocal of average time until min NIRR		
δ	Rate of depreciation of fixed capital		
ε_{H}	Parameter expectations real disp. income		
ε_{f}	Speed of adj. of mark-up		
ε_{B}	Speed of adj. expected fraction of NPL		
η	Speed of adj. actual emp. to desired emp.		
γ	Speed of adj. of inventories to target level		
gr_0	Exog. comp. real capital accumulation.		
μ	Endog. comp. in real capital accumulation.		
$\lambda_{10\text{-}110}$	Parameter in households dem. for CA dep.		
$\lambda_{20\text{-}210}$	Parameter in households dem. for SA dep.		
$\lambda_{30\text{-}310}$	Parameter in households dem. for T-Bills		
$\lambda_{40\text{-}410}$	Parameter in households dem. for CDs		
$\lambda_{50\text{-}510}$	Parameter in house. dem. for comm. paper		
$\lambda_{60\text{-}610}$	Parameter in households dem. for T-Bonds		
$\lambda_{70\text{-}710}$	Parameter in house. dem. for Corp-Bonds		

Table III.6. Results from simulations

N°	Shocked parameter	Effect upon: employment			output			real wages			consumption			net exports of goods			fiscal deficit/GDP ratio			current account/GDP ratio			net intl. reserves ratio		
		S	M	L	S	M	L	S	M	L	S	M	L	S	M	L	S	M	L	S	M	L	S	M	L
1	Ω_0	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	+	+	+	+	-	-	+	-	-
2	$gr^{G}*$	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+	+	-	-	-	-	-	-
3	$gr^{G}*$	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+	+	-	-	-	-	-	-
4	Θ_H	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+	+	-	-	-	-	-	-
5	Θ_F	+	+	+	+	+	+	+	+	+	+	+	+	-	+	-	+	+	+	-	-	-	-	-	-
6	Θ_B	+	+	+	+	+	+	+	+	+	+	+	+	-	+	-	+	+	+	-	-	-	-	-	-
7	r_{BG}^{T}	+	+	+	-	+	+	-	+	+	-	+	-	+	-	+	+	-	+	+	-	-	+	-	-
8	r_{BG}^{T}	+	-	+	-	-	+	-	-	+	-	+	+	+	-	-	+	+	+	+	-	-	+	+	-
9	Op^{o57}	+	-	-	+	-	-	+	+	-	+	+	+	-	-	-	-	+	+	-	-	-	-	-	-
10	α_1	+	+	-	+	+	-	+	+	-	+	+	+	-	-	-	-	-	+	-	-	-	-	-	-
11	α_2	+	+	-	+	+	-	+	+	-	+	+	+	-	-	-	-	-	+	-	-	-	-	-	-
12	Π_{row}	+	-	-	+	-	-	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+
13	ε_2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	-	-
14	ε_1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	+	+	+
15	μ_1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	+	+	+
16	μ_2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	+	+	+
17	λ_{60}; λ_{70}; λ_{90}	null	-	-	-	-	-	null	-	-	-	-	-	+	+	-	-	-	-	+	+	+	-	-	-
18	λ_{10}; λ_{80}	null	-	-	-	-	-	null	-	-	-	-	-	+	+	+	+	+	-	+	+	+	+	+	+
19	$\rho^{BRes_{BB}*;M1*;M2*}$	null	+	+	null	+	+	null	+	+	null	+	+	null	+	-	+	+	+	+	-	-	-	-	-
20	$gr_{y\text{-}row}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	-	-
21	$gr_{y\text{-}row}$; $gr^{G}*$	-	+	+	-	+	+	-	+	+	-	-	+	-	-	-	+	+	+	-	-	-	-	-	-

57 Notice that by increasing Op^{o} sufficiently the model switches to a market-determined flexible exchange rate regime.

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