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Open-Economy Dynamics in a Stock-Flow-Consistent Model

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Abstract

We explore the dynamical properties of the Godley & Lavoie, 2007, model. The systems theorem of unstable lower-order systems becoming stable when they are embedded in higher-order systems is vindicated. Domestic banks are fragile. They import stability from their central banks. In like manner, national financial arrangements would benefit from a World Central Bank.

.***Keywords:*** credit money, supranational bank

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Open-Economy Dynamics in a Stock-Flow-Consistent Model[*]

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1. Introduction

The institution of banking has been under the microscope for some time now because financial intermediaries have been an integral component of financial-real crises. Numerous blueprints for 'failure-proof' commercial banking are being written. All of them contain firewalls in their charts; a recapture of the idea that the flow of credit to plant and machinery and employment-generating activities needs to be separated from universal banking objectives like participating in the markets for new financial products. Advocates of competitive banking would welcome welfare-enhancing norms as all cases for markets include barriers and conduits. As long as market axioms of profit-maximization, the freedom to truck, barter and exchange and the like are in place, competition in the issue of notes should prevail. The next step, however, is a big one and would separate schools of monetary economics. The Austrians, old and new, for instance, would not move smoothly to the case for central banks. The case is open for even von Hayek, it turns out, adhered scrupulously only to the competitive principle that "choice in currency" should be allowed (Endres, 2009). Money was a "generally acceptable medium of exchange" and the freedoms to enter and exit would drive out bad money. Only "good money" would prevail. Geography did not matter and the logic of the market did not exclude the possibility of fiat money. Fiat moneys would compete. In all cases, the outcome would be the organic resolution of the tensions between individuals in the marketplace. In contrast, the systems thesis applied below is not that the whole is not just greater than, but of a qualitative order different from, the sum of the parts. Others would argue that, minimally, the institution of a national clearing-house would be called for. As soon as a model contains more than one bank, a mechanism to square debts between them and, even more, issue note by fiat, into which all debts could be redeemed, might be necessitated. If the logic is accepted, it can be pursued to make the case for a clearing-house that keeps the accounts of central banks, a world central bank.

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We support a non-general equilibrium framework to synthesize the above remarks. Many heterodox traditions support the thesis that money is measure. For instance, in the framework of M. Aglietta and A. Orléan, reckoning comes before exchange (Nenovsky, 2009). The latter implies economic relations, the former social connections, in particular those between a firm, a worker, and a mediating bank. The analytical sequence is not the familiar value-price-money, but money-price-value. Since measure is abstract, active management of monetary resources by the state is called for. One sophisticated and highly original illustration of the heterodox tradition is the circuit approach to monetary macroeconomics (see, for example, Cencini, 2005; Rossi, 2007). The thought experiment begins with Bank I solicited by a client (a firm) to supply money units. It makes a double entry in its books. The circular flow originates when a payment has to be made in favor of another client (a worker). Bank II enters the account when both clients have credit lines with different banks. Client I, the payer owns a claim on a deposit in Bank I for an amount she has to make in favor of Client II. Central bank money enters as a means of interbank clearance and the function of the bank is called "money-purveying". In addition, a so-called "credit-purveying" function is generated when Bank I, say, approaches the central bank for credit to settle its debt to Bank II. Here again, Bank I might obtain its credit from other banks. All securities transactions require payment and the central bank must provide the fiat units to satisfy Bank II's claim. If Bank I does not find takers in the interbank market, the lender-of-last-resort facility of the leader of the club of banks would be appealed to. The logic extends to relations between countries. When 'home' pays 'foreign' for its imports, it transfers to 'foreign' a claim on its deposits in the banking system. This promise does not square its debt nor is it a final payment. All foreign trade transactions have to be settled in national monies within the borders of each and in an international monetary unit between countries. 'Home' hands over a sum of dollars, say, to the clearing house in its country. Likewise, exporters in China, say, receive an equivalent amount of yuan from their clearing house. Payments between them are finalized through the emission of international money.

On the other hand, in an alternative world view, the prognosis about the current arrangements is reassuring: that the system of global imbalances characterizing Bretton Woods II will be stable. US debt can grow forever, it is claimed, as Asian investors are

only investing abroad since attractive options do no exist at home. The yields of foreign assets are higher. The impulse follows the neoliberal recipe. The accumulation of dollar reserves supplants the structuralist stance of developing domestic financial structures and implanting rules and procedures. National autonomy is the casualty with a reduced policy space. Besides, it is the monetary authorities rather than private investors that have net financed the US deficit while private purchases of foreign assets by Americans more than compensates for private purchases of US assets by foreigners. At the same time, in fostering an export-led growth strategy with the accumulation of international reserves, developing countries are doing no more than following in the footsteps of Europe and Japan in the post-war period (Carabelli and Cedrini, 2009). Logically, Asia would oust Europe in exporting to US markets and buy out European claims on the US. The trajectory to the centre can be said to be completed when millions of unemployed workers are absorbed in the modern sector. Actually, the strategy of Bretton Woods I appears not to have worked for Germany and Japan (Bibow, 2009). They have not been able to grow out of that regime but, instead, domestic demand has stagnated since the early 1990s. Besides, what Dani Rodrik calls the social cost of self-insurance of this strategy is the substantial wedge between yields from liquid assets to central banks and the private sectors' cost of borrowing abroad. He estimates that developing countries loose one percent of GDP annually by reserve accretions. Alternatively, the figure is a multiple of the budgetary allocation of the most committed anti-poverty program in developing countries. The quantity is also of the same order of magnitude as the projected gains from trade for developing countries from a successful conclusion of the Doha round of trade negotiations. Finally, he suggests that reserve accumulation is not the only manner to increase liquidity. Reducing short-term debt would serve as well. In any case, in one forecast the Bretton Woods II system is unlikely to unravel on account of the present crisis (Dooley, Folkerts-Landau, and Garber, 2009). Countries will stimulate private enterprise and encourage government intervention as well as nurture financial intermediation. Asset values will recover and US households will return to their low propensity to save and accumulate debt. Developing economies, correspondingly, will stockpile foreign assets and vigorously push exports. It should not be forgotten, however, that the financial crisis has resulted in a dip in their export earnings on two related fronts

(Naudé, 2009). The decline in commodity prices has affected primary commodities exporters in Africa. For instance, South Africa is a major exporter of the platinum group of metals. Secondly, a significant proportion of US imports are from developing countries. These are mostly imports of services, not goods. Thus, India's software sector which exports IT services is adversely affected. Developing countries might respond by strengthening their mercantilist orientation: keep their exchange rates undervalued and hoard foreign exchange reserves.

The circuit approach moves in the opposite direction. The monopoly of international note issue of the United States over time has transformed that country from its position as central banker to the World to venture capitalist of the world with high-return risky assets on one side of its balance sheet and a dangerously high leverage ratio on the other (Piffaretti, 2009). The latter does not exclude the expectations of a sudden adjustment. The massive capital inflows into the US have been of a non-speculative character with risk-free assets as their destination. All the same, the financial system has transformed domestic savings into assets that carry high cash-flow risk. We will show that the process of depreciation of the US$ against a number of currencies accompanied by a regular appreciation of the yuan against the US$ generate unstable dynamics.

2. Macrofoundations

We have suggested that a National Income Accounting approach might be fruitful in weaving together the threads of our case. The advantages are many. Clearly, we do not have to wrestle with the vexatious issue of how best to incorporate money into the schema. The data is given in nominal and, if desired, price-deflated terms. Some chroniclers of the recent crisis claim that early warning signals might have been observed in a close scrutiny of the data. Of particular force for our purposes, however, is the proposition that National Income Accounting provides for institutional design and strong policy relevance (Freeman and Desai, 2009; Offer, 2008). Architects can work with the matrices and fill, over a horizon, some submatrices, ignore others, and even reduce others to null elements. Post-War state intervention inspired by Keynes relied on National Income aggregates. It is these accounts that propelled the attention to government provision of education, health, infrastructure, and so on.

Consequently, we choose a stock-flow-consistent model written by W. Godley and M. Lavoie (2007) (hereafter G-L). In a review of G-L, Lance Taylor (2008) has recommended developing the model to capture the capitalist regime of today as it jerks back towards banks. If individualist criteria are sought, the conclusions below could be supported by the use of nominalist heuristics in actual decision making by people (Pope, Selten, Kube, and von Hagen, 2009). For instance, the assumption of interest parity picks a salient number form the set of interest rates available in each country. The medley of interest rates in an economy depend upon the institutional specifics concerning borrowing and lending. The elements of the set do not move in tandem. Indeed, on occasion, interest rates move in opposite directions. Consequently, the variable exchange rates brought about by multiple currencies leave participants subject to the (sometimes wild) fluctuations in these numbers. There is merit, therefore, in selecting a single world currency. The systems theorem cited in the Abstract has recently been recalled by Martin Shubik (2009). Good political economy calls for an appreciation of the reallocation of resources necessitated by a switch from lower to high-order levels of organization. At stake is the heterogeneity of purposes which lead to the emergence of self-renewing systems. It is not axiomatic that when the world becomes complex, for instance, countries adjust even though failure means calamity for all. Take nuclear inspection. No country does not recognize the need for a supra-national organization with enforcement powers. Yet it is not clear that current nation states will generate such an outcome.

3. Closed-Economy Circuit Economics: Solutions and Stationarity

3.1 Private Money

The first concept in the G-L model is *initial finance*. Output is produced but not sold. This production is inventories, I, which is construed as working capital. Inventories must be matched by the wage bill, WB. From the opposite angle, the inventories must be financed by new loans ΔL. Thus, (G-L, 2007, p.49)

$$I - WB = 0$$
$$I - \Delta L = 0$$

In discrete terms,

$$L_{t+1} = L_t + WB \qquad 2$$

While the physics of the equation refer to an interval (t, t+1), circuit reasoning rests on Bernard Schmitt's concept of quantum time. Economic production consists of an instant when output is given its monetary form. Workers may, in fact, be paid in advance, during, or after the period. Wages refer to a point in the interval. It is a 'wave' that quantizes the interval. At that point, the period during which matter and energy are transformed physically is covered in both directions $t \rightarrow t$+1 and t+1 $\rightarrow t$.

The determination of the value of money lies in the determination of the money wage. However, the equation also depicts the tenuous nature of the origins of banks. The solution can be a null value of the variables. A limitation of circuit starting points is *ab novo* reasoning. Beginning with a *tabula rasa*, the economic accounts are theorized to open and close in a flash. It is reassuring that, despite the crisis, the fundamental precepts of banking have not changed (Boot and Marinč, 2008). Bank loans with continue to be the optimal instruments and for many of the new 'funding vehicles', the traditional skills of the banker will be required.

Banking and credit systems are unstable because output must be validated after wages are paid and loans taken. Consequently, financial systems are underwritten by public authorities with the ability to tax and issue currency. Public bodies have the power to ameliorate crises by steering the system along National Income identities. Peter Gowan, 2009, proposes a public-utility model of credit and banking geared to capital accumulation in the productive sectors. The model does not exclude private banks. For example, post-war Japanese banks came under the Bank of Japan's umbrella 'window-guidance system'. All modern systems need banks to produce credit money and clearance systems to smoothen the payment of debts. These are essential public services. At the same time, the direction of credit flows are matters of social concern. It is perfectly reasonable, in that case, that the credit and banking system be publicly owned. The classic illustration is, of course, Germany, where the bulk of the banking system remains

in public hands. The Chinese system, as well, is built around a few publicly-owned banks and the government.

3.2 Government Money

Total production, *Y*, is defined as the sum of all payments of factor incomes (G-L, 2007, p.61).

$$Y = WB \qquad 3$$

Disposable income, *YD*, is the wage bill earned by households minus taxes, *T*. Taxes, in turn, are a fixed proportion, θ, of money income. In sum, (G-L, 2007, p.65)

$$\begin{aligned} YD &= WB - T \\ T &= \theta WB \end{aligned} \qquad 4$$

The change in high-powered money, ΔH, in each period equals the difference between government receipts, *T*, and outlays, *G*, in the period. From the vantage point of households, the change in the stock of money is the excess of disposable income over consumption, *C*. That is to say, (G-C, p.66)

$$\begin{aligned} H_{t+1} &= H_t + G - T \\ H_{t+1} &= H_t + YD - C \end{aligned} \qquad 5$$

Combing equations 3, 4, 5, we have

$$H_{t+1} = H_t + (1-\theta)WB - C \qquad 6$$

Time enters familiarly here as a connect between the income formed in the emission of money at a point in time and its consumption later. Some income is saved and transformed into capital. We propose, in the post Keynesian spirit, that governments are required to provide a bridge between the void connecting periods of real time. Through

the supravention of central banks workers are transformed from being income recipients to holders of a financial claim over future income. At the end of the period capital is reconverted into income and spent for the final purchase of current output. In a simultaneous move, income earners are credited for their sale of claims on bank deposits and debited for their purchase of the physical output stocked by firms. Government ownership of banks is driven by the absence of stabilizing control mechanisms in the private financial sphere rather than the desire of politicians to expropriate moneys to their own ends (Andrianova, Demetriades, and Shortland, 2009). Since private banks are susceptible to dubious activity, depositors prefer government banks. For empirical purposes, the authors referred to construct an index of "institutional quality" including bureaucratic quality and its insulation from political interference. While 'governance' matters, the ownership of banks does not. The effect of the state ownership of banks variable was found to be positive and statistically significant at the one percent level. In recent years, government ownership of banks played no small role in assisting countries avail of long-run growth opportunities.

4. National Monies

We proceed by first introducing short-term government bills B which pay a rate of interest r. The price of each bill is assumed to be one unit and the price does not change in the period under consideration. Open-economy macroeconomics in an SFC model is conducted by dividing a closed economy into two parts, 'home' and 'foreign' the latter distinguished by an appropriate superscript. Thus, B^f denotes a bill issued in the foreign country. Since home demand for foreign bills must be denominated in the domestic currency, their supply must be multiplied by the exchange rate xr. In that case,

$$YD = Y + r_{t-1}B_{t-1} + r^f_{t-1}B^f_{t-1}xr_t - T \qquad 7$$

For the sake of convenience, taxes are taken as exogenous. The left-hand side of the equation below is the change in total wealth, V, which is the difference between disposable income and consumption. The next equation is the government budget constraint. The government deficit is financed by the issue of new bills, B, (the left-hand

side). The first term in parentheses on the right-hand side is the sum of total outlays of government expenditure on goods and services purchased from the production sector and interest payments due on the outstanding debt.

$$V_t - V_{t-1} = YD - C + xr_t B^f_{t-1} - xr_{t-1} B^f_{t-1} \qquad 8$$

$$B_t - B_{t-1} = (G + r_{t-1} B_{t-1}) - T \qquad 9$$

Subtracting the second equation from the first and recalling our definition of *YD* above, we get

$$V_t - B_t = Y - C - G + xr_t B^f_{t-1}(1 + r^f_{t-1}) - xr_{t-1} B^f_{t-1} + V_{t-1} - B_{t-1} \qquad 10$$

The state-space representation is

$$\begin{bmatrix} V_t - B_t \\ xr_t B^f_{t-1} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & \dfrac{1}{(1 + r^f_{t-1})} \end{bmatrix} \begin{bmatrix} V_{t-1} - B_{t-1} \\ xr_{t-1} B^f_{t-1} \end{bmatrix} + \begin{bmatrix} Y - C - G \\ 0 \end{bmatrix} \qquad 11$$

Note that the autonomous portion of the system delivers familiar fillips to the state variables. There is the endogenous driver in the form of disposable income, net of interest income and government expenditure. Secondly, imagining 'home' to be any Asian country stockpiling 'foreign' reserves in the form of US$ bonds, the strategy involves the process of continuous exchange rate undervaluation, the degree of appreciation determined by the rate of return on US bonds.

Denote the coefficient matrix of the difference equation above by A. The necessary condition for stability is

$$\text{tr(A)} < 0$$

$$\text{det A)} > 0$$

The first condition is violated. The equilibrium is an unstable node.

5. Supranational Money

Our quest for stability must lead us to the deliberations of a post-Bretton Woods panel that included Nicholar Kaldor (Kregel, 2009a; Turner and Ussher, 2009). The dilemma was to combine employment generation at home with non-destabilizing open-economy policy. A relative autonomy of the domestic from the foreign sphere was to be maintained. All international development lending was to be done by central banks issuing domestic bonds, the proceeds of which would be managed by the World Bank. Keynes' architecture of the world financial system was not built around private currency trading or large capital flows intermediated by private financial institutions in order to finance external imbalances. Such flows would, he believed, be destabilizing as they had been in the interwar period (Kregel, 2009b). Keynes' plan for an international clearing union (ICU) enunciated in 1941 would have eliminated private market currency trading. The idea was to prevent a destabilizing accumulation of hoards on the part of creditors. At the same time, debtor discipline was not to be foregone (Skidelsky, 2009). Member central banks would buy and sell their currencies against debits and credits with the ICU. These reserves would be held in an international currency, bancors. The banking principle can be recalled here (Costabile, 2009). Credit money is created when an agent is indebted to a bank. Under Keynes' plan, a deficit country would, in that case, borrow from the ICU in order to finance its excess demand of a foreign currency. Banking transactions between countries would not result in the creation of excess international liquidity as the respective central bank accounts would be cleared with the ICU. At the same time, since credit money would be created by external deficits/surpluses and extinguished by the payment of debts, international liquidity would be elastic. Domestic production would respond to the foreign demand, the latter, being financed by the ICU.

Coming to the present, in the perspective of the UN Commission as well the international system suffers from an inherent tendency towards a deficiency of aggregate demand. The growth of the US financial system has permitted domestic household balance sheets to offset an increasing inequitable domestic distribution of income and export a deficiency of demand to the rest of the industrialized world. The essential flaw in using an international currency that is also domestic legal tender is that the issuing country faces a conflict between domestic objectives like generating employment and

maintaining the international public good character of the money. We must entertain the possibility of the secular decline, if not the discontinuous collapse, of the dollar standard (Alessandrini and Fratiani, 2009; Savona, 2009). In a framework for the future it is essential to recapture the insight that money and finance are intimately connected. It is futile to expect the International Monetary System (IMS) to be dynamically stable only by addressing the financial portion. The IMS itself need to be overhauled. In that case, SDRs are not a solution since they neither are money nor a claim on an international bank. One proposal, along the lines suggested by Keynes, is the institution of supranational bank money (SBM). Both exchange rate movements and capital flows would be the outcome of coordinated decisions. All countries cannot run a current account surplus at the same time. Developing countries cannot all follow a policy objective of positive net exports. The SBM would solve this aggregation problem. Since the currencies of all countries would, in principle, be of equal standing, they would not run systematic current account deficits. Every country would tend to map domestic demand into domestic production. Countries, freed from the pressure to run external surpluses, would not be impelled to pursue mercantilist stances.

The mechanics of a New International Clearing Union (NICU) has been worked out by Alessandrini and Fratianni, 2008. At the outset, a negotiated agreement would be arrived at by a group of countries that are self-interested in stabilizing the IMS. For instance, the Fed and the ECB could take the initiative but the process could as well being with the US and China (Piffaretti and Rossi, 2010). The first step would consist of both parties depositing dollar and euro assets respectively against an equivalent amount of SBM. The contrast between SBM and SDRs, then, would be as follows. The SBM would be endogenous money, emerging as result of decisions taken by a small number of countries whereas SDRs are a helicopter drop. Secondly, the clearing system operates on the banking principle. The settlement of credit and debit between central banks would take place through their SBM accounts.

The procedure begins with two central banks, home and foreign, in our case, depositing a portion of their assets, B_{cb} and B_{cb}^{f} respectively, with the NICU in exchange for supranational bank money SBM. To reduce algebraic clutter, assume that all their

assets are so deposited. If the SBM is measured in home units, the balance sheet of the NICU is

$$SBM_{t-1} = B_{cbt-1} + xr_{t-1}B^{f}_{cbt-1} \qquad 12$$

We now have a world interest rate which is a combination of the rates of the two participants, appropriately weighted. Thus,

$$r_{SBMt-1} = r_{t-1}(w) + r^{f}_{t-1}(1-w) \qquad 13$$

where w are the weights.

Reproducing equation 10 of the previous section with only central bank paper substituting for private bonds,

$$V_t - B_{cbt} = Y - C - G + xr_t B^{f}_{cbt-1}(1 + r^{f}_{t-1}) - (xr_{t-1}B^{f}_{cbt-1}) - B_{cbt-1} + V_{t-1} \qquad 14$$

In terms of our supranational vocabulary, this equation reads

$$V_t + xr_t B^{f}_{cbt} - SBM_t = Y - C - G + xr_t B^{f}_{cbt-1}(1 + r_{SBMt-1} - r_{t-1}(w) + r^{f}_{t-1}(w)) + V_{t-1} - SBM_{t-1} \qquad 15$$

In keeping with the programme, assume the initial inequality $V_{t-1} - SBM_{t-1} > 0$. In that case, in the present period the NICU issues SBM_t to exert a negative feedback of $V_t - SBM_t < 0$. In systems terms,

$$\begin{bmatrix} V_t - SBM_t \\ xr_t B^{f}_t \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & (1 + r_{SBMt-1} - r_{t-1}(w) + r^{f}_{t-1}(w)) \end{bmatrix} \begin{bmatrix} V_{t-1} - SBM_{t-1} \\ xr_t B^{f}_{t-1} \end{bmatrix} + \begin{bmatrix} Y - C - G \\ 0 \end{bmatrix} \qquad 16$$

The condition for the equilibrium to be a stable node (the coefficient matrix should have a negative trace and positive determinant) is ensured by

$$r_{t-1}(w) - (r_{SBMt-1} + r^{f}_{t-1}(w)) > 1$$

The necessary and sufficient conditions are, however, richer (Medio and Lines, 2001). Denoting the coefficient matrix by B, they are

$$1 + \text{tr(B)} + \det(\text{B}) > 0$$
$$1 - \text{tr(B)} + \det(\text{B}) > 0$$
$$1 - \det(\text{B}) > 0$$

In sum, the condition for stability is

$$1 < r_{t-1}(w) - (r_{SBMt-1} + r^{f}_{t-1}(w)) < 2$$

The condition reestablishes the attractiveness of domestic bonds, in terms of home interest rates, in portfolios. Thus, transactions by citizens would continue to be carried out in home or foreign bonds with the official exchange rate established between 'home' and 'foreign' in the ICU. The number would act as an attractor for market-determined exchange rates. The process of arbitrage will ensure that, with time, an increasing portion of foreign trade moves through the international settlement facility reducing the influence of exchange rates on foreign exchange markets. Of course, the determination of xr_t is not trivial and would have to be accepted along with SMB_t as a component of the overall package.

6. Conclusion

Writers of bank-driven models seem unaware that the solution to their equation systems might be zero. Historically, private banks have been nursed and nurtured by central banks. Extending the logic to the world at large, solving the coordination problem gets more urgent. The hegemony of the US of A in open-economy macroeconomics cannot be taken for granted. All countries will benefit from the accounting discipline imposed by a World Central Bank.

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