Structural Change in Post Keynesian Monetary Theory: A Non-Compensatory Disequilibrium Framework

Abstract

Post Keynesian Economics has shifted away and even renegade from Keynes' original research program, i.e., the Unemployment Equilibrium thesis, endogenous money and liquidity preference determination of interest rate in which money and uncertainty play a fundamental part. This paper attempts to bring back the Keynesian counter-revolution spirit into Post Keynesian Monetary Theory by introducing a Non-Compensatory Disequilibrium Framework (NCDF) that allows structural breaks in budget constraints that lead to a model where Walras' Law does not hold.

Keywords: NCDF, Money, Endogeneity, Uncertainty, Budget constraints, Structural breaks.

JEL: E12, E25, E43, E52

1. Introduction

It is argued that Post Keynesian theory has shifted away from Keynes' original research program. Furthermore, Post Keynesian monetary theory has resulted in a choice between the Horizontalist versus Structuralist (H-S) hypothesis, both of which misrepresent Keynes' work. This paper will try to bring Post Keynesian theory back to Keynes to fully represent the three fundamental concepts in Keynes' monetary theory,i.e., uncertainty, liquidity preference determination of interest rates, and endogenous money.

In section 2 the current state of Post Keynesian monetary theory will be critically analyzed with the intention of portraying its shortcomings to represent Keynes' ideas. This failure comprises the main elements of Keynes' monetary theory and results from disregarding the full implications of the nature of money and uncertainty stemming from Keynes' view of modern economies, i.e., low elasticity of production and low temporal and inter-temporal substitution for commodities.

In section 3 the nature of money in Keynes' work is fully considered leading to a Non-Compensatory Disequilibrium Framework where temporal and inter-temporal budget constraints might not compensate each other, i.e., Walras's Law does not hold. In disequilibrium, as it was already argued by Clower, individuals are constraint in the markets and cannot realize their potential demand.

Section 4 and 5 expands the analysis to different types of disequilibrium leading to structural breaks in the dynamic behavior of individuals and markets that contradicts current Post Keynesian and Non-Post Keynesian monetary theories. Section 6 concludes.

2. Current state of Post Keynesian monetary theory

Post-Keynesian economics originated as an opposing view to the bastard Keynesianism as a legitimate interpretation of Keynes' legacy. This repulsion to accept any similarity to the neo-

classical equilibrium framework has led Post Keynesian theory to shift away and even renegade from Keynes' original research program, i.e., the Unemployment Equilibrium thesis and liquidity preference determination of interest rate in which money and uncertainty play a fundamental part.

The current state of Post Keynesian monetary theory as a choice between the Horizontalist versus Structuralist (H-S) hypothesis, cannot be a logical representation of Keynes' work on different grounds.

Keynes' monetary theory entails three main concepts: Uncertainty, liquidity preference determination of interest rates and endogenous monetary creation. Whilst Post Keynesian monetary theory has preserved the importance of uncertainty for monetary analysis, it has not fully understood its relationship with money. The other two pillars of Keynes' theory have been misunderstood and hence, his ground-breaking departure from Neo-classical economics has been perverted.

First, the Post Keynesian's view about uncertainty revolves around the epistemological vs ontological debate. However, Keynes' fundamental uncertainty should include both the limitation to knowledge due to limited human capabilities and the complex nature of reality and whilst Post Keynesian economist have been engaging in this debate, DSGE models have been successful in evolving from anticipated utility models to models that incorporate expectation formations that takes into account forward-looking agents that can adapt the stochastic properties of current beliefs. In such models, agents are aware that they just do not know everything, concept that relates more closely to Keynes' fundamental uncertainty. Whether or not, it is possible to obtain a stochastic formation of referential demands defined to conform to the type of uncertainty that Keynes had in mind is something that will be out of the scope of this paper. What this paper will argue is that even if this is possible, an efficient future path of optimal decisions cannot be guaranteed today. To show this, this paper focuses

on the deep connection in Keynes' work between uncertainty and the role of money in a modern economy in contrast to a barter economy. Money in productive monetary economies does not have substitutes and therefore commodities cannot be used as a mean of exchange for inter-temporal substitution. Hence, the existence of money interferes with inter-temporal budget constraints that might not compensate each other, i.e., Walras' Law does not hold. This realization problem and its link to uncertainty is the base of the Non-Compensatory Disequilibrium Framework (NCDF) introduced in section 3 which will be used to show that structural change due to budget constraints affect the dynamic properties of the system in disequilibrium that renders future path of optimal decisions impossible to guarantee.

Secondly, the role of liquidity preference in Post Keynesian monetary theory has been diluted from a crucial role of long interest rate determination to a marginal significance for short rates. The reason why Post Keynesian monetary theory moved from a liquidity preference theory of interest determination to a mark-up theory was influenced by the dissatisfaction of Heterodox economists with the bastard Keynesianism that was based on General Equilibrium principles. Yet, in doing so, they have misrepresented Keynes' liquidity preference theory by redefining it as a choice between two assets very close to the short-period spectrum which depends on the short interest rate. Liquidity preference defined in this form will have a very limited[1] role to play in the determination of long rates, something that remains at odds with Keynes' theory. NCDF allows agents' liquidity preference to affect long rates and structural breaks present in them alter the relation between quantity of money and long rates as exposed in sections 4 and 5.

Thirdly, Post Keynesian models also usually explicitly accepts that "Keynes also assumed, along with everyone else, that the supply of money was exogenously determined" Rousseas

[1] It could have a role by making the mark-up endogenous somehow. However, for a constant mark-up the interest rates spread is also constant.

(1998: p. 37) which would undermine Keynes' meticulous and lengthy definition of different types of deposits that are included in his definition of the supply of money and which are determined by the banking system. The fact that he did not repeat the same painstaking analysis in the General Theory is a reflection that the General Theory represented for Keynes "a natural evolution in a line of thought" Keynes (1936: i). "In my Treatise on Money I studied the total demand for money under the headings of income-deposits, business-deposits, and savings-deposits, and I need not repeat here the analysis which I gave in chapter 3 of that book" Keynes (1936: p. 125). In the Treatise Keynes already stressed the role of credit by the banking system in order to reach equilibrium between Investment and Saving. Hence, in a monetary productive economy, credit is essential for entrepreneurs to realize their planned Investment. The increase in the quantity of money as credit expands is as indispensable for production to happen as necessary to reach equilibrium between Investment and Savings. In the General Theory Keynes assumes equilibrium between Investment and Savings, yet this implicitly implies the endogenous increase in credit and the quantity of money.

Hence, as we have seen above, Keynes already stated in the Treatise that money is endogenous even though its relationship with interest rates is not unique. "It follows that a given *M*2 will not have a definite quantitative relation to a given rate of interest of *r*;—what matters is not the *absolute* level of *r* but the degree of its divergence from what is considered a fairly *safe* level of *r*…" Keynes (1936: chapter 15). The NCDF also sheds light into this as the underlying structural changes in the quantity of money in disequilibrium might explain Keynes' impossibility proposition of modelling the quantity of money by a unique and continuous function with respect to interest rates.

3. Non-Compensatory Disequilibrium Framework

Post Keynesian economics views the introduction of money[2] into the system, further from dispelling transactional uncertainty, as the source of the realization problem[3] that arises due to the nature of money and reveals the uncertain nature of the market clearing condition that does not arise in a barter economy of a laissez faire style. Furthermore, due to the role of money as a store of value, economic agents can hold wealth without incurring the costs and risks that holding product would have generated. Therefore, money transforms the temporal link between production periods by letting uncertainty to slither into the economic system, shaping agents' liquidity preference and altering the certainty of the market clearing condition that reigns in barter economies.

In a monetary economy of such nature, individuals do not know how much of the initial endowment will be sold or bought and within this uncertain condition where future equilibrium prices cannot be known, they must take decisions that affect everyone else in the market. In a Keynesian[4] world, individuals must take decisions within a completely uncertain environment where money takes a decisive role that defines the entire workings of the economic system. The introduction of money into the system itself hinges on the structural institutional[5] set up that requires the smooth functioning of financial markets providing liquidity to markets and individuals. The failure of financial markets to provide liquidity to

2 Túñez (2016) for an explanation of the realization problem and its relevance in the invalidity of Walras' Law.
3 "In a real exchange economy, Say's law applies because money income is ultimately spent, either directly or indirectly, in order to realise use-values. But in a monetary economy, this simple postulate no longer applies." Lucarelly (2010: p.5).
4 Understood as a positive definition to capture those models that resemble Keynes' research programme which would include the existence of the involuntary unemployment equilibrium thesis and the inexistence of an inherent tendency towards full employment even under classic assumptions.
5 Post-Keynesians and Institutionalists have stressed out the importance of this structural institutional set up to understand how money is introduced in the economic system."Keynesian analysis is institutionally specific; it analyzes a capitalist economy with a sophisticated banking and financial system whose principal activity is financing business" Fazzari and Minsky (1984: p. 106).

markets poses such a threat to the workings of the economic system that governments must constantly supervise financial institutions aiming to avoid that kind of endemic risk.

To capture the realization problem, a Non-Compensatory Disequilibrium Framework (NCDF) based on budget constraints will be set up where real flows of commodities and services must be match by monetary flows[6]. The NCDF considers the effect of structural breaks caused by disequilibrium on behavioural economic variables and agents' budget constraints within a framework governed by the principle of monetary exchange. A 5-agents model will be introduced: Households, Non-Financial Corporations, Banks, Government and a CB as it can be seen in the descriptive NCDF matrix in table (2.1).

$$\begin{aligned} &\mathrm{Ch} + \mathrm{pb}\,\Delta\mathrm{Bh} + \mathrm{Mh} + \mathrm{Dh} + w\,\mathrm{Ne} + \mathrm{Th} + \mathrm{Eh} + \mathrm{w\,Nu} = \\ &w\,\mathrm{Nsh} + \mathrm{Msh} + \mathrm{ib\ pb\ Bsh} + \mathrm{Dsh} + \mathrm{Esh} + \mathrm{ief\ \ Esf} + \mathrm{ieb\ \ Esb} \end{aligned} \qquad (3.1)$$

Equation (3.1) is the Households' budget constraint where households' initial Cash Holdings (Msh) and Bank Deposits (Dsh) are highly liquid assets. The initial holdings of Treasury and firm bonds (pb Bsh) and Equity Funds (Esh) will not be readily converted into money unless there is a buyer. Equity funds are assumed to be non-tradeable[7]. Households are indifferent from holding firms or treasury bonds[8]. Households also supply labour services (Nsh), of which (Ne) is sold but (Nu) is unemployed, and capital services from their holdings of bonds (ib pb Bsh) and Equity (ief Esf + ieb Esb). In equation 3.1, we can see that individuals demand cash balances (Mh), bank deposits (Dh), bonds (Bh), Equity Funds (Eh), goods (Ch) and pay taxes (Th) and they are constraint by their supply of labour and capital services and holdings of cash, deposits, bonds and equity.

6 This characteristic is also the base of Social Accounting Matrix (SAM) models.

7 Equity prices are assumed to be given by the equilibrium long rate. Keynes assumed a high degree of substitutability between shares and bonds in the same risk class. For him, both assets' prices would adjust until their return will be the same.

8 Hence, long rates will not reflect idiosyncratic risk but only market risk.

$$\text{Inve} + \Delta\text{Mf} + \Delta\text{Df} = \Delta\text{Lf} + \Delta\text{Ef} + \Delta\text{Bf} \tag{3.2}$$

$$\text{ief Esf} = Y - w\,\text{Nf} - \text{ib Lsf} - \text{ib pb Bsh} = \Delta\text{Ef} = \text{PROFf} \tag{3.3}$$

Equation (3.2) is the firms' budget constraint where firms' investment (Inve) plus their increase in cash (ΔMf) and deposits (ΔDf) are financed by their increase in Loans Contracts (ΔLf), the increase in bonds (ΔBf) and the supply of Equity by firms (ΔEf). Firms' profits (PROFf) increases firms' equity which is assumed to be owned by households and reinvested in the firm to raise deposits or fixed capital as in equation (3.3). It is noted that loans do not only finance gaps between revenues and expenditures. As a matter of fact, that is generally not the case as loans are made before investment has taken place and profit is realized. Also, the ratio of loans to investment is affecting the Tobin-q and cannot be considered constant.

$$\text{pb}\,\Delta\text{Bb} + \Delta\text{Lf} + \Delta\text{Rb} = \Delta\text{Eb} + \Delta\text{DLb} + \Delta\text{Db} \tag{3.4}$$

$$\text{ieb Esb} = \text{ib pb Bsb} + \text{ib Lsf} - \text{Tb} = \text{PROFb} = \Delta\text{Eb} \tag{3.5}$$

As before, banks do have a budget constraint expressed in (3.4) that explains that they can only demand bonds (pb ΔBb), supply loans (ΔLf) to firms and increase their reserves (ΔRb) as they obtain funds via discount loans from the CB (ΔDLb), equity funds (ΔEb) or deposits from firms and households (ΔDb). Bank profits (PROFb) are assumed to be totally reinvested in equity funds. Banks supply deposits (ΔDb) on demand for any chosen deposits rate (id) which can be portray as a horizontal line respect to (id). Hence, Banks are assumed to be always willing to supply deposits to the public and to reinvest their profits as in equation (3.5). However, the same supply curve can be represented in the (ib, D) plane as a vertical constantly moving[9] line. Nevertheless, as it will be discussed in section 4, the volume of the money supply and deposits at any given long rate will still be the result of the interaction of

9 This interpretation is coherent with Howells (2007).

supply and demand conditions.

$$\Delta \mathrm{DLb} + \mathrm{pb}\,\Delta \mathrm{Bcb} = \Delta \mathrm{Ms} + \Delta \mathrm{Rb} + \mathrm{idl}\,\mathrm{DLsb} + \mathrm{Bcb} \tag{3.6}$$

The CB increases the outstanding currency in circulation (ΔMs) when it gives discounted loans[10] (DLb) to banks or increases its holdings of bonds (ΔBcb) and decreases it when receives interest (idl DLsb) or principal (DLsb) payments or banks increase their reserves (ΔRb) as the budget constraint in (3.6). Profits made by the CB could be accounted for as reverting to the government sector and decreasing deficits or as it has been done here by taking a Circuitist approach as a reflux from the private sector and decreasing the amount of outstanding currency in circulation[11].

$$G - Tg + ib\ pb\ Bsg = pb\ \Delta Bg \tag{3.7}$$

The government budget constraint is set up in (3.7). If it is further assumed that the government deficit ($G + ib\ pb\ Bsg - Tg$) and hence the supply of Bonds (ΔBg) is restricted to the willingness of the public to finance the deficit, any possible increase in reserves through this kind of fiscal policy will be ruled out. The result of having two different constraints for the CB and the Government is that deficits now cannot be monetized. Although, the possibility of debt monetizing could be easily added as in Kaldor (1982) where the proportion of deficit financed by bonds is an endogenous variable determined by individuals' portfolio decisions. Nevertheless, it must be noted that this is just a very convenient modelling procedure to guarantee that there would not be any excess demand for bonds. If Government expenditure is lower than taxes Government surplus arises. This surplus might be used to purchase bonds from the public restoring reserves or from the CB

10 According to the Federal Reserve Bank of New York "Under the administration of the discount window revised January 9, 2003, an eligible institution need not exhaust other sources of funds before coming to the discount window"

11 Free reserves are accounted for as an increase in reserves in the CB.

decreasing its holdings of bonds, outstanding currency and banking reserves. However, individuals' net demand for bonds might not be realized in purchases of bonds, i.e., excess supply of cash holdings might appear. Disregarding for the moment this possibility, we will assume in this section that the bond market clears[12].

There are similarities[13] between equations (3.1) to (3.6) and the stock-flow integrated equations of Godley and Lavoie's model that uses a methodological comprehensive accounting procedure represented in a flow of funds table. However, even though both sets of equations cause the supply of money to be equal to the demand for money under certain range of conditions, as it can be seen in section 4, it does not represent the agents' behavioural constraints in all states. The full story, which will not be exposed until section 5, needs to account for structural breaks that occur in disequilibrium. The appearance of disequilibrium affects the budget constraints of all individuals intervening in that market which alter their behavioural dynamics. Neither Structuralists nor Horizontalists models consider those structural changes in the analysis of individuals' behavioural constraints[14].

4. The Endogeneity of the Money Supply

In the previous section, the basic underpinnings of the NCDF have been presented. There remains the requisite of defining behavioural equations like asset demand functions which could be assumed to follow Tobin's portfolio choice theory as Godley and Lavoie have done or to have a more Keynesian outlook by assuming that investors do consider stock value expectations into their optimum portfolio. Hence, investors would not only demand bonds for

12 Assumption that will be relaxed in the next section to allow for disequilibrium in the bond market.
13 For example, in equilibrium, equation (3.1) could be obtained by joining two different matrices in the Godley and Lavoie's model. There are some differences made for simplification purposes but in any case, both models integrate stocks and flows consistently in a constraint that determines the behaviour of individuals.
14 See Tunez (2017) for an explanation of structural breaks in disequilibrium.

their return but also for their expected capital appreciation. This section will assess the claim that whatever demand functions are chosen, the supply and demand for money are always equal, as Lavoie and Godley (2007) have asserted[15], for equal or lower than equilibrium levels of long rates.

Moore's horizontal approach has been criticized for not placing any key role to the demand for money in his endogenous monetary theory. However, as it will be seen further on in this section, the liquidity preference plays a vital part in the determination of the long rate when this rate can be determined in the market. It is further assumed, as Keynes did[16], that short run expectations are fulfilled within the Keynesian period and individuals are not restricted[17] in any market. Hence, given the demand for money equation (4.1)[18], households are indifferent from demanding any type of bonds (4.2) and must also be holding the desired level of deposits for any given budget constraint and hence there will be no need to include that equation.

$$\mathrm{Mh} = \mathrm{lp}\ (\mathrm{ib}, \mathrm{p}, \mathrm{Y}, \ldots)^{19} \tag{4.1}$$

$$\frac{\Delta \mathrm{Bh}}{\Delta \mathrm{Bg}} = \mathrm{bh}\ \frac{\Delta \mathrm{Bh}}{\Delta \mathrm{Bf}} \quad \text{and if} \quad \Delta \mathrm{Bf} = \mathrm{bfg}\ \Delta \mathrm{Bg} \quad \rightarrow \quad \mathrm{bh} = \mathrm{bfg} \tag{4.2}$$

$$\mathrm{Mf} = \mathrm{mf}\ (\mathrm{Inve}, \mathrm{ib}, \mathrm{p}, \mathrm{Y} \ldots) = 0 \tag{4.3}$$

$$\Delta \mathrm{Bf}\ = \Delta \mathrm{Lf} \tag{4.4}$$

$$\mathrm{Rb} = \mathrm{rbl}\ \mathrm{Db} \tag{4.5}$$

15 In chapter 5 this assertion will be shown to be false for higher than equilibrium interest rates.
16 "the theory of effective demand is substantially the same if we assume that short period expectations are always fulfilled" (Keynes 1973: 181).
17 This assumption will be relaxed in the next section as we discuss the effect of disequilibrium in budget constraints.
18 Notation as above.
19 Keynes never denied the maximization principle of consumer choice theory as for him the principles do not lead automatically to full employment. "On certain assumptions, however, as to the distribution of the propensity to consume through time…for the community as a whole, it would maximise satisfaction" Keynes (1936: chapter 22). In fact, the propensity to consume is a consequence of individual preferences. Hence, in a Keynesian framework the consumer's demands for money, bonds and consumption goods should respond to the maximization of consumers' preferences.

$$\Delta Bg + \Delta Bf = \Delta Bh + \Delta Bb + \Delta Bcb \quad \text{and} \quad Eh = Esh + \Delta Eb + \Delta Eb \tag{4.6}$$

$$Pb\,\Delta Bcb = fcb \tag{4.7}$$

To simplify we will assume that firms only keep liquid balances as bank deposits but not as cash balances, hence equation (4.3). Firms are indifferent between supplying bonds or demanding loans for investment financing (4.4). Banks must choose between giving loans or buying bonds and hence they will also have to adjust loan rates to the conditions in the market[20]. Banks also keep cash balances in the CB as legal reserves as in equation (4.5). Equation (4.6) is the bond and equity market equilibrium. In this section it will be assumed that the nominal value of bonds sold by firms are equal to the total price of bonds bought by households, banks and the CB. Firms are also supposed to issue as much equity as it is demanded by households at all times as in (4.6). In general, dividends will not be totally reinvested in the firm and entrepreneurs might also sell other assets to obtain equity instead of raising debt or using capital reserves as it is assumed for simplification purposes. The CB's demand for bonds is supposed to be set by its Monetary Policy stand as in equation (4.7).

First, let us define the supply of money (MS) as in (4.8), the demand for money (MD) as in (4.9) and the Quantity of Money (QM) will be defined as the effective holdings of money for each level of long-term interest rates and equal to MD in equilibrium as in (4.11). Keynes uses supply of money and quantity of money indistinctively although he does differentiate between them and the effective quantity of money. "…when money is relatively scarce, some means is found to increase the effective quantity of money." Keynes (1936: chapter 21).

20 Hence, bond, loan or just long rates are assumed to be equal and endogenously determined by supply and demand conditions in financial markets.

$$\mathrm{MS} = \mathrm{Rsb} + \Delta\mathrm{Rb} + \mathrm{Dsb} + \Delta\mathrm{Db} + \mathrm{Msh} + \Delta\mathrm{Ms} \tag{4.8}$$

$$\mathrm{MD} = \mathrm{Rb} + \mathrm{Db} + \mathrm{Mh} \tag{4.9}$$

For lower or equal levels of the long interest rate, we can see that the volume of outstanding currency in circulation ($\mathrm{Msh} + \Delta\mathrm{Ms}$) is always equal to individuals' demand for cash and then subjected to individual preferences. Hence, as deposits in commercial banks, as much as deposits in the CB, are supplied on demand, for equal or lower than equilibrium long rates the money market is always in equilibrium as in equation (4.10) corroborating Godley and Lavoie's model.

$$\Delta\mathrm{Ms} + \mathrm{Msh} = \mathrm{Mh} \tag{4.10}$$

Furthermore, the money supply as defined in (4.8) can also be considered endogenous as it expands or dwindles in function of individual preferences and long run state of expectations despite an alleged unresponsiveness of the CB not giving discounted loans or participating through open market operations in the bond market. Endogeneity, for equal or lower than equilibrium interest rates, is then an inherent property of the system independent of behavioural dynamic requirements.

Second, given the set of assumptions already defined above, additional deposits are being created "at a rate that is exactly matched by the willingness of the community to hold additional wealth in that form" Howell (2007: p. 3). However, contrary to Howells' deduction, the slope of the equilibrium quantity of money (QM)[21], which is portrayed as the bold line in figure 1.a, might not be horizontal as we can see in equation (4.13). The quantity of money will be higher for lower levels in the required amount of cash balances by households, the less tight monetary policy stand is, the higher the monetary base or lower

21 Equilibrium Quantity of money is defined as the volume of cash in circulation plus reserves plus demand deposits at the equilibrium long rates.

reserve requirement and it could be positive or negative depending on the magnitude of those changes.

$$\mathrm{QM}^{e} = \emptyset\,(fcb, \Delta DL, Inve, G,\ i_{dl} \ldots) \tag{4.11}$$

$$\mathrm{Ib}^{e} = \delta\,(fcb, \Delta DL, Inve, G,\ i_{dl}\ \ \ldots) \tag{4.12}$$

$$\frac{dQM^{e}}{d\mathrm{ib}^{e}} = \frac{\frac{\partial \emptyset(fcb,\Delta DL,Inve,\ldots)}{\partial fcb}\ dfcb\ + \cdots + \frac{\partial \emptyset(fcb,\Delta DL,Inve,\ldots)}{\partial i_{dl}}\ di_{dl}}{\frac{\partial \delta(fcb,\Delta DL,Inve,\ldots)}{\partial fcb}\ dfcb\ + \cdots + \frac{\partial \delta(fcb,\Delta DL,Inve,\ldots)}{\partial i_{dl}}\ di_{dl}} \tag{4.13}$$

The quantity of money as specified in (4.11) emerges from solving the system of equations set up in the previous section. After solving the system with Mathematica, the resulting equation is too long and only the reduced form is shown. This equation is not a supply of money in the orthodox sense as it considers both supply and demand conditions in the market. Thus, although the supply of fiat money could be assumed to be exogenous with respect to long rates, hence the vertical lines in figure (1.a), the quantity of money cannot be either vertical or horizontal except for a very restricted set of conditions. This has led to the confusion between supplies curves and equilibrium/disequilibrium curves where both supply and demand conditions need to be considered. Setterfield's indetermination of the dynamic credit supply function in Post Keynesian models hinges on this confusion between supply curves and market equilibrium functions[22] "…identify either an upward sloping or a horizontal dynamic credit supply schedule a priori is equivalent to identifying a determinate long run equilibrium position" Setterfield (2017: p. 407).

The problem is that dynamic credit supply schedules cannot be identified with equilibrium curves as represent different conditions in the market. A supply of money schedule should

22 Supply functions do not reflect equilibrium rates as they do not consider market conditions but only supply conditions. Hence, dynamic credit supply schedules cannot be identified with equilibrium curves as Setterfield does.

only represent supply conditions. If those conditions are independent of long interest rates, it can be depicted as a vertical line respect to long rates as in figure 1. Yet, this is different, and must not be confused, with a constant quantity of money assumption. As stated above, in the Treatise on Money, Keynes already stressed the role of credit by the banking system in order to reach equilibrium between Investment and Saving and hence its endogenous nature.

Third, despite structuralists' argument[23] of a less than perfectly elastic supply of reserves, as we have already seen in the previous section, the CB does always fully accommodate banks' demand for reserves as much as it cannot refuse to accept deposits from the legal depository institutions. However, the CB must take the decision to choose one of the available options to provide this needed liquidity to pursue the goals set by the Monetary Policy Committee's (MPC) monetary policy. Even if we assume that the CB accommodates the volume of loans through the discount window to the increase in compulsory reserves held at the CB to assure stability of the short rate, the slope of the QM function with respect to the long rate might still be positive depending on the stance of the monetary authorities and liquidity preferences.

Fourth, Innovation or Asset and Liability management could reduce the volume of reserves needed to be hold at the CB by the banking system. Banks could run down their volume of bonds to obtain the required reserves and no immediate accommodation for the monetary authorities will be needed despite Horizontalists' assumption. However, depleting bonds in excess might shoot up the long rate and the CB might be forced to supply the reserves anyway to keep the long rate within a benchmark band. Banks could also turn to the interbank lending market[24] where banks could obtain liquidity in a daily basis to overcome

23 See Pollin (1991).

24 The interbank lending market, although capable to alleviate the liquidity pressures of individuals banks, cannot ease systemic liquidity constraints. Furthermore, it seems that the participants in the interbank market form close relationships in the same geography based on their dissimilarity in their cash flows. See Afonso, Kovner and Schoar (2014).

any temporal shortage of reserves at the CB. When the interbank market dries up the CB intervenes in monetary markets to keep this rate close to the base rate.

Fifth, the equilibrium long rate is achieved when the banking system is using all their reserves, i.e., there are no free reserves. Furthermore, as liquidity preference changes affect the demand for bonds, the bond market would not be in equilibrium until the money market clears. Hence, at the equilibrium long rate, both the bond and the money market need to clear simultaneously.

Sixth, any term structure of interest rates can be reconciled with Keynes' liquidity preference theory as the difference between short and long rates depends on other variables apart from individuals' preference for liquidity. Specially, the role of monetary policy might be quite significant in determining the long run equilibrium rate as in equation (4.12)[25].

However, at lower than equilibrium long rates, i.e., lower than (ib^1) in figure 1.a, 1.b and 1.c private and public willingness to spend is higher than the readiness to invest money in the form of demand for bonds or supply of loans. Yet, it can be shown[26] that the money market is still in equilibrium and hence the excess supply in the bond market might not have a compensatory disequilibrium somewhere else in the system corroborating that Walras' Law[27] does not hold. An excess supply of treasuries hinders the government ability to finance all their desired public expenditure projects. This restriction in financial markets shifts the expenditure function and all the variables depending on it. The amount of public expenditure that can be financed becomes an endogenous variable determined by the following equation.

25 Although Keynes was very dubious about the ability of Monetary Policy to affect the long rate.
26 Calculations were done using Mathematica.
27 The invalidity of Walras' Law in a monetary economy without and with bonds has already been asserted in Túñez (2016) and (2017) respectively.

$$G = C_g + w\,N_g = bg\,pb\,(\Delta Bh + \Delta Bb + \Delta Bcb) + Tg - itb\,pb\,Bsg \qquad (4.14)$$

Public expenditure (G) is equal to public consumption of private goods $\left(C_g\right)$ plus the public employment wage bill $\left(w\,N_g\right)$ and is determined by (bg) the proportion of the demand for bonds that will be allocated[28] to the supply of government bonds.

At (ib^0) households' demand for cash balances and deposits are with respectively (M_0^D) and (D_0^D) and the maximum amount of Loans is (L_0^M). The supply of loans is assumed to be horizontal until the maximum amount is reached, i.e., there is no credit rationing for risk-worthy borrowers until maximum amount is reached. However, the maximum loan function, i.e., the curve (L) between (ib^1) and (ib^0) in figure 1.b is positively sloped on long rates due to the positive effect of the decrease in liquidity preference on the loan multiplier.

Interestingly, we can observe that although the demand for deposits is negatively sloped with respect to long rates, at lower than equilibrium long rates, the deposit function (D), the bold line in figure 1.c, might be positively sloped.

If monetary policy is too restrictive the demand for loans is higher than the maximum amount of loans, firms' financial requirements will be constrained in financial markets to finance their investment projects by the bank's ability to find reserves as in (4.15). The constraint in money markets outlines the possible inability of the banking system to obtain financial resources. In this situation, at lower than equilibrium interest rates, the demand for loans might shift rightwards for higher long rates as the effect of increasing activity, due to releases of liquidity into the system, more than offsets the negative effect that higher rates have on investment demand. Hence, even though, the slope of the demand for loans with respect to long rates is negative, once it is adjusted for variations in output it might become positive.

28 This allocation could be determined by the ratio of government's supply of bonds to the total supply of bonds if there is not preference for government bonds or higher if the public prefers government bonds.

$$Investment^M = L^M + bd\ \Delta \mathrm{Bf} \tag{4.15}$$

This is the case of insufficient savings to finance investment where an increase in interest rates does bring the system to higher levels of economic growth. As individuals release part of their holdings of cash into the market demanding a higher ratio of bonds and deposits, banks' maximum ability to supply loans will expand.

The quantity of money when long rates are lower than equilibrium is depicted as the bold line passing through (QM_0, ib^0) in figure 1.a and equation[29] (4.17).

$$\mathrm{QM} = \emptyset(\ C_h, fcb, \Delta DL, ib \ldots) \tag{4.17}$$

At lower than equilibrium long rates, any decrease in interest rates will be viewed by more people as increasing the chances of future increases which will increase their demand for cash and any increase in interest rates will release part of the household's cash holding into the banking sector through higher reserves or the bond market due to the increased willingness to invest. Hence, the slope of QM with respect to long rates might be positive due to the expansionary effect higher long rates on the demand for bonds and to the maximum loan function.

When it becomes apparent that the lack of liquidity in money markets is restricting the optimizing behaviour of economic agents, the pressure on the CB to intervene actively in the markets will build on. If the CB does not respond, interest rates will shoot up until the equilibrium rates are reached. If the CB does change its monetary stand and react to the increase in households' and banks' demand for fiduciary media by increasing the outstanding currency in circulation will equip banks to provide additional credit. This can be seen as a rightward shift in the MS curve in figure 1.a.

29 Again, the solution of the system using Mathematica produces an equation that is too long if expressed explicitly.

If monetary policy is sufficiently expansionary, for example by increasing the discounted loans to banks to (ΔDL^*) in such a way that banks are now not reserve-constrained, firms will be able to access the banking system even though they are unable to find finance in the bond market. This enhanced demand for loans (ΔL^d), due to firms' excess supply of bonds, can be assumed now to be lower than the maximum amount of loans.

$$\Delta L^d = \Delta L^f + \alpha\, \Delta \mathrm{Bf} \tag{4.18}$$

An expansion in the quantity of money as in (4.19), will be now correlated with the increase in income due to the lower interest rate.

$$QM^* = \emptyset(\, C_h, fcb, \Delta DL^*, ib \ldots) \tag{4.19}$$

In this case, the path towards the equilibrium long rate follows a different trajectory represented in figure 1.a as (QM^*). Monetary expansion could also bring the equilibrium curve downwards. However, as Keynes noted, the long rate is more recalcitrant than the short rate and "may fluctuate about a level which is chronically too high for full employment" Keynes (GT: p. 130). To put it in a different way, the equilibrium level of interest might be higher than the neutral level of interest at which there is full employment.

5. Excess Supply of Money and Structural Breaks

At higher than equilibrium long term interest rates the cash balances kept by the public are no longer the desired ones as individuals are restricted in the bond market. The undesired liquidity or any over-issue of outstanding currency is partially reverted in the CB by an increase in banks unused reserves as banks are also restricted in financial markets. This excess of money brought about by constraints in the bond market is explained in this section.

According to Godley and Lavoie "A clear implication of Godley's model is that money is endogenous and cannot be otherwise" Lavoie (2001: p. 2) and "there can never be an excess supply of money" Lavoie (2001: p. 8)[30]. However, Keynes' model allowed for out of equilibrium-excess supply of money periods. "There may be, for example, some fairly stable proportion of the national income more than which people will not readily keep in the shape of idle balances for long periods… The opposite tendencies will set in if the quantity of surplus money is an abnormally low proportion of the national income" Keynes (1936: chapter 21). When the amount of this excess of money is abnormally kept at a high level, Keynes assumes that there will be a tendency for the interest rate to fall and revert to the normal proportion determined by the psychology of the public.

Nevertheless, although disequilibrium might still exist, it is far from obvious how disequilibrium feeds back into the structural properties of the economic system. That has already been the cause of intense academic debate since Walras' famous work on general equilibrium. In this paper, disequilibrium can shift the constraints faced for the economic agents involved in the market system without an automatic hydraulic compensatory mechanism characteristic of general equilibrium models. In Godley and Lavoie' integrated accounting model those types of structural breaks cannot occur. Furthermore, for Godley and Lavoie an excess of reserves in the banking system will be channelled towards financial markets pushing bond prices up and interest rates down which could trigger wealth-induced consumption booms. This process of pushing interest rates down will not finish until reserves are fully used up. However, if interest rates are still too high, the willingness to purchase bonds might be higher than the eagerness to obtain financing through bonds. The consequence of too high interest rate is that households cannot purchase all they would have

30 Lavoie and Godley assume that only expectational shocks can explain excess supplies of money. To avoid that kind of excess supply of money, expectational shocks are assumed away.

purchased having not had any restriction in the bond market. Therefore, they can only manage to buy a proportion (rbh) of the total increase in the supply of bonds discounting for the assumed exogenous role of the CB acquiring a policy determined level of bonds as in equation (5.3). Hence equation (4.2) should be substituted for equation (5.1) as individuals are restricted from buying their chosen bundle. Nevertheless, although individuals cannot hold their desire nominal value of bonds, their budget constraint still hold true for the restricted final holdings of bonds.

$$\Delta \mathrm{Bh} = \mathrm{rhh}\ (\Delta \mathrm{Bg} + \Delta \mathrm{Bf} - \Delta \mathrm{Bcb}) \tag{5.1}$$

$$\Delta \mathrm{Bb} = \mathrm{rbb}\ (\Delta \mathrm{Bg} + \Delta \mathrm{Bf} - \Delta \mathrm{Bcb}) \tag{5.2}$$

$$\Delta \mathrm{Bcb} = \mathrm{fcb} \tag{5.3}$$

$$\mathrm{Rb} = \mathrm{rbl}\ \mathrm{Db} + \mathrm{FRB} \tag{5.4}$$

Banks could be also restricted in the bond markets as it can be seen in equations (5.2). Consequently, banks are not able to use up all reserves to buy bonds. This volume of free reserves (FRB) will revert in the CB. Hence, the amount of reserves held by banks might now be higher than the legally required quantity as in equation (5.4). The outstanding currency in circulation will be lower than in equilibrium, ceteris paribus, although the amount of bank reserves has increased. However, the monetary base might be higher than before if the CB does change its intervention through open market operations or discounted loans.

$$\mathrm{QM} = \gamma(\Delta \mathrm{DLcb}, \mathrm{Inve}, \Delta \mathrm{Bcb}, \mathrm{ib} \dots) \tag{5.5}$$

By solving the new system of equations, we can observe that the quantity of money in the economy is now determined by equation (5.5) instead of by (4.11) revealing the structural break in the money market due to the constraint in the bond market. The quantity of money

for higher than equilibrium long rates is represented in figure 1.a as the dashed bold line. We can also see that now Investment has a positive influence in the current quantity of money function. As individuals are restricted by an insufficient supply of bonds at the given long rate, an increase in investment implies an increased volume of loans in the market and an increased amount of deposits in the banking system. The slope of the quantity of money function with respect to long rates is now negative.

The disequilibrium might be temporary, as there will be a tendency for the interest rate to drop. However, the lower bound of interest rates might be inhibiting the system to reach equilibrium. At this point, the economy is in a liquidity trap[31] such as the Japanese economy since the 90's as Krugman (1998) pointed out. However, Krugman's analysis asserts that monetary policy is ineffective in creating inflation due to a lack of credibility as markets do not believe the increase in base money will be sustained in the future[32]. For him, expectations management becomes the main concern for policy making purposes, although such a significant role is left mainly unexplained, i.e., it seems rather unconvincing that even after a few years of the CB commitment to expansionary monetary policy and inflation, the equilibrium price in the future (P*) is still independent of current values. In his analysis, monetary policy has a contemporaneous effect on the price level but not on the long run level which is assumed to be constant by definition and therefore independent from any policy outcome by design. On the other hand, if expansionary policies have not produced the sought-after inflationary effect in the past, it is also rather unconvincing that the CBoJ could do so in the future. Nevertheless, he asserts that if the CBoJ could persuade markets about its inflationary bias in the long run, it could swing the economy out of the liquidity trap problem.

31 Although Keynes rejected a perfectly inelastic demand for money function, the liquidity trap defined in this paper is not due to a given change in individuals' liquidity preferences but their inability to find investment opportunities at a given state of long-term expectations.

32 This issue will be explored in forthcoming papers as a model of the consumer choice theory needs to be introduced before we can examine Krugman's analysis further.

Contrary to Krugman's analysis, the liquidity trap is a natural consequence of the structural characteristics of the economic system in which the willingness to invest at any interest rate is not sufficient to guarantee the full utilization of all the funds that individuals would be willing to lend for a given state of long-term expectations.

Keynes recognized that the quantity of money could be temporarily at a high or low proportion, as we have seen above. This disequilibrium triggers off interest rates to fall until equilibrium is reached. However, in a liquidity trap, the nominal interest rate cannot fall, so the tendency towards this normal proportion cannot happen through interest rates movements.

Furthermore, at low interest rates, Keynes asserted that further decreases in rates will reinforce the belief that rates are too low, increasing the demand for liquidity as capital loses are now perceived to be more likely to happen in the future. Part of the excess supply of money can be absorbed by this increase in the demand for cash balances, i.e., and increase in the preference for liquidity. Yet, there might still exist a remnant excess of money that cannot be allocated to any viable investment opportunity given the conditions in the market. In this situation, in contrast with Krugman's analysis, an increase in the supply of base money by the CB will not be converted into increased investment nor inflation as households and banks are restricted in financial markets[33]by viable investment opportunities.

6. Conclusion

The intrinsic endogenous nature of the money supply is perfectly coherent with a vertical money supply with respect to long term interest rates. The ongoing and unresolved issues within the Endogeneity of Money debate have also been reviewd. The simplifications introduced by the Horizontalists are too simplistic and as Goodhart has claimed, Moore has

33 It has been assumed that the relation between households' cash holdings and deposits is constant and independent of interest rates. If individuals are assumed to hold the desired level of cash balances, the excess of liquidity will be entirely held in deposit accounts in the banking system. This excess is shown by the difference between the desired and realized amounts.

gone too horizontal. Although, had he made the interest charged by banks an endogenous variable he could have gone even more endogenous. On the other hand, Structuralism have missed Horizontalists' claim that under given conditions the money supply might be always equal to the demand for money at the interest rate determined by the monetary authorities without "…ignoring money demand, the complexities of policy, the endogenous nature of bank behaviour, and the existence of asset market spillover effects." Palley (2008: p. 18). In reality, both approaches have departed from Keynes' work.

Using a Non-Compensatory Disequilibrium framework to analyse the Structuralist – Horizontalist debate about the endogeneity of the money supply, a different view has been put forward. A view that reveals the existence of disequilibrium– induced structural shifts that might trigger path dependency dynamics and behavioural pattern change. This framework to disequilibrium and monetary economics has unveiled a new approach to analyse disequilibrium dynamics. Additionally, given the complex inter-relations of the financial system, simplifications were made with the objective of revealing part of that complexity.

Structural breaks in the behaviour of individuals can be explained by the existence of intertwined disequilibrium that restrict individual choices and might deter them from obtaining the optimum amount at any given time. Therefore, to analyse the interaction among individuals and markets it is required an integrated approach that examines structural breaks and market constraints. Those restrictions shift the behavioural functions of the model prompting breaks in the pattern of behavioural variables which are not accounted for either in the Godley and Lavoie's Horizontalist integrated approach or Structuralist models.

Table 1: The NCDF Matirx

NCDF		B	E	L	DL	M	D	R	BS	ES	LS	DLS	LBS	T	Y	TOTAL
RESOURCES	H	pb Bsh	Esh			Msh	Dsh		Bsh	ie Eh			w Nf			HR
	F	pb ΔBf	ΔEf	ΔLf			Dsf								Y	FR
	B	pb Bsb	ΔEb	Lsb	ΔDLb		ΔDb	Rsb	Bsb		ib Lsf					BR
	CB	pb Bscb				ΔMs		ΔRb				idl DLsb				CBR
	G	Pb Bg												Tsg		GR
	SUM															TOTR
USES	H	pb Bh	Eh			Mh	Dh							Th	Ch	HU
	F						Df		Bsf	ief Esf	ib Lsf		w Nf	Tf	Inve	FU
	B	pb Bb		Lb				Rb		ieb Esb		idl DLsb		Tb		BU
	CB	pb Bcb			ΔDLb											CBU
	G								Bsg				W Ng		Cg	GU
	SUM															TOTU
	EX	0	0	0	0	0	0	0	0	0	0	0	0		0	0

Figure 1.a: Supply and Demand for Money

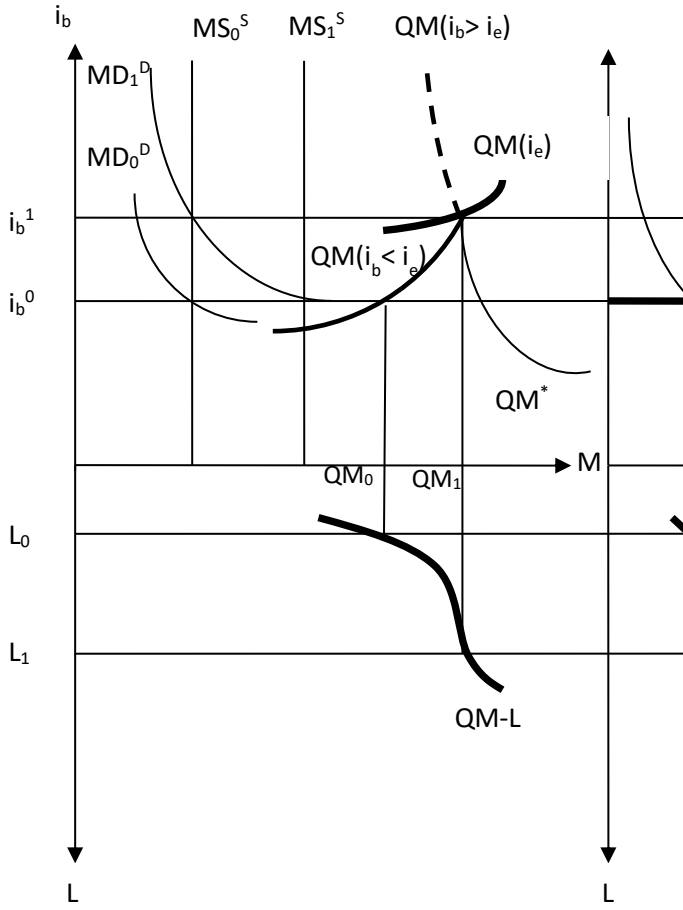


Figure 1.b: Supply and Demand for Loans

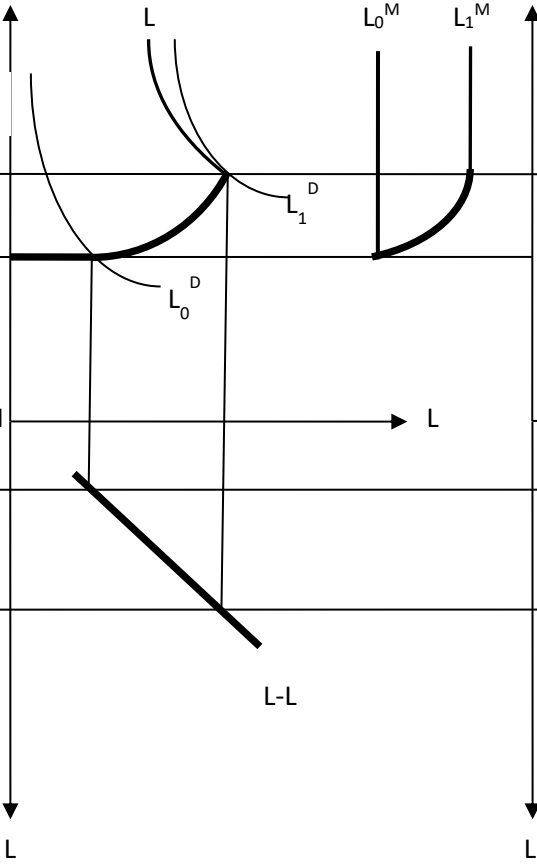
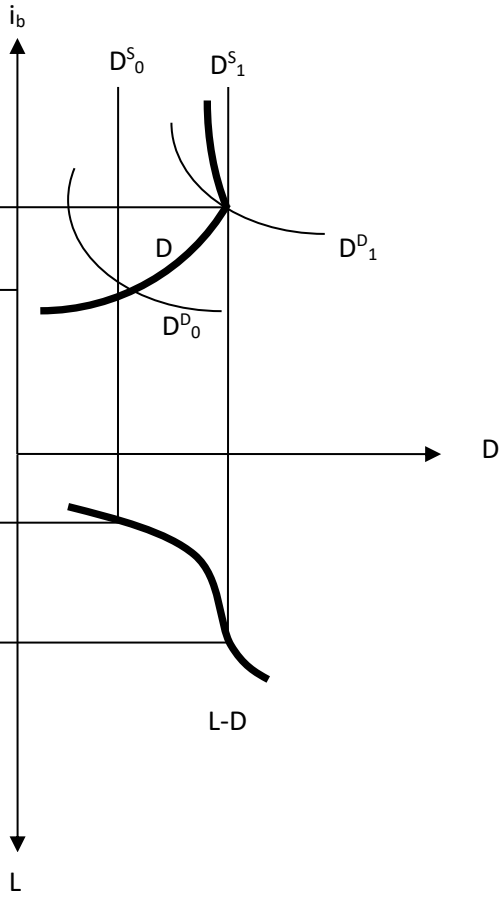


Figure 1.c: Supply and Demand for Deposits



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