The Validity of Walras' Law in a Monetary Productive Economy with Bonds: Loanable Funds theory vs Liquidity Preference theory

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Abstract

In a recent paper Túñez (2016) has reviewed the validity of Walras' Law for a Monetary Exchange Economy using a Non-Compensatory Disequilibrium Framework (NCDF). This paper will apply the same theoretical framework to a monetary productive economy with bonds to demonstrate that, conflicting with Maurer's (2009) and Patinkin's (1965) models, general excess supplies might exist, i.e., Keynes' thesis of unemployment equilibrium is hence a valid theoretical possibility as Walras' Law does not always hold. The paper will also examine the debate between the loanable funds vs liquidity preference theories using the NCDF.

Keywords: Walras' Law, Gross Substitution Axiom, Budget constraints, Realization problem, Compensatory Disequilibrium.

Introduction

In this article, the validity of Walras' Law will be analysed within a Non-Compensatory Disequilibrium Framework (NCDF) with two different types of economic agents: Households and Firms and four different markets: Commodity, Labour, Money and Bond Markets. The Money Supply will be assumed given exogenously. As it can be seen in Túñez (2016) the application of the NCDF will result in the General Law of Exchange where the violation of the Classical Gross Substitution Axiom

gives rise to the realization problem in monetary economies that has to be represented in the individuals' budget constraints.

Contrary to Patinkin (1965) and Maurer (2013)'s models, the excess demand of money is not equal to an excess of supplies in all other markets. Therefore, this paper will show that Malthusian general gluts and Keynesian unemployment equilibrium are possible. However, the only role of the banking system as simple financial intermediaries between savers and investors and not as creators of bank money does impose a restriction that will not be dealt with in this paper. Nevertheless, the intermediation role does allow for a credit giving economy where borrowing creates assets but no endogenous or bank-money.

Given the limitations of the model, any comparison with Keynes' Liquidity Preference Theory (LPT) or Wicksell's Loanable Funds Theory (LFT) would prove to be an unfair account. However, given that the objective of the present analysis is not to give a thorough account of them, it seemed to be a reasonable choice only to apply the simplest version, in order to show the validity of the Keynesian unemployment equilibrium thesis, i.e., the invalidity of Walras' Law and to clarify some differences between the two theoretical stands in opposition to Hicks' (1939) equivalence presumption.

The paper also differs with Hayes (2010)'s interpretation, in his attempt to clarify the Loanable Funds Vs Liquidity Preference (LF Vs LP) debate, that "…in Keynes' system there is no disequilibrium…" Hayes (2010: p. 808). According to Hayes (2010) no author can claim undisputed success in clinching the LF vs LP debate one way or the other whilst for Bertocco (2007) "…the fundamental elements of this theory (LFT), have been accepted by the mainstream monetary theory…" Bertocco (2007: p. 3).

A Non-Compensatory Disequilibrium Framework (NCDF)

Following Túñez (2016) the inapplicability of the classical gross substitution axiom in monetary economies leads to a general law of exchange where economic agents' budget constraints take into account the realization problem. Households are assumed to accumulate their saving into three different types of assets: Cash Balances (M_h), Own Funds (OF_h) and Bonds ($p_b B_h$) and to face a dual decision making process. First, they have to decide whether to use their resources for consumption or saving. Secondly, they decide whether to invest their savings in monetary balances, OF or bonds. Their decisions will affect the level of interest rate that balances the supply and demand for bonds which at the same time will have an effect over the level of investment demand, employment, production and

hence their volume of total savings to be distributed among the different types of assets.

Profits all accrue to the household sector and assumed to be reinvested in the company. The return on OF, as the return on bonds, is just the price that has to be paid for the supply of a capital service to firms. Profits are therefore seen as the interest that capital owners have been paid for their supply of capital to the firms. In this model OF could be calculated as the book value of the total assets minus the book value of outstanding bonds issued by the firm.

$$M_h + p_b B_h + i_w\, N_i^{us} + OF_h + C_h$$
$$= \bar{M}_h + p_b \bar{B}_h + \overline{OF}_h + i_w \bar{N}$$
$$+ i_b p_b \bar{B}_h + i_{of} \overline{OF}_h$$

(2.1)

$$S_h = i_w N + i_b p_b \bar{B}_h + i_{of} \overline{OF}_h - C_h$$

(2.2)

$$C_h = fc\left(Y, i_b, \quad p, \quad i_b^e, p^e, \quad \frac{M}{p}, \dots\right)$$

(2.3)

$$i_{of} \overline{OF}_h = PROF = i_{of} \overline{OF}^f$$
$$= \bar{Z}(w, p) - Y^{up} - i_w N - i_b p_b \bar{B}^f$$

(2.4)

$$p_b \, \Delta B_h = p_b \, \overline{\Delta B_f}^{\,s} = p_b B_h - p_b \bar{B}_h$$
$$= p_b B_h - p_b \bar{B}^f$$

(2.5)

Equation (2.1) is the households' budget constraint. Equation (2.2) represents households' savings and it is equal to households' income streams minus their consumption. Equation (2.3) describes the consumption function [1] and (2.4) states that households own profits. In this model, the supply of bonds by firms is uniquely accumulated by households as it can be seen in equation (2.5).

Firms are assumed to supply Commodities, OF and Bonds and to demand employment and commodities. Firms are also assumed to pay the price of capital services both on OF and on Bonds that have been utilized by them, they are forced to accumulate unsold commodities (Y^{us}) and to hold on unsold bonds $\left(\overline{\Delta B_f}^{\,us} \right)$[2]. Contrary to the two-agent bondless model[3], resources that are not needed in form of cash holdings will not be used in demanding consumption expenditure but in demanding bonds. Any excess demand for bonds by households will be accumulated in cash balances with no further direct repercussion over the commodity sector.

Firms are also assumed to issue property rights over their OF[4] and to demand its productive capital ($\bar{K}_f$) and its services ($i_k \, \bar{K}_f$); equities do not exist in this model. Firms' budget constraint is represented in the following equation.

$$Inv + Y^{us} + Y^{up} + p_b \overline{\Delta B_f}^{\,us} + \bar{K}_f + i_w N$$
$$+ i_b p_b \bar{B}^f + i_{of} \overline{OF}^f + i_k \bar{K}_f$$
$$= \bar{M}_f + p_b \overline{\Delta B_f} + \overline{\Delta OF}_f + \bar{Z}(w, p)$$
$$+ \bar{K}_f + i_k \bar{K}_f$$

(2.6)

Another requirement is that firms' balance sheet must be balanced; the asset side must match the liability side at the beginning but also at the end of the period. Furthermore, the increase in the supply of OF will be equal to the final nominal value of OF minus the initial nominal value as in equation (2-7), i.e., households are supposed to demand all OF supplied by firms. Part of the aggregate supply ($\bar{Z}(w, p)$) might remain unsold increasing firms' inventories which Keynes assumed to be demanded

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[1] The Consumption function could be expressed, as Keynes did, without differentiating between wage and profit earners neither did he include Patinkin's cash balances effect or any wealth effects. It could also include intertemporal utility maximization as in New-Keynesian models. Neither of these assumptions will change the fact that Walras' Law does not always hold and the existence of structural breaks in budget constraints need to be taken into account to outline the dynamic behaviour of variables in disequilibrium.

2 In general equilibrium models, it is further assumed that the price level is totally flexible and that firms will adjust production according to the level of the demand for their products and hence (Y^{us}) would be equal to cero.
3 The model is described in Túñez (2016).
[4] This assumption is similar to Morishima's adjustment of Walras' Law.

by firms and hence they will not alter market clearance in the commodity market[5]. For Keynes, an increase in inventories will increase aggregate income. In a figurative sense, the firm acts like a buyer of last resort for the remaining unsold products, eliminating any discrepancy between production and income by creating savings that match the new inventory investment. Yet, part of the $(\bar{Z}(w,p))$ might not be produced by firms (Y^{up}) if demand is lower at those expected prices and nominal wages. Hence, firms might not be producing at profit maximisation prices which will trigger a price and future expectations revision. Hayes (2010, 2013) asserts that $\bar{Z}(w,p)$ is always equal to aggregate demand "It should now be clear that there can be no disequilibrium in the goods market in Keynes' system" Hayes (2010: p. 817). However, in a recent paper, Túñez (2015) have criticised this equilibrium assumption alien to Keynes' GT and shown that disequilibrium in the commodity market might exist.

Additionally, part of the supply of bonds could remain unsold as in equation (2.8). Equation (2.9) explains that the nominal amount of bonds that have been sold will be equal to the households' total demand for bonds minus the initial amount of bonds holdings by households if households are not constraint in the bond market.

$$OF_h = \overline{OF}_h + \overline{\Delta OF}_f$$

(2.7)

$$p_b \overline{\Delta B}_f = p_b \overline{\Delta B}_f^{\ s} + p_b \overline{\Delta B}_f^{\ us}$$

(2.8)

$$p_b \overline{\Delta B}_f^{\ s} = p_b \Delta B_h = p_b B_h - p_b \overline{B}_h = p_b B_h - p_b \overline{B}^{\ f}$$

(2.9)

$$Y = C_h + (Inv + Y^{us})$$

(2.10)

From substituting equations, we get the following:

$$p_b \Delta B^f = Inv + Y^{us} - \overline{\Delta OF}_f$$

(2.11)

$$M_h^d = M_h^d(Y, i_b, \quad p, \quad i_b^e, p^e, \quad \frac{M}{p}, \dots)$$

(2.12)

$$\sum S - \sum D = \sum ES$$

(2.13)

Equation (2.11) only stresses the fact that the volume of realized investment in both fixed capital (Inv) and inventories (Y^{us}) must be financed either

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[5] Wicksell might have also assumed that inventories presuppose a saving activity "…then the formation of capital (a saving activity) which constantly is in process…" Wicksell

(1898: p. 230). Therefore, it will be assumed that inventories are not the cause of a possible mismatch between savings and investment ex-ante.

by the supply of OF or Bonds. An increase in unsold products creates an increase in both inventories and own funds ($\overline{\Delta OF_f}$). Hence, although inventories finance itself by raising firms' profits, fixed capital has to be financed by the remaining own funds or bonds. Therefore, the supply of bonds by firms will have to be allocated to that part of investment that has not been financed by internal funds. In equilibrium households will hold their desired cash balances as in (2.12) which can also be subject to intertemporal maximization rules. A change of current interest rate and consumer prices in relation to expected future prices will trigger substitution effects which depend on the elasticity of price expectations.

The equilibrium interest rate can now be calculated by solving the above system of equations (2.1/12). We could also rearrange and condense those equations into (2.13). This equation tells us that the value of supplies ($\sum S$) minus the value of demands ($\sum D$) is equal to the summation of all excess supplies ($\sum ES$). When there is no unsold excess product the equation is equivalent to Walrus' Law as the value of excess demand is equal to zero which brought Hicks (1939) to disregard one of the equilibrium equations in his IS-LM model by getting rid of the bond market-clearing equation. However, as we shall see in the next section, in disequilibrium Walras' Law does not hold as demand fails to appear somewhere else in the system[6].

GLE		CAPITAL				CAPITAL SERVICES			LBS	Y	TOTAL
		FC	B	OF	M	FCS	BS	OFS	LBS	Y	
SOURCES	H		p_bB_h	$\overline{OF_h}$	$\overline{M_h}$		$i_bp_b\bar{B_h}$	$i_{oF}\overline{OF_h}$	$i_w\bar{N}$		INVH
	F	$\bar{K_f}$	$p_b\Delta\bar{B_f}$	ΔOF_f		$i_k\bar{K_f}$				$\bar{Z}$	INVF
	TOTS										INVT
USES	H		p_bB_h	OF_h	M_h				$i_wN_h^{sat}$	C_h	FNVH
	F	K_f	$p_b\overline{\Delta B_f}^{ut}$		M_f	i_kK_f	$i_bp_bB_h$	$i_{oF}OF_h$	i_wN	$\frac{Inv}{Y^{ut}}Y^{up}$	FNVF
	TOTU										FNVT
	TOTU-TOTS	0	0	0	0	0	0	0	0	0	0

Table 2.1: NCDF: The GLE Matrix

Hence, equation (2.13), portrayed in Table 2.1, represents the General Law of Exchange (GLE) where commodities have to be exchanged for money and therefore would remain unsold if there is no monetary transformation of commodity value. Therefore, Hicks' methodological procedure did not allow him to take into account the structural breaks in household's and firm's budget constraints that correspond to the realization problem associated with the violation of the Classical Gross Substitution Axiom. In the next sections, it will be explained how the different market constraints lead to structural breaks in markets', individuals' and firms' behavioural hypothesis in disequilibrium.

Excess Supply of Bonds: Loanable Funds Theory

"If an authoritarian government fixes a rate of interest which is much lower than the rate which would prevail in a free market, then during any period saving and new investment ex-post are

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[6] See Clower (1969).

nevertheless equal, but the quantity of credit offered is found to have been smaller than the quantity demanded" Ohlin (1937: p. 424).

At a lower than equilibrium interest rate, individuals will keep a higher proportion of money in cash balances, decreasing their demand for bonds and firms will increase their supply of bonds as new investment opportunities will be profitable at the new lower rate. An excess supply of bonds would imply that firms' investment plans are not being realized. Although, ceteris paribus, at any level of Investment demand there would always be a level of supply of bonds to finance that level of capital accumulation, this level of investment will not be financed as the required volume of bonds cannot be sold. Hence the volume of investment that can be financed is determined by the following equation[7]:

$$Inv = (p_b B_h - p_b \bar{B}_h) + (\overline{\Delta OF_f} - Y^{us})$$

(3.1)

Investment is then restricted in the financial sector by household's demand for bonds. Hence, output and employment would be lower than the equilibrium levels. At this level of investment, households are not constraint in the bond market as the supply of bonds is higher than the demand, i.e., there is no excess in the money market as households

are holding the cash balances that they require. However, investment is restricted in the bond market by a lack of households' savings, i.e., a decrease in interest rates would not bring a higher level of investment. On the contrary, a decrease in interest rates would only decrease the households' savings going into the bond market and hence available to finance investment demand. Investment is then constrained by the existence of ex-ante savings as claimed by LFT. As long as there is an excess supply in the bond market, any unwanted cash balances will go into the bond market increasing the volume of investment demand that can be financed by available savings. The increase in financeable investment demand will increase production and employment until the demand for money has absorbed entirely the current supply of money, point at which no more money balances will be going into the bond market.

The striking feature of the model is that even when the bond market does not clear, by solving the system of equations now including the financial constraint, we can see that once production has adjusted to the aggregate demand for any given interest rate, nominal wage and long term expectations, the money market clears [8] independently of excess supplies in the bond, commodity or labour market, for any interest rate lower than (i_e) in Figure 3.1. Hence, there is no

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[7] It has been assumed that there is no depreciation to avoid unnecessary complications.
[8] There will also be a temporary excess supply of money until firms adapt their production level to faster replenishment of

inventories due to increased levels of investment demand. During this process the budget constraint should also reflect the lower level of income.

excess demand or supply of money as shown in Equation (3.2).

$$EDM = 0$$

(3.2)

Furthermore, we can always find a range of nominal wages and prices for which the summation of excess demands will not be equal to cero, i.e., Walras' Law does not hold out of equilibrium situations. Yet, as the equilibrium condition in the money market does not interfere in the determination of nominal wages, prices, employment or output, the equilibrium interest rate has to be determined in the bond market. Interest rates would move upwards till the bond market clears. This result is contradictory to the liquidity preference theory as interest rates would not be determined in the money market. In fact, it resembles the LFT as it emphasizes the limitation that ex-ante savings exert on realized investment. Furthermore, given the assumption made, the interest rate that will allow firms to finance all the desired[9] investment demand (Inv_d) can be calculated with equation (3-3).

$$S_h = Inv_d + Y^{us}$$

(3.3)

In Ohlin's terminology Equation (3.3) implies the equality of ex-ante savings (S_h) and ex-ante total investment ($Inv_d + Y^{us}$). These two ex-ante amounts need not be equal as we could see in Figure 3-1 although ex-post investment ($Inv + Y^{us}$) is equal to ex-post savings. Ohlin felt that Keynes did not understand his point. "Mr. Keynes interprets my ex-ante analysis of the market for credit, i.e. claims, as if it had been ex-post, and then finds that my ex-ante analysis has disappeared." Ohlin (1937: p. 424). However, Keynes assumes that ex-ante investment will be always financed and although ex-ante and ex-post investment may vary, ex-post savings increase by the same amount as ex-post investment and there is not any forced or un-genuine savings "Thus the old-fashioned view that saving always involves investment, though incomplete and misleading, is formally sounder than the new-fangled view that there can be saving without investment or investment without 'genuine' saving." Keynes (1936: p. 60).

However, Keynes relied on a money creating banking system to explain why correspondently there is no such a financial constraint[10] although that was not explicitly explained in the GT. Possibly that is the reason why Minsky believed that the GT lacked a theory of finance that would explain how investment projects are financed. Although sharing this emphasis on the banking structure with Wicksell's

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[9] The desired investment demand could be a function of profit rate and interest rates but also expectations about future income streams.

[10] The introduction of a money creating banking system which it will be analysed in forthcoming papers, although relevant in the LFT vs LPT debate, is unnecessary to exhibit the invalidity of Walras' Law thesis.

LFT, Keynes did not tie his theory to a normal rate of interest governed by the equality of savings and investment since for Keynes interest is only a purely monetary phenomenon whilst for Wicksell it is related to real factors. "Beside the somewhat too vague and abstract concept natural rate of interest I have defined the more concrete concept normal rate of interest, *i.e.* the rate at which the demand for new capital is exactly covered by simultaneous savings" Wicksell (1898: p. xiii). According to Wicksell, savings and investment, far from being analysed in a partial equilibrium model, are the result of the interaction of all markets and individuals in the system. "We have been making the implicit assumption that the relative values of commodities in exchange remain unaltered. But they are, of course, affected by the change in the conditions of production, and they in their turn exert an influence on the conditions of production. The only scientific method of dealing with the problem consists in paying *simultaneous* regard to all these factors..." Wicksell (1898: p. 132). For him the natural rate was reached at full employment, as only then the relative values of commodities would be stable. Hence, nominal wages and prices are assumed to adjust to their full employment general equilibrium level[11]. He also asserted that the normal rate of interest is

"determined by the current level of the natural capital rate, and rises and falls with it" Wicksell (1898: p.120). However, the employment level and output might not be constant along the saving and investment curves. Hence, the interest rate cannot be "determined exogenously to the income generation process" as in Pasinetti (1974: p. 47) but it would be the result itself of that process[12].

We can see in Equation (3.3) that its solution is different from the general equilibrium natural rate[13] and it renders the same interest rate as the solution to the system of equations from (2.1) to (2.12). Hence, it supports the classical view of the non-monetary nature of interest rates and, opposed to Keynes' LPT, they are not determined in the money market.
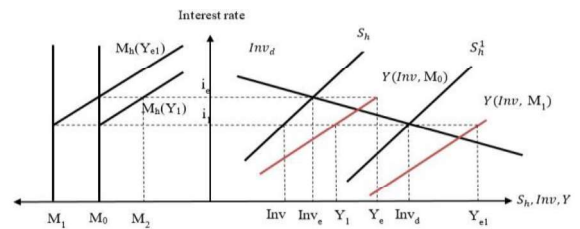
Figure 3.1: The Loanable Funds Theory of interest rates

As it can be seen in Figure (3.1), the profit rate[14] along the Y(Inv) curve increases as market

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[11] However, as we will see below, at disequilibrium interest rates, this tendency might not exist.

[12] Keynes pointed out that there will be a natural level of interest for each level of employment "I had, however, overlooked the fact that in any given society there is, on this definition, a different natural rate of interest for each hypothetical level of employment" Keynes (1936: p. 152).

[13] And then different from the Classical natural rate where full employment is guaranteed.

[14] For Wicksell the natural rate, i.e., the marginal productivity of capital is exogenously determined. That was already criticised by Myrdal and Lindahl. A decrease in markets rates trigger a decrease on the natural rate that might offset the

interest rates soars to the equilibrium rate because of increased savings on output and profit, i.e., market interest and profit rates move pro-cyclically[15] as Wicksell suggested. Also in Figure (3.1) we can see that for lower than equilibrium interest rates (i_e), production and prices will move in the same direction as interest rates and exactly in the specific proportion to shift the demand for money curve downwards to match the supply of money. This positive relationship between the price level and market interest rates which Keynes called the Gibson's Paradox[16] was already explained by Wicksell as the effect of too sluggish dynamic adjustment of interest rates to the natural rate. As market rates are lower than the natural rate higher investment demand causes prices and interest rates to rise towards the equilibrium level.

An increase in the market rate from (i_1) to (i_e) creates an excess supply of money ($M_0 - M_2$) for that volume of output (Y_1) which will be put into the credit market, increasing the volume of saving and further available credit, until output has reached the level that clears the money market. Credit is then creating savings and investment for which no ex-ante savings existed. However, at interest rates lower than (i_e) there will always be a level of output that clears

the money market without reaching the desired level of investment (Inv_d) or clearing the bond market.

Borrowing has the following effects on firms and households when it is used to purchase investment goods. First, it creates a debt equal to the increase in assets for the firm that purchased the investment good. Secondly, it creates an asset for the household equal to the decrease in its money holdings. Third, the amount of credit given increases the profits and cash holdings of the company that sold the investment good, increasing the volume of OF. These effects offset each other. Forth, the new OF increases the value of the total assets owned by households without any entry in their liability side[17].

Furthermore, an increase in the money supply[18], ceteris paribus, by increasing excess supply of money for any given interest rate, will also have a positive effect on production by increasing the amount of credit available to finance investment projects. Hence, for any interest rate the savings curve will shift rightwards as households' initial holdings of cash balances increases. Within this disequilibrium framework caused by too low market rates, an increase in the money supply from (M_0) to (M_1) as in Figure (3.1) can always push the level of employment and price level towards the equilibrium

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positive influence on prices due to the natural rate being higher than market rates.

15 The profit and interest rates do not move synchronically for higher than equilibrium interest rates as we will see in the next section.

16 "One of the most completely establish empirical facts in the whole field of quantitative economics" Keynes (1930: p. 198)

17 Credit is therefore creating an increase in the volume of net assets in the system. Although, It might also create inflation, reducing the real value of net assets.

18 The initial households' holdings of cash balances.

level. Even without wealth effects money will still be no neutral. Inflation, which will be correlated to the increase in the money supply, could therefore be understood as "always and everywhere a monetary phenomenon (Friedman 1970: p. 11)." Correspondingly, a decrease in the money supply will push households' savings backwards creating deflation and unemployment along with a lack of investment. Yet, a sufficient increase in the supply of money, the bond and money market might reach equilibrium at the unchanged low market rates.

The relationship between production and interest rates (Y(Inv)) for lower than equilibrium interest rates is determined by Equation (3.1) and the equation of aggregate demand (2.10) and it can be seen in the right graph of Figure 3-1. This curve represents the combinations of income and interest rates that will be compatible with equilibrium in the money market. However, (Y(Inv)) cannot be confused with an LM curve as the latter does not include values of savings compatible with aggregate demand at a given nominal wage and expected prices and the former does.

The excess of desired investment over savings represents an excess of potential demand in the commodity market and is equal to the excess of supply in the bond market as in (3-4). Yet, Clower

and Leijonvufdud[19] have pointed out that notional demands might not be transmitted to the commodity market because firms are restricted in the bond market, i.e., the commodity market might remain in equilibrium even when there is an unsatisfied potential demand for investment as it is transmitted to sellers.

$$(Inv_d - S_h) = \left(p_b \, \overline{\Delta B_f} - \, p_b \, \Delta B_h\right) = ESB$$
$$= p_b \overline{\Delta B_f}^{us}$$

(3.4)

$$\sum S - \sum D = \sum ES = i_w \, N_i^{us} + Y^{up} + ESB$$

(3.5)

In any case, even though the excess demand for money is zero, the demand for labour, bonds and commodities might not necessarily be equal to their supply[20], as we can see in (3-5). Hence, Walras' Law would not hold, except for a limited set of parameters, which it is also the case when there is excess demand for bonds as we shall see in the next section.

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[19] Clower (1969) and Leijonvufdud (1968) stressed that restricted demands might fail to be transmitted to other market. They argued that this type of coordination problem makes Walras' Law irrelevant.

[20] The existence of disequilibrium in the labour market has not always been acknowledged in the general equilibrium literature. See for example Klein (1950), Patinkin (1965) or Harris (1981).

Excess Demand for Bonds

"But if aggregate savings is necessarily and in all circumstances exactly equal to aggregate investment…the rate of interest to preserve equilibrium not between the demand and the supply of new capital goods, but between the demand and the supply of money" Keynes (1936: p. 10).

In the previous section, we have seen that the consequence of a lower than equilibrium interest rate is the appearance of excess supply of bonds. When higher interest rates prevail in the market, households' demand for bonds are constrained due to an insufficient supply of bonds. Therefore, the unsatisfied demand for bonds will result in an undesired accumulation of idle monetary balances. In this case, the excess supply of fiduciary media will be matched for the excess demand for bonds and the demand for investment goods is not limited in the bond market. Firms are investing their optimal amount so there is not a mismatch between savings and desired investment so interest rates cannot be the variable bringing them together as Keynes stated. This is also independent to the interest rate elasticity of both investment and savings contrary to Klein's claim. In this sense, the inconsistency between savings and investment does not emerge from the impossibility of decreasing the interest rate below a minimum rate as Tobin and Hicks suggested, as disequilibrium between savings and investment only occurs for lower than equilibrium interest rates in which case only increases in market rates will push the system towards equilibrium.

Therefore, firms' financial constraint equation gives rise to the determination of the required supply of bonds to finance the desired investment demand as in Equation (2.11) instead of leading to the determination of the financeable investment demand as in the case with excess supply of bonds in Equation (3.1).

$$M_h^d + p_b \Delta B d_h + i_w N_i + OF_h + C_h$$
$$= \overline{M}_h + \overline{OF}_h + i_w \overline{N} + i_b p_b \overline{B}_h$$
$$+ i_{of} \overline{OF}_h$$

$$(4.1)$$

$$S_h = (M_h - \overline{M}_h) + (OF_h - \overline{OF}_h) + p_b \overline{\Delta B^f}$$

$$(4.2)$$

$$M_h{}^{idle} = M_h - M_h^d = ESM$$

$$(4.3)$$

$$p_b \left(\Delta B d_h - \overline{\Delta B^f} \right) = EDB$$

$$(4.4)$$

Equation (4.1) determines households' desired net increase of bonds ($p_b \, \Delta Bd_h$). Savings will be determined by the supply of bonds as in (4.2). However, as households are constrained by the available supply of bonds, idle cash balances will be accumulated by households as determined by (4.3) where (M_h) is total cash balances and (M_h^d) is desired cash balances which is supposed to be determined by the liquidity preference of households. And by simplifying the system of equations we get to the following equality:

$$EDM + EDB = 0$$

(4.5)

We can use now Equation (4.3) which leads us to the money market equilibrium curve, to calculate the equilibrium interest rate. This interest rate is equal to the solution of Equation (3.3) and also equal to the equilibrium interest rate calculated from equations (2.1) to (2.11).

$$\sum ES = i_w \, N_i^{us} + Y^{up}$$

(4.6)

The summation of excess supplies is equal, as in the previous scenario, to the value of total wages that have not been given to the involuntary unemployed plus the value of commodities that firms have not been able to circulate in the commodity market. There might be a set of prices and nominal wages that clear both markets. Yet, in disequilibrium the total value of excess supplies might not be zero.
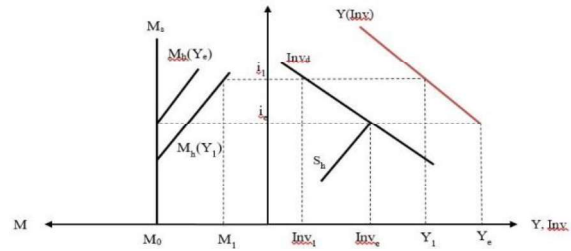
Figure 4.1: The Liquidity Preference Theory of interest rates

As we can see in Figure 4.1, at (i_e) the money and the bond market remain in equilibrium. However, this solution can be reached without any reference to full employment conditions as in the classical LFT approach to monetary theory. In Wicksell's LFT the nominal wage and prices have to continuously swing until the normal rate reaches its full employment position whilst for Keynes there would be a "different natural rate of interest for each hypothetical level of employment" Keynes (1936: p. 152). Keynes's ground breaking departure from the classical general equilibrium benchmark allowed him to analyse the conditions of less than full employment equilibrium in situations where Walras' Law does not hold, i.e., situations where Unemployment Equilibrium is a coherent theoretical possibility. Contrary to the LFT, in this type of disequilibrium, individuals' undesired cash holdings and lower employment might be a direct consequence of too high interest rates.

Keynes's argument shows that at (i_1) the volume of investment demand is equal to the amount of individuals 'savings and therefore the disequilibrium will not be apparent as an (I-S) discoordination of financial resources and rather as an excess in the money market and therefore it reveals the monetary nature of interest rates at (i_1). Furthermore, if because it is fixed, near to zero or for whatever other reason, this level of market rates (i_1) cannot be decreased, this type of disequilibrium would be dissipated if the money authorities decrease the supply of money to (M_1) as in Figure (4.1). At the same time, if market rates cannot be pushed down, any increase in the money supply will be reflected as an increase in individuals' money holdings instead and will have no effect on income or employment, i.e., a liquidity trap as expansionary monetary policy will be ineffective to bring about higher growth. However, the existence of a real balance effect on commodity markets will shift the equilibrium curves rightwards[21]. The liquidity trap could be due to an increase in the perceived uncertainty about firms' future profits which will trigger investment decisions to be postponed creating an excess supply of money. At the same time, this excess supply of money could be absorbed by an increase in households' liquidity preference for any level of income. In this situation, a not sufficiently big increase in the inducement to invest will not influence the interest rate but only employment as Keynes stated and contrary to

Robertson's assessment it might occur even if the liquidity schedule proper is not perfectly elastic.

Although, the existence of this type of disequilibrium characterised by too high interest rates in the bond market can explain Keynes' argument about the equality of ex-ante and ex-post savings and investment, as it has been pointed out above, Keynes relied on the banking system to explain this equality and how investment is financed. "…the creation of credit by the banking system allows investment to take place to which "no genuine saving" corresponds…" Keynes (1936: p. 59). However, as we have seen, at lower than equilibrium rates the credit-led growth in savings stops short of the desired investment demand. On the other hand, Keynes might have had in mind a modern banking system where asset and liability management constantly allows its volume of reserves to provide the financing of all desired investment at any given interest rate or an accommodative Central Bank that constantly satisfies reserves demand.

However, Keynes himself conceded that he overlooked how investment is financed in his GT "I should not have previously overlooked this point, since it is the coping-stone of the liquidity theory of the rate of interest. I allowed, it is true, for the effect of an increase in actual activity on the demand for money. But I did not allow for the effect of an

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[21] A Real Balance effect would exist if individuals' utility takes into account real balances. Contrary to Hicks' original assessment the real balance effect does affect both IS and LM curves.

increase in planned activity, which is superimposed on the former, and may sometimes be the more important of the two..." Keynes (1937: p. 667).
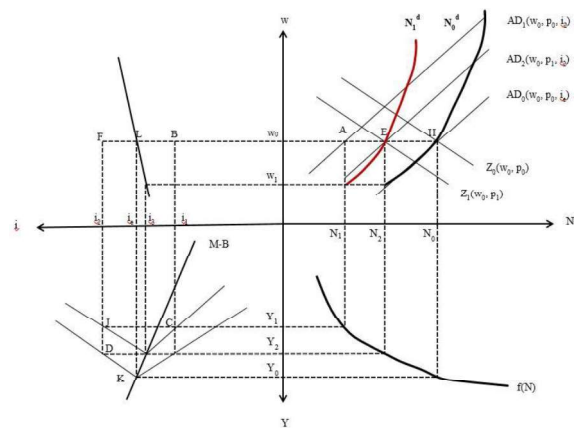
Equilibrium

The equilibrium position at H, L and K in Figure 5.1 represents Keynes' Unemployment Equilibrium point where all except the labour market might remain in a state of equilibrium[22].

From equilibrium, a temporary increase in market interest rates from (i_e) to (i_2) will shift (AD_0) to (AD_1) moving the employment level from (N_0) to (N_1), shifting K to Q and creating excess supply of commodities from A to H. At this volume of temporary employment (N_1) and price level (p_0), any decrease in market rates would push the output level alongside the curve passing through J. Nevertheless, the excess supply in the commodity market sets off deflationary pressures that will pull supply and demand schedules until they are both equal at the new commodity market equilibrium. Hence, as expected and current prices shift towards the equilibrium price level at that level of nominal wages (w_0) and market rates (i_2), the relationship between market rates and output also shifts downwards until

it passes through D. The new commodity market equilibrium curve (N_1^d) passes through the new equilibrium in the commodity market at (w_0) and (i_2), i.e., point E.

A decrease in nominal wages that might be the result of the excess supply in the labour market will push employment and prices downwards alongside the demand for labour function (N_1^d). However, this lower employment function does not correspond with any point situated alongside the curve M-B that represents the equilibrium in both money and bond market for each value of nominal wages.

Figure 5.1

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[22] See Túñez (2015).

Conclusion

This paper has used a NCDF to demonstrate that in a monetary economy with bonds Walras' Law does not hold in disequilibrium as excess demand fails to appear in the system as Clower (1965) had already pointed out. Contrary to Patinkin's (1965) and Maurer's (2009) claims excess supply of all commodities might not be equal to excess demand for money. Walras' Law is seen to be a special case of the general law of exchange that considers the realization problem of monetary economies.

Therefore, although a deeper understanding of both Keynesian LPT and Classical LFT will require the introduction of a modern banking system into the model, we can see that Walras' Law fail to hold true and the existence of unemployment equilibrium is a valid theoretical possibility.

Additionally, the departure of interest rates from the equilibrium level has revealed the possible different budget constraint scenarios and structural breaks describing different approaches to interest rates determination. Structural breaks might lead to different behavioural dynamics.

Furthermore, it has also been shown that Keynes' LPT departure from classical full employment general equilibrium allowed him to understand the multilevel interrelated economic structure as a non-compensatory disequilibrium system where tendencies towards the classical

equilibrium position cannot be guaranteed by principle.

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