Società Italiana
di Economia dello Sviluppo

Households' liquidity preference, banks' capitalization and the macroeconomy: a theoretical investigation

Marco Missaglia and Alberto Botta

June 2022

SITES Working Paper No. 10

Households' liquidity preference, banks' capitalization and the macroeconomy: a theoretical investigation

Marco Missaglia (University of Pavia, Italy)

Alberto Botta (University of Greenwich, UK)

For comments only. Please do not quote

Abstract: In this paper we build a simple model on the role of liquidity preference in the determination of economic performance. We postulate, for the sake of the argument, a purely "horizontalist" environment, i.e., a world of endogenous money where the central bank is able to fix the interest rate(s) at a level of its own willing. We show that even in such a framework liquidity preference, while obviously not constituting anymore a theory for the determination of the interest rate, continues to be a key element for the determination of both the level and evolution over time of aggregate income and capital accumulation. In our model, this happens because of the working of a mechanism so far unexplored in the literature, i.e., the endogenous variations of banks' policy of profits' distribution in response to changes in the liquidity preference of the public.

Key words: Liquidity preference, endogenous money, finance dominance

JEL code: B26, B50, E12, E44

1. Introduction: the revival of the debate on the role of liquidity preference

Economic theory seems to show a renewed interest in the theory of liquidity preference. Perhaps stimulated by the outbreak of the last financial crisis and its ensuing long-lasting effects, some recent papers (Dafermos, 2012; Bertocco and Kalajzic, 2014 and 2018; Palley, 2017; Asensio, 2017; Lavoie and Reissl, 2019; Oreiro et al., 2020 and Mehrling, 2020, among others) have revived the debate around the macroeconomic role of liquidity preference in a world of endogenous money. The roots of this debate may be summarized as follows.

The theory of liquidity preference as incorporated in the traditional IS-LM scheme was a theory for the determination of the interest rate and (then) the level of economic activity. This theory was developed in a framework of exogenous money. Money, however, is endogenous. The monetary authority does not decide the quantity of money, but the interest rate(s). This is now recognized even by the many (the large majority of the profession) who still adhere to the Wicksellian loanable funds theory and believe in the existence of a natural interest rate determined by the fundamentals of thrift and productivity. The central bank decides the policy rate and allows the supply of money to adjust to whatever is the level of demand.

Does money endogeneity imply that private sector' demand for money (liquidity preference) becomes a useless tool? Some strands of Keynesianism seem to share the same, positive answer. Take the so-called New Consensus, for instance. Carlin and Soskice (2015) are rather explicit:

> "… structural changes in the economy that shift the private sector's demand for money, do not alter the central bank's ability to achieve its desired output gap… any shift in the money demand function affects the money supply [endogenous money] but does not feedback to influence real economic activity" (pp. 158-159).

In a useful representation of the New Consensus 3-equation model, Lavoie (2009) shows things are more complicated. A rise in liquidity preference, there represented as a "Minsky moment" (a rush towards liquidity and riskless assets that prompts an increase in those market rates relevant to the private sector's spending decisions), does have a temporary recessionary impact. However, if the central bank is able to revise downward its estimate of the natural interest rate and reduces the policy rate accordingly, the economy will return at its NAIRU equilibrium and inflation on target. A variation in liquidity preference, despite its real short-term effects, does not modify the steady-state position of the economy[1].

Post-Keynesian authors do not have a unique position in this respect. On the one hand, the so-called "structuralists" (Palley, 1994, 2013a, 2017; Dow, 1997) believe that banks' behaviour is characterized by a traditional upward sloping loans' supply curve - the interest rate goes up with credit expansion and constitutes an endogenous variable of the system. In this case, money is endogenous but the liquidity preference of the public may matter again[2]. On the other hand, the so-called "early horizontalists"[3] (Moore, 1988), believe in the ability of the central bank to fix the interest rate at a level of its own willing and follow Kaldor (1985) in denying any significant role to liquidity preference:

> "… 'liquidity preference' was regarded as the essential factor that distinguished Keynesian from pre-Keynesian theories…. All this, however, depended on the assumption of the quantity of money being determined irrespective of all other factors that determined the demand for goods and services. If we regard money as an endogenous factor, *liquidity preference and the assumption of interest-elasticity of the demand for money cease to be of any importance*" (p.9; italics is ours).

[1] Of course, the real effects of liquidity preference variations would be permanent in a model with growth hysteresis. However, this would be true for any possible shock..

[2] According to Palley (2017), there are also "later horizontalists" (for instance Lavoie, 2006). These authors fully acknowledge the role of liquidity preference in the determination of interest rates, but do not recognize that the overall financial system may be "financially constrained".

[3] This terminology is due to Palley (2017).

Quite an astonishing parabola: from being the cornerstone of the Keynesian edifice ("the essential factor that distinguished Keynesian from pre-Keynesian theories"), liquidity preference "ceases to be of any importance"[4].

Some time ago, Lavoie (1996) put the basis to go beyond the old *querelle* between horizontalists and structuralists. He showed that horizontalism might be potentially compatible with the idea of liquidity preference as a relevant factor in the determination of interest rates' *spreads* among different financial assets[5]. Lavoie (1996) himself, however, recognized that a source of tension may still remain between horizontalists and those post-Keynesian authors believing in the importance of liquidity preference in the determination of the real equilibrium of the economy. This emerges from the actions taken by monetary authorities when they are determined enough to change markets' conventions underpinning an excessive (from their point of view) spread between the base rate and the interest rates on longer-term assets. In his own words, "if monetary authorities are sufficiently insistent and consistent, a shift in interest rate differentials can only be temporary" (Lavoie, 1996, p. 295). This line of thought is further developed in Godley and Lavoie (2007; chapter 5), where it is shown that "sufficiently insistent" monetary authorities may always decide to fix both the short- and the long-term interest rate and that in such a case the liquidity preference of the public does not affect the real equilibrium of the economy. It does so only if monetary authorities (the Central Bank plus the Treasury) are not sufficiently insistent.

The purpose of this paper is to show, through the help of a simple Keynesian model, that even in case monetary authorities are sufficiently insistent (a purely horizontalist environment we postulate for the sake of the argument), the liquidity preference of the public affects both the short- and the medium-run equilibrium of the economy.

As argued below, the alleged irrelevance of liquidity preference - or what we label here as the "Kaldorian view" - rests essentially on two key assumptions:

(a) Capital gains/losses are assumed away;

(b) Banks' profits are fully distributed to households, which essentially means that banks operate without own funds.

Taylor and O'Connell (1985), Taylor (2004), Taylor and Rada (2008), Dafermos (2012), Lavoie (2014) and Asensio (2017) show that liquidity preference affects macro outcomes via its effects on either interest rates, interest rate spreads or capital gains/losses. Essentially, they remove assumption (a). In this paper, instead, we analyse what happens when assumption (b) is removed. The removal of assumption (b) does not amount to a simple "static" parametric exercise (i.e., to assuming a positive value for an exogenous parameter that others take to be nil). Rather, it constitutes the basis for a better description of banks' behaviour - corporations that *need* to retain part of their profits in order to be able (and

---

[4] This horizontalist perspective is also incorporated in a post-Keynesian model proposed by Fontana and Setterfield (2009), in an attempt at building a teachable post-Keynesian model to be contrasted with the 3-equation model of the new-Keynesians and the more traditional IS-LM scheme.

[5] Before Lavoie (1996), see also Townsend (1937) and Chang *et al.*, (1983) as contributions discussing liquidity preference as relevant factor for the determination of interest rates' spreads over assets with different maturity.

allowed) to conduct and expand their business. It is for this reason that, in our model, the distribution of banks' profits becomes a key *endogenous* variable, at least in the transition from the short to the medium run (see section 5 below). We obtain two main results.

First, we show that once assumption (b) is removed liquidity preference influences economic activity and capital accumulation even if it *does not* play any role in the determination of interest rates, interest rate spreads or capital gains. For the sake of our argument, consistent with Keynes (1937) and Rochon (1997), we assume a purely horizontalist banking system in which the interest rate(s) is (are) exogenous and monetary authorities are "sufficiently insistent" to take full control of it (them). Yet, liquidity preference matters because it affects the relative importance of the different ways through which capital incomes accrue to households (either direct returns on bonds' holding or banks' dividends).

Second, we show that changes in liquidity preference affect economic activity and capital accumulation both in the short and in the medium run[6].

The rest of the paper is organized as follows. Section 2 describes the structure of our model through the analysis of the balance sheets (stocks) and the Social Accounting Matrix of our economy. Section 3 illustrates the "Kaldorian view". Sections 4 and 5 describe the short- and medium-run equilibria of the economy, and the way liquidity preference affects them. Section 6 concludes.

2. Structure and accounting

The recent debate on the macroeconomic role of liquidity preference does not consider exclusively the liquidity preference of the public (households' liquidity preference), but also the liquidity preference of banks and other financial firms (Le Heron and Mouakil, 2008). This certainly helps and constitutes an element of realism in any applied macro model. The route we are going to follow here, however, is different. We use a definition of liquidity preference consistent with Wray (1992, p. 301 and 303): "The liquidity preference of the *nonbank* public can be satisfied by the stock of bank liabilities … rising liquidity preference represents a desire to exchange illiquid assets for assets with greater liquidity" (italics is ours). We will illustrate, on the basis of the ideas expressed by Keynes in 1937 (Keynes, 1937) and through a simple Keynesian model, the reasons why the liquidity preference of the general public continues to represent, even in a world of endogenous money, an important determinant of the short-run and steady state medium-run level of real output.

We assume a simple closed economy without government composed by households, non-financial firms (or simply firms) and banks. The balance sheets of these social actors are summarized in Table 1. Table 2 reports the corresponding flows:

[6] In this paper, we don't employ the expression "long run" in association with the steady state equilibrium of the system. The reason is that labor productivity (technology) and population (labor force) are taken as fixed. The time horizon we take into consideration is not "long" enough to allow these magnitudes to vary.

Table 1 – The balance sheets of the economy

	Households	Firms	Banks	Total
Deposits	M		$-M$	0
Bank loans		$-L$	L	0
Bonds	B_H/i_B	$-B/i_B$	B_B/i_B	0
Capital		K		K
Banks' own funds	OF		$-OF$	0
Balance	$-V_h$	$-V_F = 0$	$-V_B = 0$	$V_h = K$

The reader might think of column "Banks" in Table 1 as the consolidation of commercial banks and a central bank. Commercial banks have loans and reserves among their assets, and deposits and own funds on the liability side. The central bank has bonds on the asset side and reserves on the liability side. Commercial banks make loans on demand, whereas the central bank holds those bonds that households do not want to hold anymore in order to keep the interest rate at the desired level[7]. This is the perfectly horizontalist environment we alluded at.

For the sake of the argument, we assume that firms do not retain profits (including retained profits would not change the logic of our argument, except in the completely unrealistic case where this is the only way of financing capital accumulation). Hence, their wealth, V_F in Table 1, is zero, and they must make recourse to external finance to fund capital accumulation. Banks and households may provide this finance:

> "The transition from a lower to a higher scale of activity involves an increased demand for liquid resources which cannot be met without a rise in the rate of interest, unless the banks are ready to lend more cash or the rest of the public to release more cash at the existing rate of interest" (Keynes, 1937, p.222).

Households ("the rest of the public") provide funds to firms by subscribing bonds "B_H" ("releasing more cash"), i.e., by changing the composition of their wealth (less money, more bonds). Firms are assumed to be indifferent between getting bank loans or issuing bonds (more on this in section 5) and the market for bonds is demand-driven. Firms issue bonds in the amount demanded by households. In case households want to sell some bonds, banks purchase them in order to ensure full control of the interest rate(s)[8]. We assume bonds are "consols" or perpetuities. These are pieces of paper which are never redeemed and pay the owners, say, 1 dollar after one period has elapsed. The market price of these bonds is "p_b"

[7] In our model, the central bank behaves passively by adjusting its holding of corporate bonds (which is what some central banks did during the pandemic crisis). In a more complete model with a Treasury (see for instance Godley and Lavoie (2007), chapter 5), the central bank would also adjust its holding of government securities. In both cases, this is done to maintain full control of the interest rate(s).

[8] In a recent debate, Lavoie and Zezza (2020) on the one hand, and Sardoni (2020) on the other, while partially disagreeing on the relation between savings, investment and interest rate(s), agree on explaining the macroeconomic role of liquidity preference with its effects on the interest rate on corporate bonds.

and by construction the interest rate on them is $i_b = 1/p_b$, with $p_b = 1 + 1/(1+i_b) + 1/(1+i_b)^2 + \ldots = 1/i_b$. The total interest bill paid on them coincides with the number of outstanding bonds, i.e., "B".

The banking system creates money (M) by extending loans (L) – "loans make deposits", according to the endogenous money *adagio*. As we already saw, the banking system hold those bonds that households do not want to hold anymore, "B_B".

What are banks' own funds (OF)? And what are they for? Clearly, they are an asset from the perspective of banks' owners (some households) and a liability from the perspective of banks. According to banking regulations, banks' own funds are the *paid-in* capital and retained profits that allow banks to start and develop their business. They are "perpetual" (i.e., shareholders cannot redeem their funds on demand or at a given maturity)[9] and "must be available to institutions for unrestricted and immediate use to cover risks and losses"[10]. Given their purpose, banks' own funds are kept in the most liquid possible form and cannot be used to purchase interest-bearing assets. From the point of view of households, banks' own funds may either take the form of untraded shares or common equities traded (but not redeemable or without maturity) in the stock exchange. For the sake of the argument (we want to abstract from capital gains), we follow Godley and Lavoie (2007) and assume that "banks are privately held companies, which do not issue stocks. As a result, the net worth of these banks belongs to the private owners of the banks and must appear as part of the net wealth of households" (Godley and Lavoie, chapter 11, p.380)[11]. Obviously, nothing prevents the reader from thinking banks' own funds to be shares ordinarily traded in a secondary market. In this case, however, capital gains/losses would become part of the picture, giving rise to mechanisms different from those we want to focus on. Indeed, our argument holds regardless of whether banks are corporate or unincorporated firms. Observe, also, that banks wealth is zero.

[9] According to Basel III agreement, this applies to the TIER 1 component of banks' own funds, which is set to be equal to 4.5% of banks' risk-weighted portfolios.

[10] See Bundesbank's definition of banks' own funds at https://www.bundesbank.de/en/tasks/banking-supervision/individual-aspects/own-funds-requirements/own-funds/own-funds-622952.

[11] The scheme proposed in Table 1 is essentially the same as the balance sheet in Godley and Lavoie (2007), chapter 11. In our case, however, commercial banks and the central bank are consolidated, and therefore we do not see commercial banks' reserves held at the central bank. To avoid any misunderstanding, it is worth stressing that commercial banks' own funds and reserves are two completely different things. The former are commercial banks' "perpetual" *debts* towards their owners that constitute banks' passive liquid buffer against losses and risks. The latter are commercial banks *credits* towards the central bank and are constantly mobilised in banks' daily operations.

Table 2 – The Social Accounting Matrix of the economy

	Hous.	Firms		Banks		TOT
		c/a	k/a	c/a	k/a	
Cons	$-C$	C				0
Invest		I	$-I$			0
Bank int.		$-i_L L$		$i_L L$		0
Bonds int.	B_H	$-B$		B_B		0
Wages	W	$-W$				0
F. profits	Π_F	$-\Pi_F$				0
B. profits	$\lambda \Pi_B$			$-\Pi_B$	$(1-\lambda)\Pi_B$	0
Money	$-\dot{M}$				$\dot{M}$	0
Bonds	$-\dot{B}_H/i_B$		$\dot{B}/i_B$		$-\dot{B}_B/i_B$	0
Loans			$\dot{L}$		$-\dot{L}$	0
TOT	0	0	0	0	0	
memo	$-\dot{OF}$				$-\dot{OF}$	

According to Table 2 (where, following standard conventions, a dot over a variable indicates its time derivative and a "hat" its growth rate), the economy produces one commodity, GDP, used for both consumption and investment purposes and its price is fixed at 1 (putting inflation into the picture would not change our point).

We assume that banks do not pay interests on households' deposits and a fraction λ ($0 \leq \lambda \leq 1$) of their profits is distributed to households. In Table 2 "i_L" is the lending rate, i.e., the interest rate charged by banks on their loans to firms. Taking the central bank explicitly into consideration would certainly make the descriptive structure richer and allow to incorporate interest rates' multiplicity. In such a more realistic setting, the lending rate "i_L" would be typically determined as a mark-up on the policy rate decided by the central bank. Whilst it could be argued that the size of the mark-up varies with the level of banks' own funds (or capital cushion) and other factors[12], people liquidity preference among them, we take it as given. Indeed, the inclusion of multiple interest rates and interest rate spreads would just make the analysis more complicated without altering the validity of our argument. Moreover, as Rochon (1997) claims, the idea that the interest rate can be treated as an exogenous variable is fully coherent with (the evolution of) Keynes' own views on monetary theory:

[12] Carlin and Soskice (2014) argue that the mark-up lowers with higher own funds because commercial banks are better equipped to deal with riskier loans, expand their credit supply and the lending rate falls. Mark-ups and lending rates might also be affected by people liquidity preference and/or central bank's open market operations. Let assume people (money managers) and/or the central bank want to increase the share of bonds in their portfolios. Ceteris paribus, this will lower the return on bonds and induce commercial banks to hold less of them and expand their credit supply to the private economy. Once again, the lending rate (mark-up on the policy rate) would fall too.

"In the *General Theory*, Keynes introduced his liquidity preference theory of the rate of interest. As I will argue below, however, Keynes began moving increasingly away from this analysis toward the view that the rate of interest is an exogenous variable. … Keynes's liquidity preference theory of the rate of interest should therefore be seen as a two-stage process, as Keynes himself recognized. First, Keynes argues that an increase in the finance required will impose pressure on the rate of interest. However, the actual movement in the rate depends not on the demand curve, but on the supply curve. … Finally, in March 1945, Keynes … makes the following decisive statement on the issue: 'The monetary authorities can have any rate of interest they like… They can make both the short and long-term [rate] whatever they like…'… It now appears that Keynes has come around to accepting the exogeneity of the interest rate" (Rochon, 1997, pp. 287-289)[13].

3. The Kaldorian view

The idea that liquidity preference "ceases to be of any importance" can be easily illustrated within the simple structure illustrated by Tables 1 and 2 if we assume that conditions (a) and (b) identified above hold true.

In this model economy, output (*Y*) is determined by aggregate demand, consumption plus investments: $Y = C + I$. Normalizing by the capital stock and defining $u = Y/K$ (rate of capacity utilization), $c = C/K$ (normalized consumption) and $g = I/K$ (rate of capital accumulation), we get:

$$u = c + g \tag{1}$$

As it is the case in several Keynesian models, aggregate consumption is postulated to be a positive function of households' current income and accumulated wealth (this can be easily derived from a Modigliani (1986) aggregate consumption function). Given assumption (b), households' income is here the same as GDP (there are no banks' retained profits, i.e., $\lambda = 1$) and, using a linear form, we may write:

$$C = \alpha Y + \beta V_h$$

where, consistent with common sense and empirical evidence, $\alpha > \beta$. i.e., the marginal propensity to consume out of income is higher than that out of wealth.

Normalizing again by the capital stock and using $V_h = K$, this becomes:

[13] This is clearly a radical Keynes' departure from the Keynes of the General Theory, where – as Le Heron (2020, p.144) reminds us – the view of an exogenous short-term rate of interest was already there, but the long-term rate of interest was said to be a "highly psychological phenomenon", a magnitude "more recalcitrant" to be controlled by monetary authorities.

$$c = \alpha u + \beta \qquad (2)$$

The good way to write an investment function is a controversial issue within the Keynesian tradition. In fairly general terms, aggregate investment spending is likely to respond positively to the (expected) profit rate. In the simple economy we are dealing with, the net macro profit rate accruing to non-financial firms is to be calculated as:

$$r = \frac{Y - W - i_L L - B}{K}$$

where W is the wage bill paid by firms to households and interest payments have been accounted for in the calculation of net profits. Be $W/K = \omega N/K = \omega(N/Y)(Y/K) = \omega a(Y/K)$, with "$N$" indicating total employment, "ω" the wage rate (real and nominal, there is no difference here) and "a" the labour coefficient (the inverse of labour productivity). Assuming $a = 1$ (we are not interested in studying the dynamics of labour productivity), we have $W/K = \omega(Y/K)$, with ω representing at the same time the wage rate and the wage share in total GDP. Then, defining $l = L/K$ (the share of capital accumulation financed through bank loans) and observing that accounting consistency implies $L/K + (B/(i_b K)) = 1$, we may express the profit rate as

$$r = (1 - \omega)u - [i_L l + i_b(1 - l)]$$

Assuming that bank loans and bonds are perfect substitutes, implying that $i_b = i_L = i$, the profit rate becomes:

$$r = (1 - \omega)u - i$$

There are different ways of mixing the components of the net macro profit rate – distribution (ω), demand (u) and finance (i) – to cook some kind of Keynesian investment function. Here, we want to keep it as simple as possible and concentrate on the response of capital accumulation to aggregate demand. Therefore, we collect all the "exogenous" determinants of investment decisions (i.e., firms' animal spirits and, in this model, finance and distribution) into the constant term γ. Calling δ the parameter measuring the response of investments to aggregate demand, we end up with.

$$g = \gamma + \delta u \qquad (3)$$

Equations (1), (2) and (3) constitute a complete model for the determination of the flow-equilibrium of the economy. This model fully determines the three endogenous variables u, c and g.

Figure 1 – Short- and long-run equilibrium in the Kaldorian view

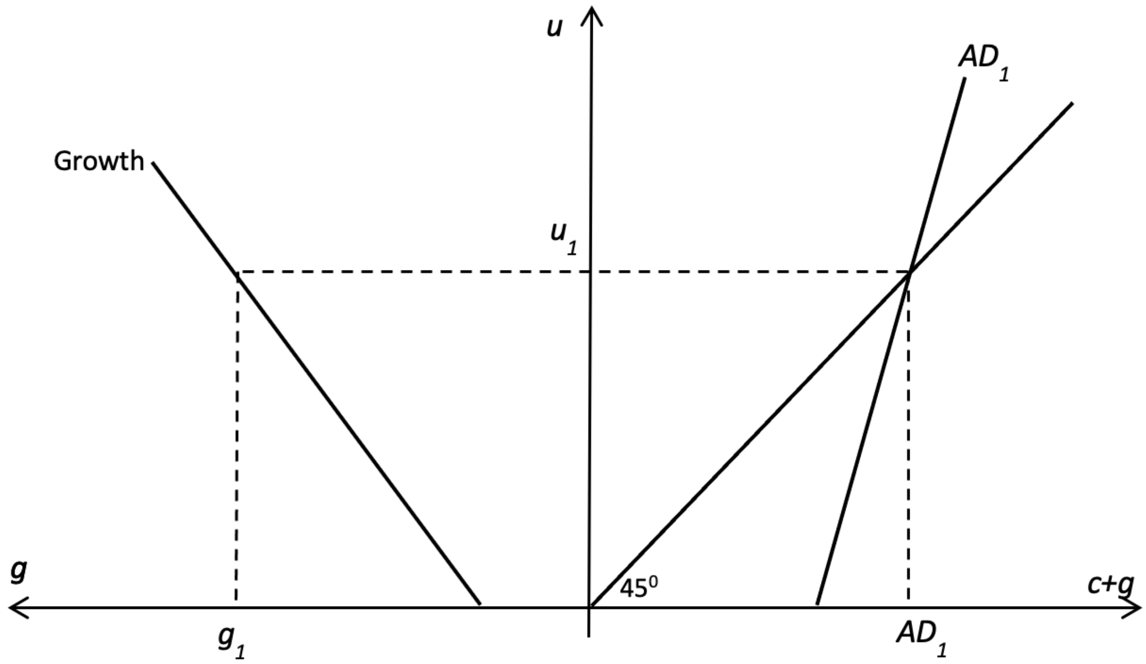


Figure 1 shows the solution. The AD curve expresses aggregate demand ($c + g$) as a function of capacity utilization, whereas the "Growth" curve represents equation (3). Provided that the standard Keynesian stability condition holds, i.e. $(1 - \alpha) > \delta$, the slope of the AD curve is greater than 1 and the equilibrium values u_1, g_1 and c_1 are all positive (unless autonomous investment, γ, is strongly negative). It might be noticed that the position of the AD curve depends on all the parameters included in the consumption and investment functions but does not vary with the willingness of the public to "release more (or less) cash", i.e., households' liquidity preference. To understand the economic rationale of this point, assume the economy is in a steady state position: period after period, each flow and each stock grows at the rate g_1 we just solved for. This clearly implies that in such a steady state the shares of money and bonds in households' portfolios as well as the shares of firms' investments funded by bonds and bank loans are constant. At a point, for whatever reason (a sunspot), liquidity preference goes up. People stop subscribing bonds at the same rhythm as before and banks – in order to prevent the interest rate from increasing – expand their supply of funds. Banks provide firms with the amount of funds households do not want to lend anymore and give households the extra-money they want to hold (money supply adjusts to money demand). The share of firms' investment funded by banks and the share of money in households' portfolios increase, but the real equilibrium is totally unaffected. To go back to Keynes' 1937 quotation, this is nothing but a model where in case "the public decides to release less cash", "banks are ready to lend more". A world where households get in the form of banks' distributed profits what previously earned as a remuneration on bonds' holding. No more than that. The equilibrium represented in Figure 1 is both a short- and a medium-run equilibrium.

This result of irrelevance of liquidity preference rests essentially on the two assumptions mentioned above. Removing assumption (a) would certainly be enough to put liquidity preference back at the centre of the stage. Indeed, taking interest rate's changes or capital gains into consideration would force us to recognize that households' wealth and its evolution over time (and then aggregate consumption, aggregate demand and output) do not depend exclusively on households' overall savings, but also on how these savings are allocated between money and bonds, since the latter is the only item on which capital gains (losses) may mature. This is the route already explored by a series of contributions (Taylor and O'Connell, 1985; Taylor, 2004; Taylor and Rada, 2008; Lavoie, 2014). Our purpose, however, is to remove assumption (b): the interaction between banks' profits distribution and banks' capitalization is indeed an important channel through which liquidity preference affects macroeconomic outcomes.

4. Banks' profits and capital

International banking regulation imposes banks to hold a minimum level of own funds with respect to the value of their assets in order to be allowed to operate. This is the so-called *required* (or minimum) capital adequacy ratio, say $\overline{\Omega}$, originally set at 8 percent of banks' assets in Basel II agreement and now raised to 10.5 percent under Basel III. In order to accomplish with these regulatory requirements and have enough margins of flexibility in the event of non-performing loans, banks generally pursue a *target* (or normal) capital adequacy ratio $\Omega^* > \overline{\Omega}$ (see Godley and Lavoie, 2007). This can be stated as a multiple of the minimum capital, i.e., $\Omega^* = (1+\eta)\overline{\Omega}$, around which the *actual* capital adequacy ratio Ω fluctuates. According to the Federal Reserve Bank of New York (2018), for instance, actual own funds of US financial institutions fluctuated from 10 percent to about 13 percent of their assets from 1996 to 2018[14].

Retained profits play a leading role here. Indeed, banks use retained profits to keep their actual capital adequacy ratio close to the target and adjust their own funds to the amount of their assets. Banks retain a portion of their profits because they have to (this is imposed by banking regulation) and also because they want to (banks ensure they remain trustworthiness by pledging part of their profits as immediate guarantee against losses and risks). As shown by Cohen (2013), for instance, the brunt of changes in banks' own funds come from retained earnings. In the years following the outbreak of the last financial crisis, banks increased the amount of retained profits up to or above 60 percent of their net income, in some cases close to 80 percent[15]. Gambacorta *et al.*, (2020), in turn, provide empirical evidence showing how

[14] The argument we are going to develop holds regardless of the specific value taken by η. In particular, the following results are valid even when $\eta = 0$.

[15] Following Palley (2013b), if we look at the US economy, the shares of total financial profits over GDP and non-financial profits has significantly increased since 1970s. In the years just before the outbreak of the last financial crisis, they accounted for almost 4 percent of US GDP and 44 percent of non-financial profits. If we look at commercial banks only, commercial banks' profits suddenly returned to represent about 15 percent of non-financial profits from 2010 to 2014 after the considerable decline experienced in 2008 and 2009 (see Lapavitsas

banks increase retained profits as a strategic action in order to open more space for the expansion of their balance sheet, i.e., to implement more aggressive policies in the concession of new loans.

Assume, then, that banks only distribute a fraction 0 < λ < 1 of their profits, and the rest is devoted to the accumulation of own funds. In section 5, we will discuss the determinants and endogenous evolution of λ according to the empirical literature just mentioned. In the short-run version of the model, however, λ can be safely taken as given. Equations (1) and (3) remain the same as before, but the consumption function (2) is to be properly amended. As is clear from Table 2, in this case households' income does not coincide with GDP (Y), since households are not receiving the totality of banks' profits anymore. If we maintain that aggregate consumption is a function of households' income and wealth, the relevant equation becomes:

$$c = \alpha[u - i(1-\lambda)(l + b_b)] + \beta \quad (4),$$

where $b_b = B_b/(i_b K)$ is a normalized measure of the importance of bonds in banks' assets.

This is not the end of the story, however. Defining $\mu = (B_H/iV_H) = (B_H/iK)$ the fraction of households' wealth held in the form of corporate bonds, and observing that accounting identities (the balance sheet matrix) implies that $1 - \mu = l + b_b$, we finally get to

$$c = \alpha[u - i(1-\lambda)(1-\mu)] + \beta \quad (5)$$

Needless to say, μ is the parameter through which we can capture changes in households' liquidity preference (Taylor (2004) and Lavoie (2014) also represent liquidity preference simply through a fixed parameter). The stronger their liquidity preference, the lower μ. Solving the model formed by (1), (3) and (5) is extremely easy. The short-run solution is:

$$u = \frac{\gamma+\beta-\alpha(1-\lambda)(1-\mu)i}{1-\alpha-\delta} \quad (6)$$

$$g = \frac{\gamma(1-\alpha)+\delta[\beta-\alpha(1-\lambda)(1-\mu)i]}{1-\alpha-\delta} \quad (7)$$

The standard short-run stability condition for this kind of Keynesian model is (1 – α – δ) > 0, and we will assume it holds.

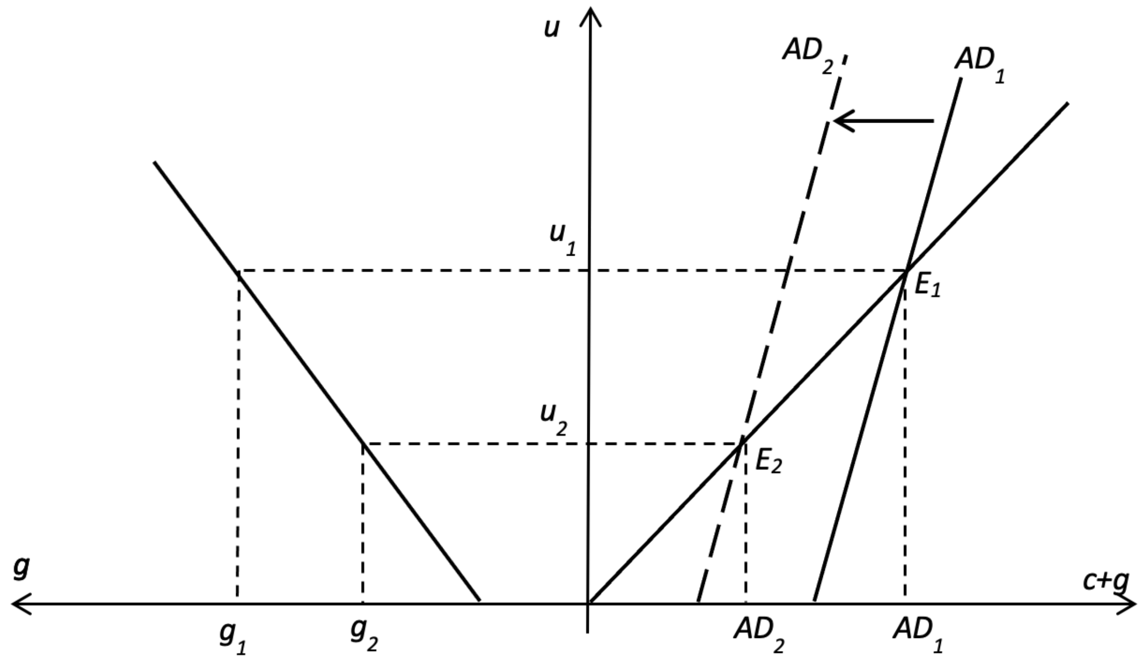
Clearly, households' liquidity preference (μ) and banks' dividend policy (λ) now contribute to the determination of the short-run equilibrium. Activity and growth increase with λ, since a higher fraction of banks' distributed profits raises households' income and consumption

---

and Mendieta-Munoz, 2017). Aaccording to data from the Federal Reserve Bank of St. Louis, commercial banks' net income accounted for 0.61 percent of US GDP, on average, from 1984 to 2019. This implies that commercial banks' retained profits could stand up to half percentage point of US GDP, a non-negligible amount indeed. See https://fred.stlouisfed.org/series/USNINC#0.

expenditures. As to μ, the higher households' liquidity preference (the lower μ), the lower their income and consumption expenditures, which in turn depresses aggregate demand and then activity and growth. This is shown in Figure 2 below. This result is in stark contrast with what described in Figure 1 under the "Kaldorian view". The economic rationale of this result is pretty simple. Ceteris paribus, a higher liquidity preference of the public implies that a higher share of investment is financed by banks[16]. As a consequence, households will receive lower "direct" capital incomes from financial markets and higher banks' profits in the form of dividends. However, only a share λ of banks' profits will be distributed as dividends, whilst the remaining will take the form of additional banks' own capital. Given different households' propensity to consume out of income and wealth, and the reduction in overall households' income, consumption expenditures decline and so does aggregate demand. The AD curve moves leftward from AD_1 to AD_2 in Figure 2. The economy reaches a new short-run equilibrium (point E_2) featuring lower levels of capacity utilization (u_2) and capital accumulation (g_2) with respect to the original equilibrium E_1.

Figure 2 – Short-run effects of an increase in liquidity preference in a non-Kaldorian world



Our analysis shows that liquidity preference returns to be a key parameter in the determination of short-run macro equilibrium (with respect to the Kaldorian view) even in a very simple context with endogenous money and a fixed, policy-determined interest rate established by "sufficiently insistent" monetary authorities. In other words, differently from previous contributions, we show that liquidity preference Is relevant even in the absence of

[16] Adrian and Shin (2009), for instance, noted that in the immediate aftermath of the 2007-2008 financial shock, commercial banks' lending partially compensated for the dry-up of credit via market-based intermediaries.

capital gains (see Taylor and O'Connell, 1985; Lavoie, 2014) or changes in the level of the interest rate or in the spread among different interest rates (see Dafermos, 2012; Asensio, 2017). All what we need is to recognize the very simple fact that banks (must) retain some profits to accumulate own funds in order to be allowed to keep on conceding loans. Will this result hold in the medium run as well? It is time to say more on banks' own funds accumulation.

5. Liquidity preference and economic activity in the medium run

Banks' ability to operate and extend loans is influenced by the solidity of their balance sheets. In our simple aggregate model, this can be captured by banks' own funds-to-assets ratio $\Omega = OF/(L + B_b/i_b)$, i.e., the equivalent to the capital adequacy ratio in the jargon of the Basel agreements. Using again the accounting identity $1 - \mu = l + b_b$, this ratio may be re-expressed as:

$$\Omega = \frac{OF}{(l+b_b)K} = \frac{OF}{(1-\mu)K} \tag{8}$$

The dynamics of Ω is governed by the variation of banks' own funds and firms' capital accumulation. Taking into account that banks' own funds are accumulated via retained profits, the relevant differential equation for Ω reads:

$$\dot{\Omega} = \Omega\left\{\frac{\dot{OF}}{OF} - g\right\} = \Omega\left\{\frac{(1-\lambda)i}{\Omega} - g(\lambda)\right\} = \theta(\Omega, \lambda) \tag{9}$$

According to Godley and Lavoie (2007), banks adjust their policy of profits' distribution in order to satisfy shareholders' demand for financial returns but also to avoid excessive discrepancies between the actual capital adequacy ratio and the normal one. This is the meaning of equation (10), which simply states that banks adjust the share of distributed profits to the gap between Ω and Ω^*:

$$\dot{\lambda} = \varphi(\Omega - \Omega^*) = f(\Omega, \lambda) \qquad \varphi > 0 \tag{10}$$

Banks distribute more profits each time the actual own funds-to-assets ratio exceeds the target Ω^*, and vice versa. The parameter φ represents the speed of adjustment, which may be influenced by shareholders' quest for dividends.

Equations (9) and (10) describe the dynamics of the system over the medium-run. The non-linearity of the system implies that stability can be assessed only in the neighbourhood of the equilibrium. We do this in Appendix 1. In what follows, we concentrate on the two isoclines for Ω and λ.

Put (7) into (9), take the steady-state values of Ω and λ and call them Ω_{SS} and λ_{SS}. After rearranging, one can easily find an explicit solution for λ_{SS}:

$$\lambda_{SS} = 1 - \frac{\Omega_{SS}[\gamma(1-\alpha)+\delta\beta]}{[\Omega_{SS}\delta\alpha(1-\mu)+(1-\alpha-\delta)]i} \tag{11}$$

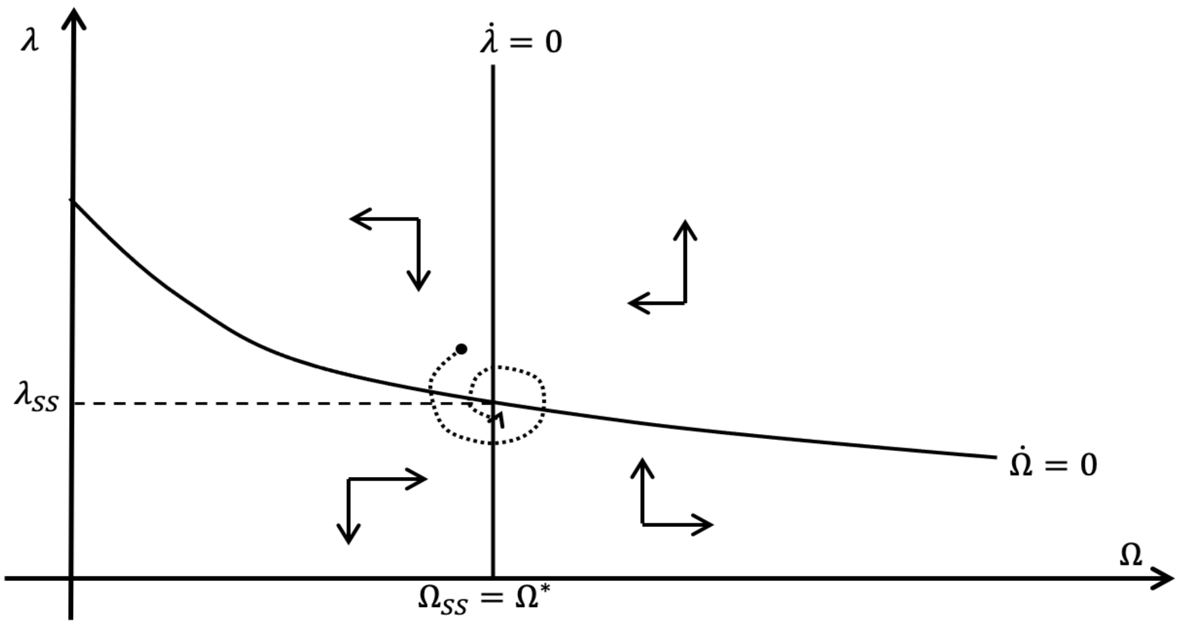
Using (11), one can easily verify that the isocline $\dot{\Omega} = 0$ is a downward-sloping function of Ω[17], with vertical intercept equal to 1 and a horizontal asymptote at $\lambda_{AS} = 1 - \frac{[\gamma(1-\alpha)+\delta\beta]}{\delta\alpha(1-\mu)i} < \lambda_{SS}$.

The analysis of the isocline $\dot{\Omega} = 0$ is much simpler. This is nothing but a vertical line at:

$$\Omega_{SS} = \Omega^* \tag{12}$$

The economic rationale is fairly intuitive. Outside the equilibrium, whenever the actual own funds-to-assets ratio falls below target, banks will reduce λ and distribute to shareholders a lower share of realized profits. They do this in order to "reintegrate" own funds and bring the own funds-to-assets ratio closer to target[18]. The opposite happens when $\Omega > \Omega^*$. The two isoclines $\dot{\Omega} = 0$ and $\dot{\lambda} = 0$ are represented in Figure 3, where it is also shown that the economy converges cyclically to its medium-run equilibrium (see Appendix 1 for a fully-fledged local stability analysis).

Figure 3 – The medium-run equilibrium



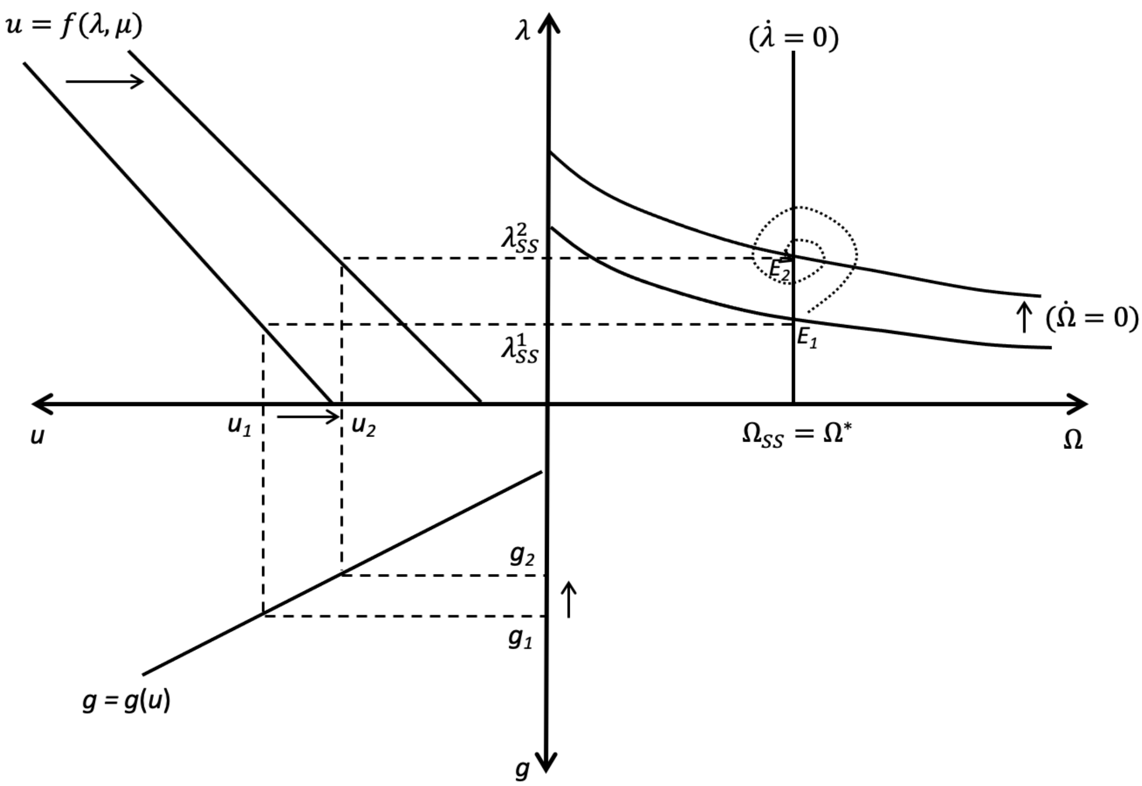
[17] One can verify that $\frac{\partial \lambda_{SS}}{\partial \Omega_{SS}} < 0$ if $(1-\alpha-\delta)i > 0$, which we assume to hold true by default as it is the standard Keynesian stability condition for a meaningful short-run equilibrium.

[18] Once again, this is not just a matter of complying with bank regulations. Banks are very peculiar corporations; they are also *rentiers*: they adjust own funds to go on making money out of thin air, exactly in the same way as a landlord that from time to time must spend some money to keep her plot of land in decent conditions to be able to go on renting it out. The privilege of making money out of thin air has a price.

We are now in a good position to study the medium-run effects of variations in the liquidity preference of the public. Formal details may be found in Appendix 2. Here, we focus on the economic rationale and the graphical representation of our story (see Figure 4 below).

Let us consider an increase in liquidity preference (lower μ). From (11) and (12), it is easy to see that the isocline $\dot{\lambda} = 0$ is unaffected by this change, whereas the isocline $\dot{\Omega} = 0$ moves upwards (i.e., $(\partial\lambda_{SS}/\partial\mu) < 0$) when people decide to "release less cash to firms" (see North-East quadrant in Figure 4). The economic mechanism behind this result goes as follows. A higher preference for liquidity induces households to reduce the share of their wealth held in the form of bonds. In our simple model, this forces banks to step in and satisfy firms' financial needs with loans and, eventually, purchase those bonds that households might want to sell. Banks' own funds-to-asset ratio, however, increases. This is due to the short-run contractionary effects of higher liquidity preference, which curtails current capacity utilization and induces firms to accumulate less capital. Such a reduction in "*g*" will in turn imply that, *ceteris paribus*, firms will demand (and receive) less loans than before. From the point of view of banks' balance sheet, this would cause an increase in their *actual* own funds-to-assets ratio. To keep it on target, banks will then distribute more dividends and retain a lower share of profits, i.e., λ will increase.

Figure 4 – Medium-run effects of a rise in liquidity preference



The reduction in μ and the rise in λ bear opposite consequences in terms of the evolution of capacity utilization and capital accumulation. The increase in liquidity preference tends to reduce "*u*" (see the rightward shift of $u = f(\lambda, \mu)$ in the North-West quadrant of Figure 4) and, therefore, "*g*" (South-West quadrant of Figure 4). A higher share of distributed profits (out of banks' total profits), instead, leads to higher households' income, consumptions expenditures, "*u*" and "*g*". We determine the final net effect of an increase in liquidity preference in Appendix 2. The direct, contractionary effect of a reduction in μ over "*u*" and "*g*" prevails over the expansionary indirect effect (via increased λ). In the end, an economic shock that brings about an increase in the liquidity preference of the public will cause the economy to stagnate (capacity utilization decreases from u_1 to u_2 in Figure 4) and capital accumulation to slow down (from g_1 to g_2) not only in the short run, but also in the medium run.

There are three important implications stemming from our analysis. First, even in a world of endogenous money where the central bank adopts a fully accommodationist stance and the banking system behaves horizontally, liquidity preference of the general public affects the performance of the economy *both* in the short *and in the medium run*.

Second, we do not need to take into account capital gains/losses and/or changes in the interest rate(s) to give liquidity preference such an important role. In our model, liquidity preference does not play any role in setting interest rates or interest rates' spreads. Yet, it remains important simply because it influences the banks' policy of profit distribution and then the different channels through which households' (capital) income is generated (i.e., direct remuneration of bonds' holding or banks' dividends). This, in turn, affects households' (consumption) expenditures, aggregate demand, capacity utilization and capital accumulation.

Third, our model also shows that financial turbulences and sudden increases in liquidity preference (i.e., sharp reductions in μ) may cause long-lasting negative effects on economic performances. In other words, a financial crash and a sharp flight to liquidity may throw the economy into an enduring depression or stagnation.

6. Concluding remarks

In this paper, we contribute to the debate about the role of liquidity preference in the determination of economic activity in a world of endogenous money. In particular, we show that liquidity preference does not need to influence the determination of the base rate, or the spread among yields from different financial assets, or even the occurrence of capital gains or losses in order to affect capacity utilization and capital accumulation both in the short and in the medium run. In a world where banks behave in a "perfectly horizontalist" manner, and the central bank adopts a fully accommodationist stance, we show that the endogenous adjustment of banks' profit distribution (and the simple fact that some are to be retained) is more than enough to give back liquidity preference the role it had in the original Keynesian framework.

A word of caution is needed. Our medium-run analysis seems to suggest that having households eager to invest in financial markets, perhaps with a higher propensity to risk and a lower liquidity preference, might be beneficial for capital accumulation and economic dynamics. Could we take this result as an indication of the potential virtues of "money managers" capitalism (Wray, 2009)? Are households' active participation to financial markets, as intermediated by buoyant institutional investors, and the rising share of capital income over national income (Power *et al.*, 2003; Piketty, 2014) good news for the whole economy? The answer is no, at least for two good reasons.

First, in this paper, we do not make any comparison between different types of capitalism, say *paternalistic* or *industrial capitalism* (Minsky, 1986; Hudson, 2010) of the "golden age" on the one side, and the current *financial capitalism* on the other. What we claim is that in a system where financial markets gain increasing relevance in affecting the behaviour of the economy, it is vital to ensure that financial markets keep on working smoothly, and that they are not hit by major waves of panic and sudden runs to liquidity. Even the more so if the increased participation of the public to financial markets via the intermediation of money managers may have increased exposure to financial shocks[19]. In a way, our paper echoes the original Minsky's idea that "the channels by which Federal Reserve [central banks, more generally] operations affect the economy may no longer be by changing the availability or cost of financing, but rather by affecting uncertainty: by affecting the evaluation by portfolio managers of the viability of enterprises and the stability of markets" (Minsky, 1994, p.1). In such a state of capitalism, saving Wall Street from financial shocks is fundamental to avoid Main Street to collapse. We could well interpret this result as an additional sign of financial markets' "take-over" of the real economy (Storm, 2018).

Second, our model does not take on board several aspects of modern economies. In this paper, for instance, we do not endogenize the heightened instability and vulnerability of modern economies to financial crises, with the ensuing consequences in terms of (non-financial) firms' animal spirits and willingness to invest. Moreover, we do not pay attention to distributional issues. Indeed, here we do not model the increasing level of income inequality and wealth concentration that has accompanied the development of most economies in the last four decades, as well as the increasing debt burden on the shoulders of low- and middle-income households. All these aspects could well contribute to compensate or even revert the possibly expansionary effects of a reduced preference for liquidity and booming financial markets.

All these issues are potentially interesting extensions of our model and could make it richer. None of them, however, would alter the central theoretical message of our work. The original insight of Maynard Keynes is to be rescued. Liquidity preference and financial markets matter, and money endogeneity, not even in a pure fully accomodationist horizontalist world, does not allow us to think of the banking system as the unconstrained *deus ex-machina* of the economy we live in.

[19] Indeed, this is a crucial tenet of Minskyan analysis stressing how money manager capitalism may be affected by heightened financial instability (see Wray, 2009).

References

Adrian T., and H.S. Shin, 2009. "Money, Liquidity, and Monetary Policy", *American Economic Review: Papers and Proceedings*, vol.99 (2), 600 – 605.

Asensio, A, 2017. "Insights on endogenous money and the liquidity preference theory of interest", *Journal of Post-Keynesian Economics*, vol.40 (3), 327 – 348.

Bertocco, G. and A. Kalajzic, 2014. "*The liquidity preference theory: A critical analysis*", University of Insubria department of economics working paper no.1402.

Bertocco, G. and A. Kalajzic, 2018. "The zero lower bound and the asymmetric efficacy of monetary policy: A view from the history of economic ideas", *Italian Economic Journal*, vol.4 (3), 549 – 566.

Carlin, W. and D. Soskice, 2014. *Macroeconomics: Institutions, Instability and the Financial System*. Oxford: Oxford University Press.

Chang, W.W., Hamberg, D., and J. Hirata. 1983. "Liquidity Preference as a Behavior toward Risk is a Demand for Short term Securities - Not Money", *The American Economic Review*, vol.73 (3): 420 – 427.

Cohen, B.H. 2013. "How have banks adjusted to higher capital requirements?", *BIS Quarterly Review*, September 2013, 28 – 42.

Dafermos, Y., 2012. "Liquidity preference, uncertainty, and recession in a stock-flow consistent model", *Journal of Post-Keynesian Economics*, vol.34 (4), 749 – 776.

Dow, S. C, 1997. "Endogenous Money". In: G. C. Harcourt G.C. and P.A. Riach (eds.). *A 'Second Edition' of The General Theory*, 43 – 55. London and New York: Routledge.

Federal Reserve of New York. 2018. "*Quarterly trends for consolidated U.S. banking organizations – first quarter 2018*".

Fontana, G. and M. Setterfield, 2009. "A simple (and teachable) macroeconomic model with endogenous money". In: Fontana, G. and M. Setterfield (eds.). *Macroeconomic Theory and Macroeconomic Pedagogy*, 144 – 168, London: Palgrave Macmillan.

Gambacorta, L., Oliviero, T., and H.S. Shin. 2020. "*Low price-to-book ratios and bank dividend payout policies*", BIS Working Paper no.907.

Godley, W. and M. Lavoie, 2007. *Monetary Economics: An integrated approach to credit, money, income, production and wealth*. London: Palgrave Macmillan.

Hudson, M. 2010. "*The Transition from Industrial Capitalism to a Financialized Bubble Economy*", Levy Economics Institute of Bard College Working Paper no.627.

Kaldor, N. 1985. "How monetarism failed", *Challenge*, vol.28 (2), 4 – 13.

Keynes, J.M., 1937, "The 'Ex-Ante' Theory of the Rate of Interest", *The Economic Journal*, vol.47 (188), 663 – 669.

Lapavitsas, C., and I., Mendieta-Munoz. 2017. "*Explaining the historic rise in financial profits in the US economy*", University of Utah Department of Economics Working Paper no.2017-06.

Lavoie, M. 2006. “Endogenous money: Accommodationist”. In: Arestis, P., and M. Sawyer (eds). *Handbook of Alternative Monetary Economics*, 17 – 34, Cheltenham, UK: Edward Elgar.

Lavoie, M. 1996. “Horizontalism, Structuralism, liquidity preference and the principle of increasing risk”, *Scottish Journal of Political Economy*, vol.43 (3), 275 – 300.

Lavoie, M. 2009. “Taming the new consensus: Hysteresis and some other Post-Keynesian amendments”. In: Fontana, G., and M. Setterfield (eds.). *Macroeconomic Theory and Macroeconomic Pedagogy*, 191 – 213, London: Palgrace Macmillan.

Lavoie, M. 2014. *Post-Keynesian economics: New foundations*, Cheltenham (UK) and Northampton, MA (USA): Edward Elgar.

Lavoie, M. and S. Reissl. 2019. “Further insights on endogenous money and the liquidity preference theory of interest”, *Journal of Post-Keynesian Economics*, vol.42 (4), 503 – 526.

Lavoie, M. and G. Zezza, 2020, “A Simple Stock-Flow Consistent Model with Short-Term and Long-Term Debt: A Comment on Claudio Sardoni”, *Review of Political Economy*, vol. 32 (3), 459-473

Le Heron, E. and T. Mouakil. 2008. “A post-Keynesian stock-flow consistent model for the dynamic analysis of monetary policy shock on banking behaviour”, *Metroeconomica*, vol.59 (3), 405 – 440.

Le Heron, E., 2020, “Endogenous money, liquidity preference and Confidence: for a qualitative theory of money”, in Rochon L.P. and H. Bougrine (eds.), *Credit, Money and Crises in Post-Keynesian Economics*, 133 – 151, Cheltenham (UK) and Northampton, MA (USA): Edward Elgar.

Mehrling, P. 2020. “*Payment vs. funding: The law of reflux for today*” Institute of New Economic Thinking working paper series no.113, freely downloadable from the Institute of New Economic Thinking (INET) website: https://www.ineteconomics.org/uploads/papers/WP_113-Mehrling-Payment-vs-Funding.pdf.

Minsky, P.H. 1986. *Stabilizing and Unstable Economy*, Yale University Press.

Minsky, P.H. 1994. “*Financial instability and the decline(?) of banking: Public policy implications*”, Levy Economics Institute Working Paper no.127.

Moore, B. 1988. “The Endogenous Money Supply”, *Journal of Post Keynesian Economics*, vol.10 (3), 372 – 385.

Oreiro J.L., Fernando de Paula, L., and J.P. Heringer Machado. 2020. “Liquidity preference, capital accumulation and investment financing: Fernando Carvalho’s contributions to the post-Keynesian paradigm”, *Review of Political Economy*, vol. 32 (1), 121 - 139.

Palley, T.I. 1994. "Competing views of the money supply: Theory and evidence", *Metroeconomica*, vol.45 (1), 67 – 88.

Palley, T.I. 2013a. “Horizontalists, verticalists, and structuralists: the theory of endogenous money reassessed”, *Review of Keynesian Economics*, vol.1 (4), 406 – 424.

Palley, T.I. 2013b. *Financialization. The economics of finance capital dominance*. New York: Palgrave Macmillan.

Palley, T.I. 2017. "The theory of endogenous money and the LM schedule: prelude to a reconstruction of IS-LM", *Revista de Economia Politica*, vol.37 (1), 3 – 22.

Piketty, T. 2014. *Capital in the Twenty-First Century*, Cambridge (MA) and London (UK): Harvard University Press.

Power, D., Epstein, G., and M. Abrena. 2003. "*Trends in the Rentier Income Share in OECD Countries, 1960 – 200*", PERI Working Paper no.58a.

Rochon, L.P. 1997, "Keynes' finance motive: a re-assessment. Credit, liquidity preference and the rate of interest", *Review of Political Economy*, vol. 9 (3), 277-293.

Sardoni, C. 2020, "Saving and Investment Financing: Different Approaches", *Review of Political Economy*, vol. 32 (3), 474-480.

Storm, S. 2018. "*Financial Markets Have Taken over the Economy. To Prevent Another Crisis, They Must Be Brought to Heel*", freely downloadable from the Institute of New Economic Thinking (INET) website: https://www.ineteconomics.org/perspectives/blog/financial-markets-have-taken-over-the-economy-to-stop-the-next-crisis-they-must-be-brought-to-heel.

Taylor, L. 2004. *Reconstructing Macroeconomics*, Cambridge, MA (USA), and London (UK): Harvard University Press.

Taylor, L., and S. O'Connell. 1985. "A Minsky crisis", *The Quarterly Journal of Economics*, vol.100 (supplement), 871 – 885.

Taylor, L., and C. Rada. 2008. "Debt-equity cycles in the twentieth century: Empirical evidence and a dynamic Keynesian model" In: Flaschel P., and M. Landesmann (eds.). *Mathematical Economics and the Dynamics of Capitalism*, London: Routledge.

Townsend, H. 1937. "Liquidity Premium and the Theory of Value", *The Economic Journal*, vol.47 (185), 157 – 169.

Wray, R. 1992. "Commercial banks, the central bank and endogenous money", *Journal of Post Keynesian Economics*, vol. 14(3), 297-310

Wray, R. 2009. "The Rise and Fall of Money Manager Capitalism: A Minskyan Approach", *Cambridge Journal of Economics*, vol.33 (4), 807 – 828.

Appendix 1

In order to analyse the local stability of our system of differential equations, let first define the Jacobian matrix (*J*) of partial derivates in the neighbourhood of the steady state. We do this in the mathematical expressions (A.1) and (A.2) below.

$$J = \begin{bmatrix} \theta_{11} & \theta_{12} \\ f_{21} & f_{22} \end{bmatrix} = \begin{array}{c} \begin{array}{cc} \quad\Omega & \qquad\lambda \end{array} \\ \begin{bmatrix} \left.\frac{\partial \theta}{\partial \Omega}\right|_{\theta=0} & \left.\frac{\partial \theta}{\partial \lambda}\right|_{\theta=0} \\ \left.\frac{\partial f}{\partial \Omega}\right|_{f=0} & \left.\frac{\partial f}{\partial \lambda}\right|_{f=0} \end{bmatrix} \end{array} \tag{A.1}$$

$$J = \begin{bmatrix} -\frac{(1-\lambda_{SS})i}{\Omega_{SS}} & -\frac{[(1-\alpha-\delta)+\delta\alpha(1-\mu)\Omega_{SS}]i}{(1-\alpha-\delta)} \\ & \\ 1 & 0 \end{bmatrix} \tag{A.2}$$

Consistent with Figure 3 in the main text, the definition of the Jacobian matrix (*J*) in expression (A.2) confirms that the locus for ($\dot{\Omega} = 0$) is a downward-sloping function of Ω, whilst the locus for ($\dot{\lambda} = 0$) is straight vertical line. Moreover, given (A.2), we compute the determinant *det.*(*J*) and the trace *Tr.*(*J*) of the Jacobian matrix (*J*) in equations (A.3) and (A.4) below:

$$det.(J) = i\left[1 + \frac{\delta\alpha(1-\mu)\Omega_{SS}}{(1-\alpha-\delta)}\right] > 0 \tag{A.3}$$

$$Tr.(J) = -\frac{(1-\lambda_{SS})i}{\Omega_{SS}} < 0 \tag{A.4}$$

It is easy to see that the determinant is positive, whilst the trace is negative. The medium-run equilibrium of our economy is locally stable. Outside the equilibrium (but close to it), the economy will cyclically converge back to it giving rise to a *focus*.

Appendix 2

In order to define the medium-run effects of a rise in liquidity preferences, we need to take the medium-run equilibrium value of capacity utilization (i.e., the level of capacity utilization in the steady state) and totally differentiate it with respect to μ and λ. We get:

$$du = \frac{\alpha(1-\mu)i}{1-\alpha-\delta} d\lambda_{SS} + \frac{\alpha(1-\lambda_{SS})i}{1-\alpha-\delta} d\mu \tag{A.5}$$

After dividing both side by $d\mu$ and obtaining from (13) the partial derivative of λ_{SS} with respect to μ, we get:

$$\frac{du}{d\mu} = \frac{\alpha(1-\mu)i}{1-\alpha-\delta}\frac{d\lambda_{SS}}{d\mu} + \frac{\alpha(1-\lambda_{SS})i}{1-\alpha-\delta} = -\frac{\alpha(1-\mu)i}{1-\alpha-\delta}\frac{{\Omega_{SS}}^2[\gamma(1-\alpha)+\delta\beta]\delta\alpha i}{\{[\Omega_{SS}\delta\alpha(1-\mu)+(1-\alpha-\delta)]i\}^2} + \frac{\alpha(1-\lambda_{SS})i}{1-\alpha-\delta} \tag{A.6}$$

In order to verify whether a rise in liquidity preference will expand or curtail capacity utilization in the medium run, we need to determine the parametric conditions under which equation (A.6) is positive. More specifically, we have:

$$\frac{du}{d\mu} > 0 \text{ if } \frac{\alpha(1-\mu)i}{1-\alpha-\delta}\frac{{\Omega_{SS}}^2[\gamma(1-\alpha)+\delta\beta]\delta\alpha i}{\{[\Omega_{SS}\delta\alpha(1-\mu)+(1-\alpha-\delta)]i\}^2} < \frac{\alpha(1-\lambda_{SS})i}{1-\alpha-\delta}$$

Once plugged in the above expression the value for $(1-\lambda_{SS})$ from equation (13), we have:

$$(1-\mu)\frac{{\Omega_{SS}}^2[\gamma(1-\alpha)+\delta\beta]\delta\alpha i}{\{[\Omega_{SS}\delta\alpha(1-\mu)+(1-\alpha-\delta)]i\}^2} < \frac{\Omega_{SS}[\gamma(1-\alpha)+\delta\beta]}{[\Omega_{SS}\delta\alpha(1-\mu)+(1-\alpha-\delta)]i} \tag{A.7}$$

After some simple algebraic adjustments, one can rewrite condition (A.7) as follows:

$$(1-\mu)\frac{\Omega_{SS}\delta\alpha}{[\Omega_{SS}\delta\alpha(1-\mu)+(1-\alpha-\delta)]} < 1. \tag{A.8}$$

Once multiplied both sides of (A.8) by $[\Omega_{SS}\delta\alpha(1-\mu)+(1-\alpha-\delta)]$, it is easy to verify that it always holds true since that $(1-\alpha-\delta) > 0$. A rise in liquidity preference (i.e., a lower value of μ) will depress economic activity (u) and, therefore, capital accumulation (see equation (3)) in the short run. Such contractionary effects of a higher preference for liquidity will persist in the medium run also.