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1. INTRODUCTION

Until Krugman’s alarm (Krugman, 1998), liquidity trap (LT) was a concept related to the old Keynesianism and a curiosity in the USA history of monetary policy. The Japan and the situation in the USA and EU has caused a regained interest both historical and theoretical about this phenomenon. We begin our paper (section 2) by recalling the Keynesian definition of LT (2.1), its origin and critics to the concept, and we follow with the presentation of our thesis about LT (2.5). We confirm it for the USA in the empirical part of this paper (section 3). In this last section, after data description (3.1), we study the behavior of the income velocity of money and the money multiplier and with the help of a VAR and a VECM model we confirm our thesis about the LT phenomenon (3.2). Finally we conclude (section 4).

2. A REASSESSMENT OF THE LT LITERATURE

2.1 A KEYNESIAN DEFINITION OF LIQUIDITY TRAP

Keynes (1936) has suggested the expression of absolute liquidity-preference (p. 191) to the situation we know nowadays as Liquidity Trap (LT). Tobin (1947) used the expression “Keynesian impasse” (p. 128) to express the same situation. We owe the current term LT to Robertson (1940, pp. 34, 36) even if Hicks (1937, p. 56) knew the expression that was subsequently popularized by by Hansen (1953) in the opinion of Sutch (2009). Robertson proposed the expression to illustrate the consequences of a money demand negatively sloped on the

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saving-investment process, process (Boianovsky, 2003). The standard Hicks-Modigliani-Hansen unemployment equilibrium model (Patinkin, 1974), became the source for the LT explanation based on the assumption of Keynesian interest rate regressive expectations. The situation of a LT explained in terms of term structure of interest rates proposed by Keynes and accepted by Hicks, was replaced by the following explanation: the floor of the long run interest rate doesn’t depend on uncertainty (Kaldor, 1939; Robinson, 1951).

The LT was the main reason for the role ascribed by macroeconomic textbooks of the 60’s to fiscal policy by identifying a “Keynesian case” (Modigliani, 1944, p. 56), where “nobody will be willing to hold nonphysical assets except in the form of money”, (p. 53). And as a consequence: “(a) any increase in the supply of money to hold now fails to affect the rate of interest”, (p. 55). The General Theory was consequently conceived as “the Economics of Depression” (Hicks, 1937, p. 155). The (Bordo & Schwartz, 2003) observation that Modigliani (1944) viewed Keynes “absolute liquidity preference as a curiosity and not the true hallmark of the Keynesian model” (p. 221) doesn’t express Modigliani thinking.

The refusal of the LT came from Patinkin (1974) that defends against the conventional IS-LM model explanation of sustainable less than full-employment an alternative one based on the General Theory, “generated by the fact that the rate of interest falls too slowly in relation to the marginal efficiency of capital” (p. 9). The refusal comes also from Brunner and Meltzer (1968) two well-known representatives of the monetarist thinking. These authors considered what they call different types of LP: “Traps have been said to affect interest rates, the bank’s demand for excess reserves, the public’s supply of loans or commercial banks, and the public’s demand for money” (p. 2). They correctly reoriented the discussion towards the transmission mechanisms of monetary policy but they deny the ineffectiveness of monetary policy and so they also deny the existence of the different kinds of traps (p. 28). The authors write that “some form of a trap had existed” (p. 1) nevertheless they cite the famous page 207 of Keynes (1936) as a reference for its (non) existence, “I know of no example of it hitherto”, just the opposite.

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2 The complete phrase is “This situation that plays such an important role in Keynes’s General Theory will be referred to as the “Keynesian case”.

3 Italics in the original, p. 9.
This hypothesis was subject to both theoretical and empirical critics. Haberler (1937) and Pigou (1943) argued that deflation that characterized the LT hypothesis leads to an increase in agents’ real income (a shift to the right of the IS curve) which would be sufficient for economic recovery starting. This hypothesis was referred to as “Pigou effect”. Friedman (1956) and Brunner and Meltzer (1968) argued that the demand for liquidity would never become absolute and therefore monetary policy would remain effective if unconventional policies, that Friedman called “money gift”, were adopted. Those policies consisted in establishing a higher monetary base growth rate target or diversifying open market securities purchases with special focus on longer-term maturities.

2.2 CURRENT DEFINITIONS OF LT

In the framework of the IS-LM model, the phenomenon of LT is interpreted as a situation of perfect substitutability of money and bonds at a (near-)zero short-term nominal interest rate and so this irreducible interest floor becomes a binding constraint making ineffective traditional procedures of monetary policy (Krugman, 1998; Buiter & Panigirtzoglou, 1999; Benhabib, Schmitt-Grohé et al., 2002; Auerbach & Obstfeld, 2004; Hanes, 2006; Svensson, 2006; Eggertsson, 2008; Sutch, 2009; Rhodes, 2011). Additionally, the Central bankers’ reputation for maintaining a stable reduced inflation rate is also an important factor in current times to push interest rates to near zero values (Sumner, 2002). Buiter and Panigirtzoglou (1999) call LT “an inefficient equilibrium” and Blinder (2000) comparing it with zero gravity or near absolute zero temperature writes that “it may indeed be a new world” and Pollin (2012) stresses the specific environment of high unemployment, high inequality, household wealth collapse and fiscal austerity policies accompanying the LT. This is not far from what Modigliani (1944) defines as the “Keynesian case” (p. 56) or Hicks (1937) the “Economics of Depression” (p. 155) when the LM curve is horizontal.

The majority of the LT interpretations are addressed in terms of money demand behavior. The problem of money supply is rarely taken into consideration and when it occurs it is exclusively confined to the monetary base behavior. In Svensson (2003), the confusion between monetary base and money supply effects is notorious,
(p. 147). Krugman (1998) explicitly says that “base and bonds are viewed by the private sector as perfect substitutes” (p. 141). This may be true for banks but obviously not for the “private sector”. So monetary policy is ineffective due to the behavior of money demand. Some authors look at the monetary base but do not go further, e.g., Brunner and Meltzer (1968) give another interpretation for monetary policy ineffectiveness, “the banks desired to hold excess reserves and were unwilling to lend” (p. 12) but they dismissed that explanation in the absence of evidence supporting it as Sumner (2002) also did. A similar interpretation is given too by Svensson (1999, 2003) who claim that the increase in the monetary base beyond the satiation point is ineffective on nominal and real prices and quantities. Krugman (1998) recognizes the impossibility of increasing “monetary aggregates” although the MB increment, he is categorical pointing out that the essential problem does not lie in the banking sector (p. 140) since the solution to the problem is the creation of inflation expectations. But he does not explain how those expectations can be effective in the absence of money supply growth. Pollin (2012) shows that at least for the current crisis there is no satiation level for the MB in the USA and so the problem lies on the transformation of the MB on money supply. And without an increase in the money supply we cannot expect the reduction in longer interest rates that will affect consumption and investment (Svensson, 2003).

What are the consequences of the usual definition? Monetary policy is ineffective to achieve full-employment or to reverse the downward slide in prices under a LT context (Benhabib, Schmitt-Grohé et al., 2002)4 Auerbach and Obstfeld (2004) and Eggertsson (2005, 2008)) are supportive to the idea that even in a LT, large-scale open market operations are a powerful instrument for fiscal policy. Bernanke (2000), Orphanides and Wieland (2000) and Pollin (2012) recommended solutions to change the rigidity of high values of longer rates of interest in a LT.

2.3 OUR THESIS

The common vision bases the phenomenon of LT on the demand for money. We propose to analyses it as a rupture in the money supply mechanism. The central problem is the banking sector. Banks do not create money because they

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4 We have no pretension of being exhaustive.
do not have reserves to do so but it because they consider that there is no acceptable level of risk from bank credit demand. The proposals to eliminate this situation based on the creation of inflation expectations should be compatible with money supply targets and should be founded in realistic forecasts of banking lending.

The current analysis of LT has some limitations that are a direct consequence of the framework of analysis initially used — the IS-LM model. This model has some black boxes (BB) in terms of monetary policy. Not only ignoring that the LM curve depends on the operational targeting of the CB (Bofinger, 2001, pp. 85-90), but also to assume that banks have a passive role in the transmission of monetary policy. In a LT situation the chain represented by the monetary base multiplier is broken and so this monetary transmission mechanism does not work: ignoring banking credit demand money creation is also ignored. The LM curve represents the equilibrium between the demand and supply of money. Money demand is dependent on income and its value is always finite and so a LM curve represented by a horizontal curve makes non-sense. An LM curve horizontal supposes an infinite banking lending to the economy for an infinite value of the permanent income. The derived idea of a near zero velocity of money in a LT situation is also incorrect.

We have by now a considerable period of an ex ante strategy for monetary expansion (Fawley & Neely, 2013) and we focus on the quantitative easing in the U.S.A. The concept of QE refers to a set of unconventional monetary policy measures related to changes in structure and/or balance sheet size of central banks and massive asset purchases by introducing high power money in huge amounts seeking to facilitate access to credit for non-financial agents. This concept arises in the literature as one of the most debated solutions to overcome the LT, and there are two historical episodes, identical in shape but different in content, of the adoption of such policies: by the Bank of Japan after the Japan’s Lost Decade and by the FED during the period following the 2007 Financial Crisis.

The problem in terms of diagnosis is on the rupture of the money multiplier and in terms of cure is on the spender side of the economy. Government must

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5 Current, permanent income or wealth. But for the main argument this is secondary.
borrow money to spend it immediately and “conditions” must be offered to banks to lend money to firms, even if this creates a moral hazard problem.

The classical analysis of active/idle balances (Humphrey, 1974, 2004) is ignored nowadays. In a LT episode the level of idle balances is growing and this is equivalent to an excess of money supply. The Government could borrow these balances and spend them, even if this operation increases the borrowing interest rate. Is this operation in contradiction with the classical policy measure of reducing the interest rate to near-zero values? No, it is not. If idle balances are transformed in active balances, the increase in global demand will contribute to the money supply growth and the major problem in a LT episode relies on the money supply mechanism. And without no banking credit demand there will be no increasing money supply.

3. EMPIRICAL ANALYSIS

We first describe our database. The econometric study if conducted in two stages, (A) and (B). In the first stage (A) we study the evolution of the income velocity of money and the money multiplier. We compare the actual values during the financial crisis with forecasting values obtained until its beginning. With this analysis we focus on two characteristics of a LT situation: the decline of the money velocity which is usual recognized but exaggerated and the decline of the money multiplier that is almost always ignored. In the second stage (B), we build and estimate two reduced money supply models (a VAR and a VECM) in order to draw conclusions about the responses of the variables to shocks. This will enable us to evaluate the impact of money supply policies (such as QE) on the U.S economy. We have divided the period of study (1959:01 to 2013:10) in a “normal period” (1959:01 to 2008:03) and a “crisis period” (2008:04 to 2013:12), and the latter one we associate to a possible LT period.

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6 The shock value is equal to the standard deviation of the estimation for each variable.
3.1 DATA AND DESCRIPTIVE ANALYSIS

The database is from FRED (Federal Reserve Bank of St. Louis) and contains monthly values between 1959:01 and 2013:10. The variables are the output (LYR), the nominal interest rate (R), the consumer price index (LP), the monetary base (LMB) and the monetary aggregate M1. All variables except the nominal interest rate, are in logs. LYR refers to real GDP at 2009 prices in billions USD. This variable was converted from quarterly to monthly data using the package “tempdiscagg” from “R” software, (Sax and Steiner 2013). R is the Effective Federal Funds Rate, the actual values of the operational target of the FED monetary policy. LP is a measure of monthly prices of a set of goods and services purchased by consumers with 1982–84 as the base year. LMB refers to the adjusted monetary base of the Federal Reserve of St. Louis. LM1 is the narrow definition of money supply in the U.S. Lv measures the income velocity of money (=LYR+LP-LM1), while Lm measures the money multiplier (=LM1-LMB).

We highlight in what follows the evolution and the relationship between two of the crucial variables of our study the money supply (M1) and monetary base (MB). We assist after 2008 to a great increase in the values of M1 and a huge MB growth. These evolutions hide a completely different picture in terms of the transmission mechanism of monetary policy.

3.2 ECONOMETRIC ANALYSIS

We study the evolution of the income velocity of money and the money multiplier (A). In a LT the velocity of money, Lv, will tend to minimum values corresponding to an increase in the amount of idle money. The following general ADL (augmented distributed lags) model was investigated:

\[ L v_t = c + a(L) L v_{t-1} + b(L) R_t + \varepsilon_t \]  \hspace{1cm} (1)

where \( a(L) \) and \( b(L) \) are lag polynomials with order 1 and 2.\(^7\) For this model there are no problems of autocorrelation of the errors or misspecification. The

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\(^7\) All our models were chosen by the likelihood ratio test.
The coefficient of the interest rate is positive as expected. The forecast for the period of crisis, considering a confidence interval of 90%, is shown in Figure 1.

**Figure 1.** Income velocity of money (M1).

**Figure 2.** Money multiplier.
The velocity of money fell far beyond what was expected from the previous behavior, what can be interpreted as a situation of “excess money” because a substantial part of the stock of money is inactive (the fall was 40% compared to the forecast value). This evolution is in accordance with our representation of a LT.

We consider that the normal transmission mechanism of monetary policy does not work in a LT situation. The banking sector does not transform “high power money” into money supply, money that circulates in the economy. This capacity of the banking sector can be measured by the money multiplier. The ADL model for \( Lm \) is the following:

\[
Lm_t = c + a(L) Lm_{t-1} + b(L) R_t + c(L) LY R_t + +d(L) LP_t + \varepsilon_t
\]

where the lag polynomials \( a(L) \) and \( b(L) \) are of order 4 and 5. Again, we have no problems of autocorrelation and misspecification. The dynamic forecasts of the money multiplier for the crisis period, with the 90% confidence interval, are in Figure 2. The evolution of \( Lm \) reflects a relative stability of the money multiplier, as was supported by monetarist’s authors. The least we can say about the evolution of their values during the crisis is that the fall was brutal (for instance in 2013:10 the difference between the actual and the forecast value was 74%). In our opinion this is an essential characteristic of the LT.

At stage (B) we analyze the LT from the point of view of money supply. We consider the following scenario: the Central Bank opts for a policy of money creation, increasing the monetary base, but banks, either due to rearrangement of their assets or to the reduction of their lending capabilities, do not increase the money supply. The monetary policy is in this situation ineffective. To verify this hypothesis we propose a reduced model in which the interaction between monetary base and money supply (LMB and LM1) variables are studied. The model is applied to the two sub-periods previously defined: 1959:01 to 2008:08 (VAR(7)) and 2008:09 to 2013:10 VAR(3)). We analyze the effectiveness/ineffectiveness of monetary policy with a VAR in a situation of LT through the comparison of the results from different shocks in the two periods. The Johansen test for co-integration has rejected any type of relation.

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8 The variables were ranked in terms of proximity to the action of MA.
With regard to the first sub-period no autocorrelation of order 1 was detected. In terms of the variance decomposition LMB is mainly explained by itself (93%) while it explains 37% of the variance of LM1. This model is stable, as the roots associated with the VAR which lie inside the unit.

We will identify a shock of LMB as a money supply shock and a shock of LM1 as a money demand shock (Figure 3). A money supply shock causes, in the period up to the present crisis, an increase in the money supply that stabilizes after almost a year. A money demand shock has a much reduced effect on the monetary base and after 1 year is practically negligible. Thus, the role of monetary authorities through money supply policy is clear and corresponds to what is expected theoretically. At the same time we confirm the exogeneity for the monetary aggregate M1.

Figure 3. Money Supply and Money Demand Shocks (VAR – 1st sub-period)

Figure 4. Money Supply and Money Demand Shocks (VAR – 2nd sub-period)
We present now the second sub-period VAR. We continue to have no problems of autocorrelation of order 1. The variance decomposition of LMB is split in half between itself and LM1. For LM1 99% of its variance is explained by itself. The model is also stable.

A shock of money supply quickly cancels its effects on LM1 and its effects can never be taken as non-zero. In turn, money demand shocks significantly and durably affect LMB. So contrary to what happened before the crisis, money supply shocks don’t have a growth effect in money circulating in the economy. It can be concluded that for the period under review, monetary policy based on money supply shocks is ineffective in preventing the emergence of a situation of deflation.

Hoffman and Rasche (1996) marked a new route in monetary empirical research with cointegration (C-I) monetary modeling. We propose a C-I model with the rate of interest, the monetary base and the income velocity of money (R, LMB and Lv). These variables are I (1) by the usual ADF and KPSS tests. The optimal order of the VECM for the first sub-period is 6. Applying the Johansen test we cannot reject the presence of 1 co-integration vector by the Lmax and Trace tests. The sign of the short-term adjustment coefficient ($\alpha$) is negative as expected and the inverse of the roots of the VECM lie inside the unit circle. In terms of the variance decomposition both R and LBM are mostly explained by themselves while R has a share of 42% in explaining Lv which corroborates the importance of the interest rate in the transmission mechanism of monetary policy.

In Figure 5 we have the results from the different shocks.

We identify a shock on R as a money supply “price shock”, a shock on the monetary base as a money supply “quantity shock” and a shock on the velocity of money as a money demand shock. The effects of a “price shock” on the velocity of money are positive and permanent. A “quantity shock” has positive and permanent effects on the monetary base. As for the effects on the velocity of money, a “quantity shock” reduces the velocity of money in the short-run and can’t be considered different from zero after 10 months (in terms of the expected value is always negative although this is reduced over time). In short money supply policies have clear effects on the interest rate, the monetary base and velocity of money, while money demand shocks only have a significant effect on the interest rate.
For the second sub-period the optimal order of the VECM is 5. The Johansen test doesn’t reject the presence of 1 co-integration vector by the Lmax and Trace tests. The sign of the short-term adjustment coefficient ($\alpha$) is negative and the inverse of the roots of the VECM lie inside the unit circle.

In terms of the decomposition of the variance the fact that LMB and Lv have shares of 70% and 2.9%, respectively, in the explanation of R is understood due to the period under analysis: QE policy is a combination of both an increase in monetary base and a decrease in the interest rate; and a relatively lower velocity of money has a reduced impact on the evolution of interest rates. The money velocity has also a very reduced impact on the evolution of the monetary base. The variance of this last variable is explained by the interest rate (14%) and by itself (85%). The variance of the velocity of money is explained in practically equal parts by itself and by the monetary
base. It is also important to highlight the fact that R lose explanatory power on Lv and this fact maybe an indicator of a possible ineffectiveness of the MP during this period.

Figure 6. Money Supply and Money Demand Shocks (Model B – 2nd sub-period)

A “price shock” (Figure 6) has a positive effect on Lv (though not different from zero after 4 months). A “quantity shock” has a negative effect on R during 3 months. A “quantity shock” has also a permanent and positive effect on the variable itself and a negative effect on Lv (though after about 2 months this effect is not different from zero). In short, in terms of monetary policy a “price shock” or a “quantity shock” are ineffective since they have no significant impact on LMB and Lv. Finally money demand shocks does not significantly affect R or LMB but they have a very high degree of inertia in itself.

Thus, as we have already confirmed with the VAR model, we can prove that monetary policy does not exert significant effects on non-banking economy in
the second period analyzed, unlike what happened in the first. This second period is likely to be identified as a period of LT.

4. CONCLUDING REMARKS

With this paper we study the phenomenon of LT. We started with the definition of LT from the origins of the concept in the Keynesian literature to the more recent definitions. Contrary to the common vision that bases the phenomenon on the demand for money we propose to see it as a money supply rupture.

To test our thesis about LT we have looked at the newly QE policy adopted by the FED and its effects on the U.S. economy. We have divided the period of study (1959:01 to 2013:10) in a “normal period” (1959:01 to 2008:03) and a “crisis period” (2008:04 to 2013:12). This last period is identified as having the characteristics of a LT episode. We demonstrate that the decrease of the income velocity of money is important but far it is from the zero value predicted by the traditional and current definition. The most important element of a LT is not the evolution of the income velocity of money but the evolution of the money multiplier. As a consequence we propose a VAR model to analyze the evolution of the monetary base and the money supply. For the first period we prove the exogeneity of the money supply and the null effect of the demand for money over the monetary base. In the second period a shock on the money supply quickly cancels its effects on M1 and money demand shocks affects permanently the monetary base. The relevant conclusion with this model is the ineffectiveness of money supply shocks in the current situation since 2008:04 to the present.

We have also studied a monetary equilibrium model with short and long term relations between the interest rate (Federal Funds Rate), the monetary base and the income velocity of money. These variables are cointegrated of order 1 and so we use a VECM model to simulate shocks in the two selected sub-periods. During the normal period the effects of a monetary “price shock” is positive and permanent on the income velocity of money and a “quantitative shock” has permanent effects on the monetary base. Resuming our results money supply policies have clear effects on the interest rate, the monetary base and the income velocity of money and money demand shocks have only significant effects on
the interest rate. The same type of model for the period after 2008:4 gives very different results. A monetary policy “price shock” or a “quantity shock” are ineffective since they have no significant impact on the monetary base and in the income velocity of money. Money demand shocks do not significantly affect the interest rate or the monetary base. Instead they exhibit a high level of inertia on themselves.

Our takes the banking sector as central to LP. Banks can create money but they simple do not do it because they consider that there is no acceptable level of risk from bank credit demand. The creation of inflation expectations as a way to originate incentives for banking borrowing has to be compatible with money supply targets and these should be realistic with banking lending. There is another way to increase inflation expectations, through government expenditures, but this latter is not available. It is well-known that almost everywhere government as a spender of last resort is limited by high levels of indebtedness.

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