Department of Economics and Business

Thesis in Money and Banking

Theory, evolution and evidence of the liquidity trap and the current condition

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Introduction

This paper will discuss the notion of liquidity trap, from the origins to the evolution of the theory that lies behind. Moreover, it will analyze the empirical evidence in modern days of the actual existence of such problem, which seems to appear when the interest rates reach the effective lower bound.

The liquidity trap was theorized by John M. Keynes in the first half of the XX century, and that seems to have happened in modern days to various developed economies. Additionally, this has important implications with respect to the central bank's ability to conduct monetary policies. Subsequently to the COVID-19 pandemic, the solution proposed by Keynes to break the trap seems to have been adopted by the trapped economies. For these reasons, although this topic was theorized almost 90 year ago, it is still incredibly relevant to present times.

The first chapter will be dedicated to the discussion of how the theory and the notion of liquidity trap have evolved. Starting from the initial notion of "liquidity trap" in Robertson (1940) and the meaning he attributed to such concept. Furthermore, the report will examine the theory that lies behind it with Keynes's *General Theory of Employment, Interest and Money*. Consequently, the paper will analyze the development of the theory and the new meaning that liquidity trap assumed with John R. Hicks. Indeed, it was Hicks who put together certain concepts from Keynes's theory and the term used by Robertson, to create what today is referred to as liquidity trap.

For many years the theory of the liquidity trap was not developed further, due to the conditions of the world economy. There were both, high levels of interest rates and, high (if compared to today's) inflation rate. These two conditions made the liquidity trap to be an irrelevant topic for many years.

However, in more recent days, due to various crises and the development of the global economy several countries fell in what looks like a liquidity trap, starting from Japan in the 1980s and moving on to both the Euro area and the US. Thus, with Paul Krugman in 1998, there is a reappraisal of the theory of liquidity trap that he develops by analyzing Japan's stagflation problems. Since the theory was first originated in the first half of the XX century, he will reformulate it and actualize it to modern days, taking into account the evolution that the economic system has had.

The second chapter will deal with the current economic condition of the US and the Euro area, and the empirical evidence of the existence of the liquidity trap in both economies.

Finally, the conclusion will discuss the reasons behind today's ultra-expansionary quantitative easing implemented by both the Federal Reserves Bank and the European Central Bank. In particular, the implications that this expansionary monetary policy is having on the fiscal policies. Keynes's suggestion on how to exit the liquidity trap was based on the adoption of a strong expansionary fiscal policy. The problem, as Paul Krugman highlighted in 1998, is that nowadays the developed

economies tend to have a very large stock of debt, thus limiting governments' ability to engage in strong expansionary fiscal policies. Accordingly to the outbreak of the COVID-19 pandemic, the economic situation worsened for the trapped economies. They then responded with an expansionary strategy that will likely be able to break the trap, as well as having great relevance for future policies.

Chapter 1. Defining the notion of liquidity trap

1.1 Introduction

The notion of liquidity trap indicates the situation where expansionary monetary policy fails to lower interest rates with the aim of stimulating economic activity. The concept is originally attributed to John Maynard Keynes, in his *General Theory of Employment, Interest and Money* (1936). In this book, he discussed the possibility of a lower limit to the rate of interest, using the expressions "liquidity preference becomes absolute"[1] or "liquidity preference becomes virtually absolute"[2]. Hence, the chapter will review the origins of the notion liquidity trap, introduced by Dennis H. Robertson in 1940 whilst reviewing Keynes's theory, which was subsequently taken up by Hicks. The section will discuss the evolution of it, and in particular, how it became of public interest in modern days. Finally, there will be the analysis of how Paul Krugman reviewed the theory in the end of the XX century.

1.2 Robertson and the origins of the notion of liquidity trap

It has to be said that the term "liquidity trap" was not coined by Keynes, but rather by Robertson referring to the "effect of individual acts of additional savings on rate of interest"[3].

Dennis H. Robertson was a British economist, who reviewed and published various critiques on Keynes's General Theory. Since then there was a debate between the two economists (Robertson and Keynes), with various arguments and counterarguments by both. Robertson supported the theory under which, in the long run, the forces of thrift are balanced with those of productivity, so that interest rates are determined by real factors (such as productivity of capital). Thus, a natural level of interest rate will tend to prevail. This is the traditional theory of interest rates which Keynes opposes to. According to the latter, interest rates are determined by monetary factors, and in particular productivity depends on investment. In turn, the investment depends on the interest rates. However, this theory will be discussed in more depth in the following chapter.

In an essay published in 1940, Robertson coined the term "liquidity trap" and, as stated previously, it had a different meaning compared to the one John Hicks adopted and which made the concept famous.

[1] "General Theory of Employment, Interest and Money", page 191.

[2] IBID, page 207.

[3] "To use the words of Keynes…" Oliver J. Blanchard on Keynes and the "Liquidity Trap", page 6.

Suppose a person decides to divert an amount of income from consumption to buying an equivalent amount of securities. Robertson defines as "siding or trap" the circumstance that, when the interest starts to decrease individuals will be induced to sell the security and hold increased cash. This will counteract the initial fall in interest rates. At the end of this essay Robertson came up with the famous words:

> "How far is the existence of the liquidity trap for saving likely to hamper the banking system in its long-run task of executing the chosen policy, and so bringing the fruits of saving to birth?"[4]

Robertson's liquidity trap thus referred to a trap of liquidity, that is the trap for savings represented by accumulation of idle balances:

> "It is the demand for money as a store of wealth and as a hedge against uncertainty that prevents the transformation of savings into investments."[5]

Hence, the difference with respect to Hicks's version of the term stands in the fact that Hicks refers to liquidity trap as trap *for* liquidity, that is the meaning with which the notion became famous.

1.3 The liquidity trap in Keynes's General Theory

Written in response to the failure of (neo)classical economic theory to account for the persistence of mass unemployment in the late 1920s and 1930s, Keynes' *General Theory of Employment, Interest and Money* presents a model that may be summarized as follows.
Employment (N) depends on the level of production (Y):

(1) $$N = N(Y)$$ With N'(Y)>0

The higher the production level, the higher the employment.
Production, in turn, depends on aggregate demand, based on the idea that firms (and enterprises in general) produce based on the sales they expect to make:

[4] "New Perspectives on Political Economy and Its History", page 355, from "Robertson 1940", page 34.
[5] IBID, page 357.

> "Output is primarily produced for sale; and the volume of output depends on the amount of purchasing power, compared with the prime cost of production, which is expected to come in the market."[8]

This is reasonable in the sense that, firms do not produce for the sake of production, but they do it to sell at good prices, that enable them to at least cover for the costs.
Thus production, and indirectly employment, depend on aggregate demand, that in the best possible case consists of consumption (C) and investment (I):

(2) $$Y = C + I$$

Consumption depends on income (Y) through the marginal propensity to consume (c, where $0 < c < 1$). Specifically, consumption is made of a constant factor (C0), which reflects the part of consumption due to necessity, plus a factor composed of the marginal propensity to consume times the disposable income, that reflects individuals' behavior (based on their income net of taxes):

(3) $$C = C0 + c * (Y - T)$$

On the other hand, investment depends inversely on the real rate of interest (r). However, to Keynes it is not the rate of interest that equates saving to investments, but rather the changes in income will adapt to effective demand so that savings equal investments. Therefore, the following expression defines Keynesian investment function:

(4) $$I = f(r, E)$$

Particularly, factor E reflects the investor's expectations on the returns the investment will provide. An important role in this sense is played by the marginal efficiency of capital. In Keynes' view, to understand how good the capital investment is the so-called yield[9] of the investment has to be computed and compared with the rate of interest on capital accounts. An efficient capital investment must have a yield larger than the account interest rate.
Replacing equation (3) and (4) into equation (2) the above equation is rearranged as follows:

[8] "An Open Letter to President Roosevelt", page 2.

[9] The yield is the discount rate that equates the investment made to its net present value.

(5) $$Y = c * Y + I(r)$$ … that becomes…

(6) $$Y = I(r)/(1 - c)$$

Here certain simplifying assumptions were made in order not to have taxes and expectations in this last equation.

It is important to analyze more in depth the meaning of such formula which can be rewritten as:

(7) $$Y = \left(\frac{1}{1-c}\right) * I(r)$$

The first factor is also referred to as the Keynesian multiplier. What does the marginal propensity to consume (MPC) reflect? What does this whole factor stand for?

MPC can be defined as the extra money individuals spend when they get an additional unit of income (Y). Consequently, the term (1-c) represents the percentage of saving of persons. The Keynesian multiplier tells us what happens when the government spends one additional unit to purchase a given product or service. In doing so the government pays this additional unit to agent A, in exchange for a product or service, as previously claimed. This unit (i.e., one dollar) becomes agent's A income. Based on MPC, a part of this will be spent by the individual, and another part saved. Nevertheless, the part the agent spends to consume, will become another agent's income, and this process will continue. Due to an increase in government spending, the GDP (Y) will increase in proportion to the Keynesian multiplier.

Reverting to the meaning of the whole equation, GDP (Y) depends on the Keynesian multiplier and on investment, which is a function of the interest rate (r). This rate is determined by equating the money supply (M) with the demand for money (L).

The demand for money is determined by the liquidity preference of companies and persons. In chapter XV of the *General Theory of Employment, Interest and Money*, Keynes analyses in detail this concept.

In particular, he explains that there are 3 main reasons for which individuals and companies demand money. The first reason is that of money demand for transaction purposes, that is money held to be spent on predictable purchases or payments. This can be divided into income motive and business motive. The former refers to household receiving their income and spending it gradually over time. Whilst the latter, is money demand to bridge the gap between costs and revenues for both companies and households.

The second rational is money demand for precautionary motive, that is money held in view of unpredicted opportunities of advantageous purchases.

The third reason is that of money demand for speculative motive, which is that part of the demand for money demanded to be stored in alternative securities other than money itself. This third one is the big innovation introduced by Keynes.

It is crucial to focus on the last reason described, starting by making a distinction by characteristics of money and securities.

Money is risk free. In the sense that, it cannot depreciate in nominal terms as it is unit of account (i.e., a $100 banknote will always be a $100 banknote). However, because of its nature it yields nothing, thus the return on money is zero.

On the other hand, long-term securities are risky, as they can depreciate in nominal terms. The nominal value of a bond (the security Keynes had in mind in his writings) can change over time. This is due to the fact that, as the interest rate on newly issued bonds rises, the price of old bonds will fall by virtue of investors wanting to sell that bond to buy the newly issued one. As a result of such uncertainty on nominal values, securities yield an interest rate, and thus have a return which is usually greater than zero.

How does an investor decide what to hold?

If the speculator expects the interest rate to fall, he predicts prices of the securities to rise. Thereby, he will want to buy such securities to profit in the future from the sale of the same assets at a higher price (the so-called bulls).

On the other hand, if the speculator expects the interest rates to rise, resulting in the prices of the securities to fall, he will want to sell assets for money (the so-called bears).

When the rate of interest is high, the market will be full of bulls expecting interest rates to go down, hence betting on prices of the securities to rise.

If instead the interest rates are low, the market will be full of bears expecting interest rates to rise, thus betting on prices of the securities to fall.

It is vital to note how the interest rates are the bridge between the monetary economy and the real economy.

The equilibrium condition in the money market, that leads to the determination of interest rates, is defined as follows:

(8) $$M = L1(Y) + L2(r)$$

Where, M is the money supply, which is directly controlled by the central bank. L1(Y) is the liquidity function that depends on the level of income (thus related to the transaction and precautionary demand for money). While L2(r) is the liquidity function that depends on the relation between current rate of interests and the state of expectations (hence related to the speculative demand for money).
When dealing with these two functions, there has to be a distinction between changes in interest rates due to changes in the supply of money (M) and, changes in interest rates due to changes in expectations. Therefore, the former does not affect the liquidity preference function (see Fig. 1), whilst the latter influences the liquidity function itself.

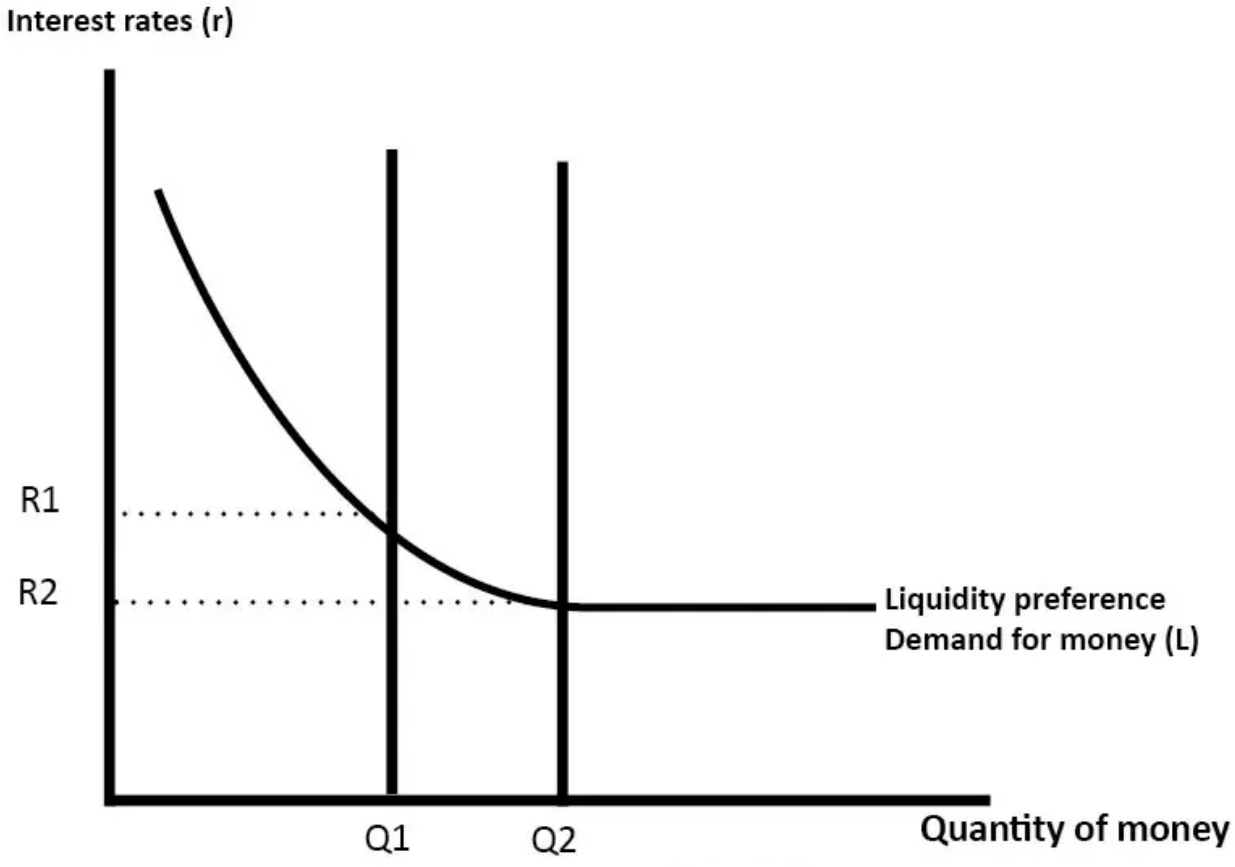

Figure 1: graph that represents the equilibrium between money demand (L) and money supply (M, represented by the vertical lines for two different levels Q1 and Q2).

In the second case, suppose investors fear a market crush. They would run for liquidity and withdraw from banks. Thus, the money demand function shifts upward and, since the level of money supply stays unchanged, this will cause the equilibrium level of interest rates to be higher.
Based on Keynes's model, monetary policy expansion is the first remedy against unemployment. Ceteris paribus, a rise in the supply of money (for a given liquidity preference) leads the rate of interest to decline. Accordingly, this would stimulate investments since investments are inversely

dependent on interest rates. The result is a rise in GDP (Y). Lower rate of interests make borrowing less expensive, hence stimulating firms and households to borrow money and invest.
If monetary expansion fails to lower the rate of interest, the policy fails to achieve its end. According to Keynes, this happens when interests are so low that individuals and firms would keep liquidity instead of investing in securities (bonds) that yield an extremely low rate of interest.
The obstacle, as underlined by Keynes in his *General Theory of Employment, Interest and Money*, is that:

> "There is the possibility that, after the rate of interest has fallen to a certain level, liquidity preference may become virtually absolute in the sense that almost everyone prefers cash to holding a debt that yields so low rate of interest."[10]

As formerly discussed, investors face a choice when they deal with the speculative motive for money demand, that is the choice between risky securities and riskless money. If the interest charged for the additional risk investors take in holding the security is too low, then they would always prefer to hold money. This is the liquidity trap condition. No matter how much money the central bank pumps into the economy, it will have no effects on the level of interest rates, thus it will be ineffective in terms of stimulus for the economy (see Figure 2). Under this condition, the extra money pumped in the economy is not invested in securities (bonds) by investors but stored in form of cash.

Furthermore, as the interest rates lowers the duration of the bonds rises, meaning that a slight adjustment upward in the interest rates level, would lead to large capital losses for bondholders. Ergo, liquidity preference rises sharply if the uncertainty about the future increases.

[10] "General Theory of Employment, Interest and Money", page 207.

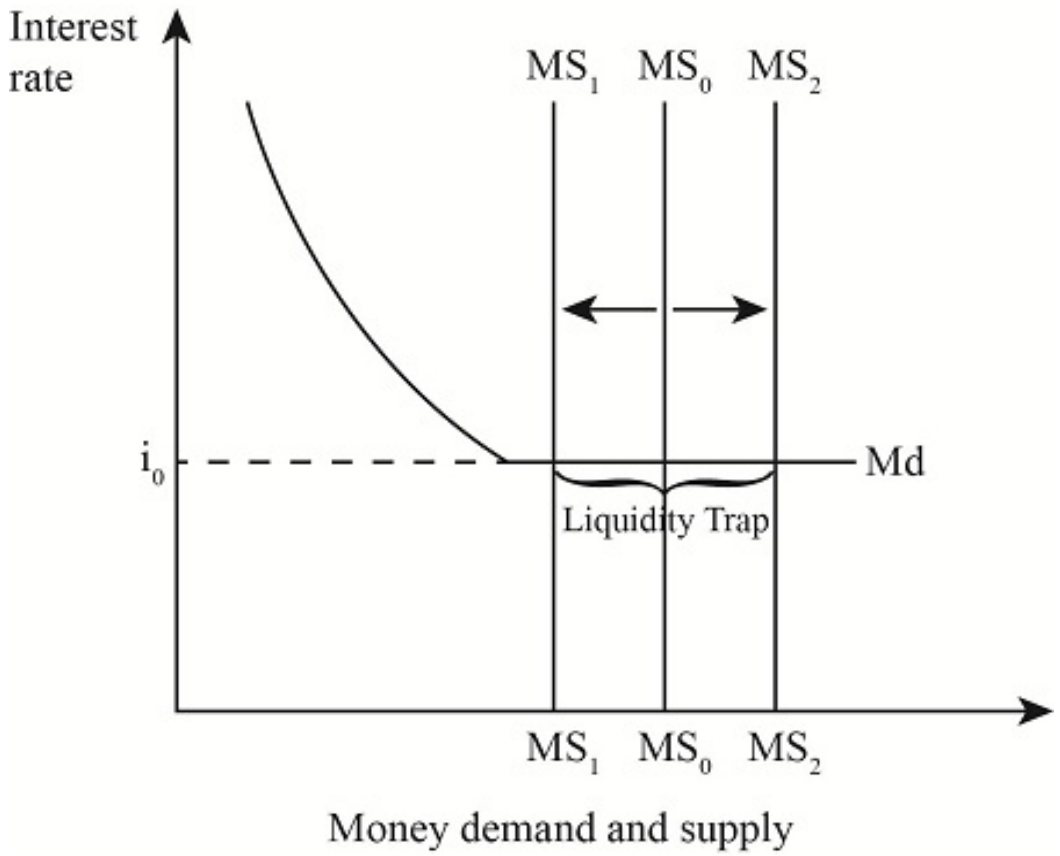

Figure 2: money demand and money supply equilibrium for a given money demand (L, Md in this specific graph) and different levels of money supply (MS_0, MS_1, MS_2). Note that once the lower bound is reached (that is for the level i_0 of interest rates), the demand for money function becomes horizontal, meaning that changes in the money supply, in such a region, will have no effects on the level of interest rates.

Keynes did not consider the zero-lower-bound for interest rates. In reality, "Keynes believed the effective lower bound for long term government bonds was 2%."[11] Once this threshold is reached, the liquidity preference becomes virtually absolute. If this happens, he believed "monetary authority would have lost effective control over the rate of interest."[12] This implies that increased money supply is not any more effective in lowering the interest rates and, the economy wouldn't experience growth as expected in normal circumstances.

In this instance other measures are called for, including public investments. Echoes of this doctrine can be found in Keynes's *An Open Letter to President Roosevelt* of 1933[13]. Here he analyses the steps to be taken to get out of the Great Depression that was affecting the US economy in those years. He

[11] "How has Keynes's liquidity trap theory held up over time", econlib.com.

[12] "General Theory of Employment, Interest and Money", page 207.

[13] Keynes in 1933 wrote this letter in response to the *New York Times*' request for his view on the American economic outlook.

gets to the conclusion that for the economy to restart, the output has to rise in order for employment to increase and for citizens to be more confident about future conditions: "the object of the recovery is to increase the national output and put more man to work"[14].

Keynes indicates three ways to have national output growth:

> "Individuals must be induced to spend more out of their existing incomes; or the business world must be induced, either by increased confidence in the prospects or by a lower rate of interest, to create additional current incomes in the hands of their employees, which is what happens when either the working or the fixed capital of the country is being increased; or public authority must be called in aid to create additional current incomes through the expenditure of borrowed or printed money."[15]

Indeed, in bad times the first is hard to occur, as individuals are willing to hold liquidity. The second is a direct consequence of the third possibility. As the central bank prints more money and finances government expenditures, the money supply increases, leading to a lower rate of interest (see Fig. 1). It is at this point that, borrowings become less expensive and, the economy will experience an expansionary effect, as the higher expected income thus higher expected sales, will boost employment. "The object [of such a monetary policy] is to start the ball rolling"[16]. In fact, Keynes, in his letter, criticizes the theory under which output and, income can be raised just by increasing the quantity of money (the Quantity Theory of Money), and argues that this "is like trying to get fat by buying a larger belt."[17] The quantity of money is merely seen as a limit factor, while the volume of expenditure is the operative factor. Note in fact that, there cannot be rising output without increasing prices and, money supply has to support such an expansionary wave because otherwise "rising output and rising incomes will suffer a set-back sooner or later if the quantity of money is fixed."[18] "The stimulation of output by increasing aggregate purchasing power is the right way to get prices up; and not the other way around"[19].

[14] "An Open Letter to President Roosevelt", page 2.

[15] IBID, page 2.

[16] IBID, page 5.

[17] IBID, page 3.

[18] IBID, page 3.

[19] IBID, page 3.

Indeed, there would be an obstacle to the strategy if the objective was only that of trying to lower interest rates by increasing the money supply and, in this way stimulating companies' expenditures and improve their expectations of output growth.

This is why in his letter to the President; Keynes underlines the importance of government expenditure in the process. He is skeptical about the success of a merely monetary policy directed toward influencing the rate of interest because of this liquidity trap problem. "Public sector investment and public sector investment programs can boost growth, reduce uncertainty, and restore investors' confidence."[23]

To summarize and conclude Keynes's view of the liquidity trap it can be affirmed that this stems from the condition of uncertainty of the economy and the related liquidity preference of investors. This happens because, related to the speculative motive of money demand, as interest rates are low, no matter how much money is pumped into the economy, investors will hold it instead of investing it, liquidity preference is absolute[24].The reason to this is that they would prefer to hold a riskless asset instead of a risky one for an exceptionally low compensation for risk. Additionally, it is because as interests are low the duration of the bonds is high, and as investors fear future interest rates to rise, they also fear their bond's value to fall. Hence Keynes suggests, as an action for recovery, to ensure the "maintenance of cheap and abundant credit and in particular the reduction of long-term rates of interests."[25] Nonetheless, a merely expansionary monetary policy will be ineffective in the objective of stimulating output, because investors will still have no incentive in storing their money in the form of securities. For the monetary policy to be effective in having the economy start rolling, it has to be supported by public sector investments. In addition, Keynes specifies that the government "preference should be given to those which can be made to mature quickly on a large scale as for example the rehabilitation of the physical conditions of railroads."[26] This is due to the fact that, to exit the liquidity trap firms and investors have to change their expectations of future growth. If new possibilities of growth are given to firms, then the expectations of the economy will change, resulting in boosting growth.

[23] "Japan's Liquidity Trap", page 30.

[24] Keynes did not refer to the zero-lower-bound but instead to an interest rate of about 2%

[25] "An Open Letter to President Roosevelt", page 5.

[26] IBID, page 5.

1.4 Hicks's liquidity trap

John R. Hicks in his IS-LM article (1937) and in his book *Value and Capital* (1939) criticizes several ideas that Keynes presented in his *General Theory of Employment, Interest and Money* as new. However, he underlined various times the importance of the concepts Keynes introduced related to the "liquidity trap". He emphasized the importance of this concept much more than Keynes himself did. Hicks, in fact, analyzed the ideas brought in by Keynes on the matter and discussed the topic more in depth.

As seen earlier, Keynes's model is characterized by the fact that long-term interest rates are the relevant opportunity cost in the money demand and, expectations about the future values of that long rates are assumed to be regressive or inelastic[27]. This because of the new liquidity preference theory he introduced, which takes into account the "speculative motive". This implies that investors, no matter the current value of interest rates, will always expect them to get back to their "natural levels". This means that when interest rates are low, bondholders will prefer to hold money instead of securities, as a rise in interest rates will cause capital losses. The consequence is that, for low levels of interest rates (low with respect to the natural level), increased money supply will have no effects on investment and on output growth (∂GDP). Note that differently from Keynes's perspective, here there isn't money hoarding due to uncertainty, but rather due to certainty, which is that of interest rates to go back to their natural level.

Hicks's view on this matter more in depth will be analyzed and specifically how long-term rates are determined, to then move to the IS-LM model he introduced.

In his book *Value and Capital*, Hicks introduced the concept of temporary equilibrium to deal with economic phenomena. He defined equilibrium over a period of time, when supply and demand in all markets are adjusted to price expectations defined at the beginning of the period. Hicks introduced the important concept of elasticity of price expectations to understand how prices change with changes in price expectations. Moreover, he defined the elasticity of a "person's expectations of the price of commodity X as the ratio of the proportional rise in expected future prices of X to the proportional rise in its current price."[28] There can be different elasticities.

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[27] "The IS-LM Model and the Liquidity Trap Concept: From Hicks to Krugman", page 1.

[28] "Value and Capital", page 205.

In the first extreme scenario, when we have elasticity of price expectations equal to zero, meaning it is inelastic (as Keynes assumed), individuals interpret price changes as only temporary and that in the long run the prices will go back to some defined level. If this is the case and the current price level changes, the economy will be stabilized by a temporary large substitution effect in markets for inputs and outputs.

On the other case, if there is unit elasticity of price expectations, meaning it is completely elastic, then price changes are assumed to be permanent. If that were true, this has big implications for the economic system. When price expectations change as well as current prices, then there is no substitution over time. If there are falling prices there may be, under particular conditions (i.e., low rates) a preclusion of stabilization through a reduction in the expected real rate of interest. This situation leads to cumulative falling prices due to the inability of the interest mechanism to stabilize the economy.

> "Technically, then, the case where elasticities of expectations are equal to unity marks the dividing line between stability and instability … The proposition which we have thus established is perhaps the most important proposition in economic dynamics."[29]

It is crucial to note that, in case of unity elasticity of price expectations, if current prices rise, then future prices are expected to rise, affecting money demand. This is due to the fact that investors expect inflation hence a devaluation of money. Consequently, given a fixed money supply, a higher interest rate is required to stabilize the economy and check the increase in prices.

Suppose on the other hand that there are falling prices, this, under the same unity elasticity, implies expected prices to fall (deflation). As a consequence, in order to stabilize the economy, there is the need to lower interest rates. Nevertheless, if interest rates are already low, then this interest rate mechanism may not be effective in stabilizing the economy, as in this situation investors have a strong preference in holding money instead of securities:

> "If the rate of interest was reasonably high to begin with, it seems possible that this reaction may take place without difficulty. But if the rate of interest is very low to begin with, it may be impossible for it to fall further – since… securities are inferior

[29] IBID, page 255.

> substitutes for money, and can never command a higher price than money. In this case, the system does not merely suffer from imperfect stability; it is absolutely unstable."[30]

Thus, an important problem is that during a depression, the central bank cannot avoid a process of falling prices when interest rates hit their minimum level.

In chapter XIII of *Value and Capital*, Hicks continued his analysis basing it on this hypothesis. He affirms that, short term interest rates are determined by transaction costs, meaning by the lack of general acceptability or imperfect liquidity of very short bills. Subsequently, according to the theory of term structure he introduced in chapter XI, long rates are determined by expectations about the future course of short-term rates.

It is important to highlight again a substantial difference with respect to Keynes in the theory of interest rates determination. As stated by Keynes, current rate of interest is determined by nothing else but uncertainty about future values of the rates.

On the other hand, Hicks's long rates depend on expected short-term rates, which in turn depend on current supply and transaction demand for money:

> "If the costs of holding money can be neglected, it will always be profitable to hold money rather than lend it out, if the rate of interest is not greater than zero. Consequently the rate of interest must always be positive. In an extreme case, the shortest short-term rate may perhaps be nearly zero. But if so, the long-term rate must lie above it, for the long rate has to allow for the risk that the short rate may rise during the currency of the loan, and it should be observed that the short rate can only rise, it cannot fall. This does not only mean that the long rate must be a sort of average of the probable short rates over its duration, and that this average must lie above the current short rate. There is also the more important risk to be considered, that the lender on long term may desire to have cash before the agreed date of repayment, and then, if the short rate has risen meanwhile, he may be involved in a substantial capital loss. It is this last risk which provides Mr. Keynes' "speculative motive" and which ensures that the rate for loans of infinite duration (which he always has in mind as the rate of interest) cannot fall very near zero."[31]

[30] "Value and Capital", page 259.

[31] "Mr. Keynes and the "Classics"", page 154.

In this analysis of Keynes's theory for the floor of interest rates, Hicks introduced two very important notions. The first is the "expectation theory" of term structure, long rates are an average of current and expected short rates. The second is the "liquidity preference theory" of term structure. This is based on the assumption that speculators are risk-averse, they must be paid a "liquidity premium" or "risk premium" to cover for the additional risk they are taking in buying long-term securities (bonds) with respect to short-term bonds. Note in fact that due to the higher duration, long-term bonds will be affected more by changes in the interest rate level, compared to short-term bonds.[32]

Furthermore, Hicks added two very important footnotes to the above cited paragraph. The first is that although short-term rates are very low, it is unlikely that investors interpret that condition as permanent, which would imply long term rates close to zero. They will consider such condition as part of the business cycle, thus temporary. This implies that the rates may rise if the economy does well or, they may worsen. The second is about the fact that, in Hicks's opinion, the "speculative motive" introduced by Keynes cannot account for the system of interest rates alone. This is of course a critique and point of discontinuity with respect to Keynes's theory. It is very important to note from the first of the two notes that Hicks believed that the positive floor for interest rates was only a temporary condition to be attributed to the business cycle.

In *Value and Capital*, Hicks introduced another important concept, that is the elasticity of interest expectations. This measures the effect of changes in current short-term rates or long-term rates on their expected values. In the case of short-term rates, if elasticity of interest expectations is inelastic, then changes in these (short-term rates) will have no effect on long rates. It is crucial to mention that this would be both a positive and negative situation. The positive aspect is that the central bank is enabled to lower interest rates in order to achieve equilibrium in the economic system. On the contrary, the negative aspect is that an expansionary monetary policy would be ineffective in case of very low rates, as investors expect rates to rise. This would disincentivize them from holding bonds, and they will always prefer money. If instead there is elastic interest expectations, then changes in current short-term interest rates will have an impact on long-term interest rates. In such case, the above discussed negative effect that implied an ineffectiveness of interest rate policies, is not a problem anymore. With low current rates, investors will now expect even lower interest rates. It can be said that in the analysis of elasticity of longer rates Hicks's theory is closer to Keynes's. If long term rates expectations are inelastic, then a fall in long term rates is perceived as a temporary condition and will lower current long-term rates by little. According to many economists commenting

[32] "The IS-LM Model and the Liquidity Trap Concept: From Hicks to Krugman".s

Keynes's theory and the concept liquidity trap in that period, it is actually the condition of inelasticity of interest expectations that explains why the demand for liquidity funds is highly elastic with respect to long-term rates. As these are stable (inelastic) with respect to short-term rates and, if rates fall to minimum levels, the economy may be caught in the liquidity trap. In fact, as discussed, investors under such low-rate levels and expecting rates to rise sharply, will have a strong preference in holding money instead of securities and, additional money pumped into the system would have no expansionary effects on the economy. Note that this is different from what Keynes stated, where the condition was a consequence of uncertainty concerning future interest rates.

To Hicks the most important concept introduced by Keynes in his General Theory, that is completely innovative with respect to the classics, is that there are conditions in which "the interest-mechanism will not work. The special form in which this appears in the General Theory is the doctrine of the

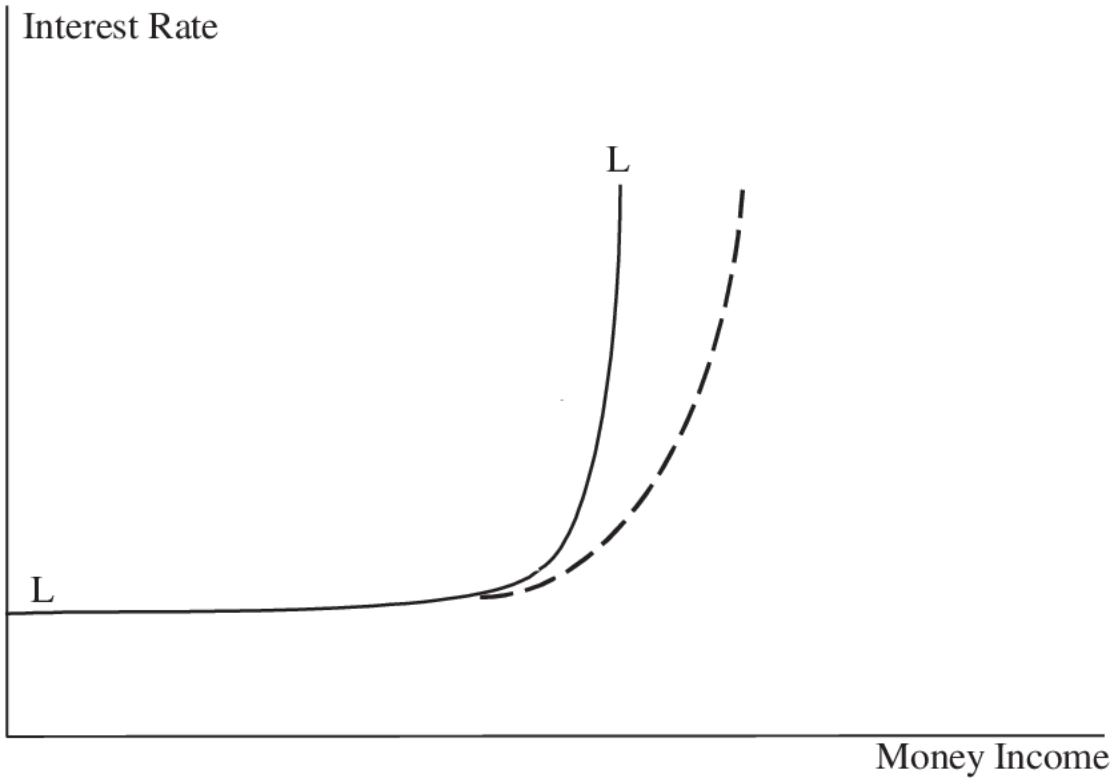

Figure 3: the graph of the LL (later on renamed LM) curve, that represent the set of all GDP and interest rates at which money demand (L) and money supply (M) are in equilibrium. As we can see the left hand side of the curve is horizontal. This is the point at which the curve reaches the lower bound of interest rates. All other levels of the LL curve will have in common the horizontal portion of the curve at that same level of interest rate (that is in fact the lower bound).

floor to the rate of interest – the 'liquidity trap' as Sir Dennis Robertson has called it."[33] To Hicks it is important to understand the implications of what Keynes introduced on the shape of the LL curve (later on renamed LM, standing for 'liquidity-money'). This curve depicts the set of all GDP and interest rates at which money supply and money demand are in equilibrium. Because of the floor of interest rates, the curve will be nearly horizontal on the left (that is at low levels of rates of interest). On the right side instead, the curve will be nearly vertical because there is an upper limit to the velocity of money[34] (see Fig. 3).

The right-hand side of this LM curve will be criticized in modern economics, as the model does not take into account financial intermediaries. This will be discussed later on in this chapter.

Keynes's theory becomes relevant when there is weak inducement to invest and high propensity to save. This implies, graphically, that the IS[35] curve will intercept the LM curve on the left-hand side, where this last one is horizontal. If this happens, the economic system is caught in a liquidity trap. Additional money pumped into the system will have no effects on interest rates, thus no expansionary effects on the economy. Note that Robertson had a big influence on Hicks:

> "Some part of the additional savings devoted by individuals to the purchase of securities will come to rest in the banking accounts of those who, at the higher price of securities, desire to hold an increased quantity of money. Thus the fall in the rate of interest and the stimulus to the formation of capital will be less than if the [liquidity schedule] were a vertical straight line, and the stream of money income will tend to contract...Liquidity [is] a trap for savings."[36]

In terms of Hicks's IS-LM model, Robertson's trap refers to a shift of the IS curve at points where the LM curve is horizontal.

Some economists, such as Ralph G. Hawtrey[37], believed that the liquidity trap concept was already a feature of the classical view (Quantity Theory of Money) and not a point of discontinuity. In the sense

[33] "A Rehabilitation of "Classical" Economics?", page 297.

[34] "Value and Capital", page 154.

[35] It is the income-saving curve, that depicts all points at various levels of interest rates and GDP that provide the real market with equilibrium.

[36] "Some Notes on Mr. Keynes' General Theory of Interest", page 188.

[37] Ralph G. Hawtrey was a British economist, and a close friend of J. M. Keynes.

that, in case of depression it may be impossible to expand money supply through the banking system due to a crisis of confidence affecting both demand and supply sides of the credit market[38]. The problem in depression circumstances is that the rate may be set very low and real rate become even negative, but bank rates cannot fall lower than zero. If this happens, the central bank pumping money into the economic system (which conventionally is done through banks) will not have the effect desired (money supply to rise), as in such situations banks prefer to hold liquidity in the form of reserves instead of lending them out. It is important to mention how "the "excess reserves trap" argument advanced by Hawtrey is consistent with the Quantity Theory of Money, since it is not about the ineffectiveness of changes in money supply (as in Hicks's liquidity trap discussion), but about the difficulty of increasing the money supply through the banking system in the depression"[39].

Therefore, when is it that the economy falls in a Hicksian liquidity trap?

This happens when the following three characteristics affect the economic environment. The first is that interest rates are very low and close to the floor of interest rates. The second characteristic has to do with the fact that people expect prices to fall in the future. And the third is about individuals' expectations just like the second, but this time it has to do with the inelasticity of long-term rates, meaning that changes in short-term rates do not affect (extreme case) long-term rates. The consequence of such inelasticity is that investors will not invest in bonds, because they expect interest rates to rise sharply (since the other condition is that the rates are close to the floor of interest rates) and thus would experience large capital losses.

Hicks, in his discussion about the liquidity trap, made no reference to the banking system, just as he in his basic IS-LM model. However, he tried to incorporate some features of the banking system to his analysis. When considering money supply to include also bank deposits, then things change in the model. There is not anymore a fixed money supply, thus the right hand side of the LM curve won't be vertical anymore[40]. As shown in Figure 5, if such condition is included, the shape of the LL curve on the right-hand side (i.e., for interest rates larger than the lower bound) will no longer tend to be vertical, even if it will continue to grow in interest rate equilibrium as money income increases.

[38] It is the concept of "credit lock" introduced by Hawtrey in that period.

[39] "The IS-LM Model and the Liquidity Trap Concept: From Hicks to Krugman", page 6.

[40] "A contribution to the theory of trade cycle", page 141.

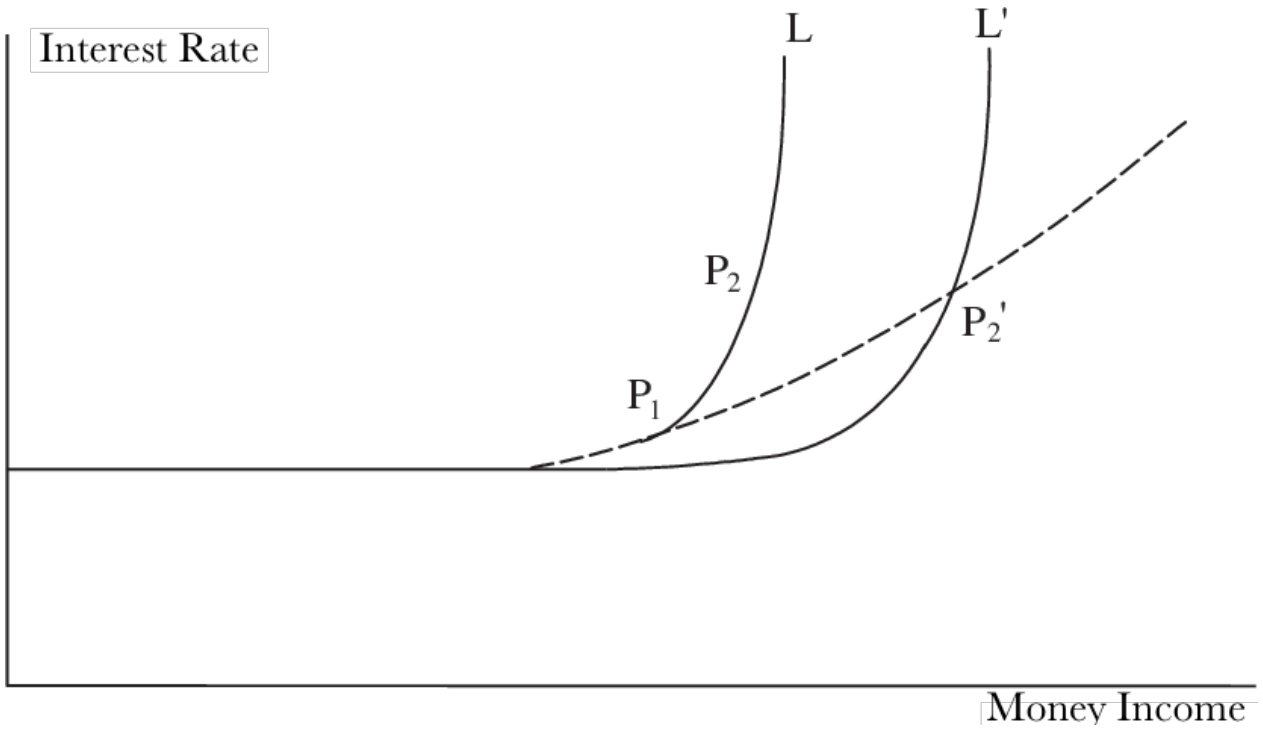

Figure 4: the graph represents two LL curves (LL and LL', with LL<LL') that at some level of money income become vertical, and a third LL curve (the dotted one) that represents the set of combinations of GDP and interest rate that bring to equilibrium money demand with money supply, and includes the bank deposits in money supply (thus taking into account the banking sector.

If the economic system is elastic, meaning that an increase in the rates of interest leads to higher money supply, then there would be a shift from P1 to P2' (with a larger money supply) rather than to P2 (that would be the point in case of fixed money supply). Why does money supply increase as interest rates increase, if bank deposits are included in the money supply, thus taking into account the banking sector in the analysis? This because as the interest rate increases, banks become more willing to lend money that, through active deposit creation, will lead to new bank deposits hence, higher money supply. By connecting the points of the various new money supplies, given changes in the interest rate, and for a given elasticity, it results in the LM curve for that specific elasticity. If all other possible elasticities are considered, then it is possible to construct all various LM curves. Note that in case of unity elasticity of the monetary system, the LM curve is horizontal on the left-hand side (see Fig. 4). It is worth mentioning that the introduction of such feature did not change the liquidity trap conditions, as the left-hand side of the LM curve remains unchanged.

However, the IS-LM model will be criticized and, the analysis Hicks made on the liquidity trap with it. This is due to the absence of four important features of the economic system: capital markets, foreign trade, capital mobility, and (the most important one) financial intermediaries.

1.5 Postwar analysis of the notion of liquidity

In the following years, many economists have discussed the topic without bringing in important changes. Alvin Hansen and, Paul Samuelson stated that the floor for interest rates was not positive (as affirmed by Keynes) but instead zero, thus introducing the concept of zero lower bound for rates of interest. Modigliani, in his 1944 article *Econometrica*, affirmed that a line should be made to separate Keynes and the "classics" based on the money-wage rigidity (assumed by Keynes) and flexibility (assumed by the "classics") assumption. Hicks, during the 1970s affirmed that, in case of relatively high inflation rates, as the one the developed world was experiencing in that period, the floor to interest rates and the liquidity trap are not a problem to be concerned with:

> "Perhaps I should say something about the 'floor to the rate of interest', which was so important in Keynes's own thinking, and which figured a good deal in my earlier writings on Keynes. One can see why it appeared, in the thirties, to be such an important matter; in the inflationary conditions to which we have now become accustomed, it is irrelevant."[41]

This was indeed true, and economists did not focus on such topics for a long period. However, in the 1990s these concepts became of public interest again, as Japan seemed to fall in such a condition. It became even more relevant in the first two decades of the XXI century as many developed countries and areas, shocked by several crises, found their economies with very low (if not negative) inflation rates, and interest rates levels historically low (even negative in the Euro Area).

1.6 Krugman and the liquidity trap

In the 1990s the liquidity trap, became of public interest due to the fact that Japan seemed to be caught in such "trap". In particular the second world largest economy presented low unemployment rate, historically low interest rates, and still could not get output to grow in a significant way. This implied, that conventional monetary policies seemed not to be working.

Krugman between the end of the XX and the beginning of the XXI century was very active on the topic. He even publicly criticized modern economists in his articles. Modern economists "view is basically that a liquidity trap cannot happen, did not happen, and will not happen again. But it has

[41] "On Coddington's Interpretation", page 994.

happened, and to the world's second largest economy."[42] In that specific article he analyzed Japan's situation, that he believed to be stuck in a liquidity trap. Krugman in that same article *It's Baaack*, gave a clear definition of what a liquidity trap is and when it occurs:

> "A liquidity trap may be defined as a situation in which conventional monetary policies have become impotent, because nominal interest rates are at or near zero: injecting monetary base into the economy has no effect, because base and bonds are viewed by the private sector as perfect substitutes."[43]

Krugman's analysis of the liquidity trap comes from a reformulation of the Hicksian IS-LM model. Krugman introduced a simple rational expectation model of an individual agent maximizing his intertemporal utility function. He will demand money based on a cash in advance constraint. Furthermore, he assumed no uncertainty. Under such conditions the individual will only hold enough cash to make consumption purchases. It is important to note the relationship between price level and money supply:

(9) $$P = (M/y)$$

With y being output equal to consumption, P the price level and, M the money supply. Figure 5 shows this relation with the MM curve, that represents the equilibrium in the money market. This is the equivalent of Hicks's LM curve. Krugman states that the CC curve (that will be discussed later on) determines the relation between the nominal interest rate i and the price level P. This arises from the intertemporal choice of how to allocate consumption in order to maximize utility for a given level of endowments. In particular, the CC curve shows an inverse relationship for given future price level, present and future endowments, and the discount factor. Thus, a central bank can set the desired nominal interest rate by appropriately moving the price level, which is determined by means of the money supply, as shown in equation (9).

The IS curve[44] is as usual the equilibrium in the market for goods and is described by equation (10), that stems from Euler's equation for consumption. Euler's function represents the condition for

[42] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 138.

[43] IBID, page 141.

[44] It was slightly changed and renamed CC by Krugman, that stands for customer-credit, due to the inclusion in the model of commercial banks acting as financial intermediaries and providing loans.

intertemporal utility maximization. It is important to recall that the IS curve represents the set of GDP and interest rate that bring to equilibrium aggregate demand and aggregate supply. Indeed, aggregate demand is based on the same utility maximization principle.

In particular, to get the CC curve, the ratio between the marginal utilities and the product of the discount factor of the representative agent times the gross real interest rate (Euler's equation) are equated. Then, by substituting in the ratio between marginal utilities the two amounts of endowments (since they are fully consumed) the following equation is determined:

$$(1+i) * \left(\frac{P_t}{P_{t+1}}\right) = \left(\frac{1}{D}\right) * \left(\frac{y_{t+1}}{y_t}\right)^{\rho} \tag{10}$$

D and ρ representing respectively the discount factor and the relative risk aversion of the agents. P_{t+1}, that is the expected price level in period t+1, is defined by money supply and output at t+1, and both are assumed to be constant (as shown in equation (9)). If this is the case, there is price stickiness. Since expected money supply and output are assumed to be constant, then the price as well is expected to be constant. This implies, that a rise in current price leads to expected deflation, in order for the prices to go back to the given level (determined, as underlined, by output and money supply at t+1, assumed to be constant). Then as a rise in the price level implies expected deflation hence, lower nominal interest rates[45]:

> "Since future price level is assumed held fixed, any rise in the current level creates expected deflation; hence higher [current] price level means lower interest rate."[46]

This explains the downward sloping shape of the CC curve (see figure 5). In the graph interest rates and price level are on the axis, instead of having the usual interest rate and output of the original IS-LM model. Money supply is impounded in the MM curve as shown in equation (9), while the income is impounded in the CC curve, as claimed by equation (10).

[45] Recall the Fisher equation i = r + π, where i is the nominal interest, r is the real interest rate, and π is the inflation rate.

[46] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 145.

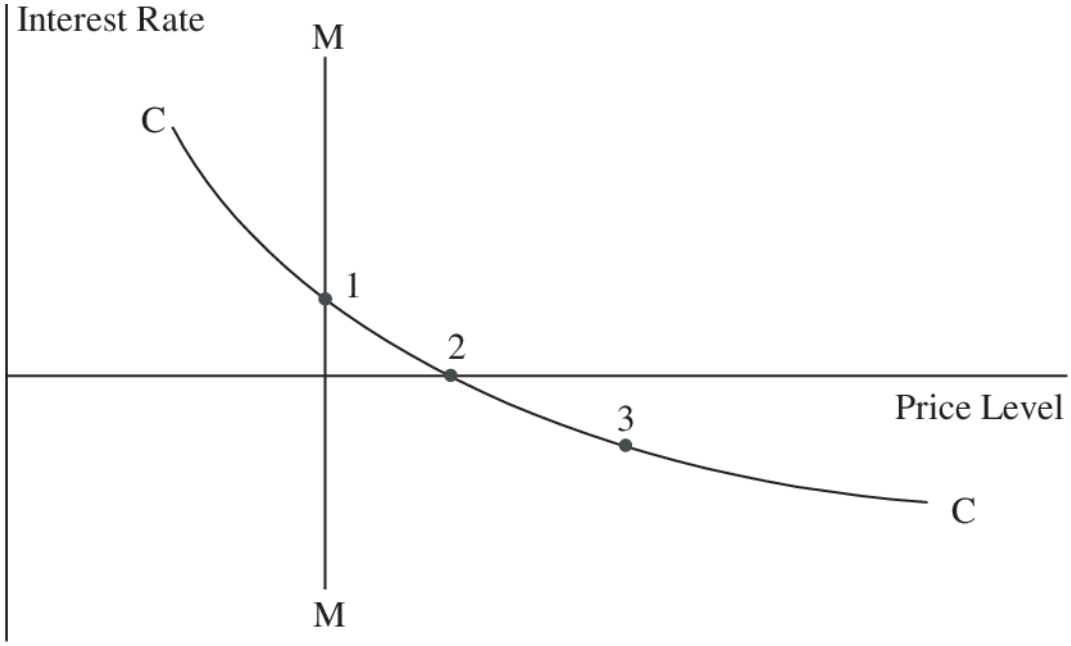

Figure 5: represents the CC and MM curves in the (P,i) plane. The CC curve represents the combinations of i and P that bring into equilibrium the commodity market, while the MM represents the equilibrium in the money market.

Hicks's conclusion, in the case of inelasticity of price expectations, is that the system can be stabilized through intertemporal substitution of endowments. This is the same conclusion that Krugman reached almost 60 years later although in a different context.

However, Krugman started the study of conditions in which the central bank may lose its ability to control the price level, by assuming price flexibility. As Fig. 5 indicates, a rise in the current money supply (given that long-run money supply and expected price level are fixed) implies that the CC and MM curves intersect at point 2 (the zero-lower bound) and possibly even further at point 3, implying a negative nominal interest rate. Yet this, explains Krugman, cannot happen as "[…] the interest rate cannot go negative, because money would then dominate bonds as an asset."[47] Then:

> "[…] it must be that any increase in money supply beyond the level that would push interest rates at zero is simply substituted for zero interest bonds in individual portfolios (bonds being purchased by the central bank in its open market operation!), with no further effect on either price level or the interest rate. Because spending is no

[47] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 146.

longer constrained by money, the MM curve becomes irrelevant; the economy stays at 2 no matter how large the money supply."[48]

Under the above conditions, a liquidity trap arises if there are expectations of deflation (that would shift the CC to the left) or if the equilibrium real interest rate is negative, due to individuals' intertemporal consumption preferences. Under a liquidity trap, investors (under Krugman's assumptions) expect future price level to be predetermined, thus allowing to stabilize the economy. It needs to be recalled that under Hicks's assumption of unity elasticity of expected prices (where current price level affected expected price level) and in a liquidity trap, the economy couldn't stabilize due to continuously falling prices.

Subsequently, Krugman investigates the consequences of monetary policies under liquidity trap and now under the assumption of predetermined current price levels. Now, output is determined by consumption demand, and this is a decreasing function of interest rates. This is because the higher the interest rate, the less individuals will be willing to consume, as securities now earn a higher interest. With respect to the previous analysis, in this case price expectations are predetermined; thus, P is currently the constant factor.

The higher the interest rate, the less money investors will be willing to hold (interest rate is the opportunity cost of holding money). Hence, the lower the consumption demand and as a consequence the lower the level of output. A new equation for the CC curve is formed (Hicks's IS curve) that can now be represented in the (y,i) plane:

(11) $$y = y_{t+1} * \left(\frac{P_{t+1}}{D * P_t}\right)^{1/\rho} * (1+i)^{-1/\rho}$$

As said, this new equation is presented in an output-interest rate graph, just as the original IS-LM model (see Fig. 6). Accordingly, a rise in the supply of money will not be able to raise output beyond point 2. This is where interest rate level is at zero. This point will be below the output produced at a full employment level, given by point 3 in the below graph.

[48] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 146.

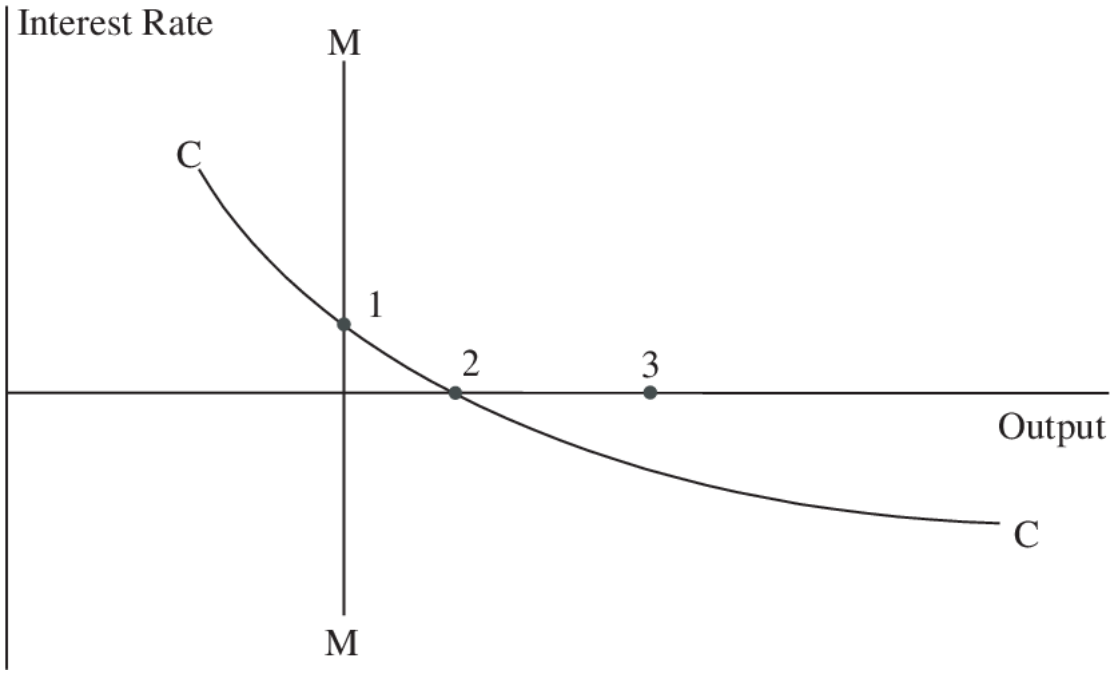

Figure 6: the MM and CC curves represented in a (y,i) plane, where now the future price level is predetermined and the consumption demand determines output. Note that output (y) can be raised by increasing money supply until point 2, as then the interest rate would fall into negative values. Point 2 is however lower (in terms of output) with respect to point 3, that is the full employment level of output.

Nonetheless, in Krugman's view, this is true only if the monetary policy expansion is perceived to be temporary. That is if the future money supply is held constant. "Monetary policy will in fact be effective if the central bank promise to be irresponsible, to seek a higher future price level."[49] If the mandate of the central bank is to guarantee price stability, promising an increase of the price level goes against its mandate. If this is the case and the central bank acts "irresponsibly", permanently increasing the supply of money then, even at a zero interest rate level, monetary policy would still be effective, as the CC curve would shift to the right both in the graph of figure 5 (flexible price model) and 6 (sticky output model), as individuals now expect higher prices. Therefore, the liquidity trap concept with Krugman involves a credibility problem: "monetary policy is ineffective only if people do not believe that monetary expansion will be kept in the future."[50] He will also state that "a monetary expansion that the market expects to be sustained […] will always work, whatever the structural problems the economy might have."[51]

[49] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 139.

[50] IBID, page 142.

[51] IBID, page 142.

Other than introducing this credibility problem in the theory of the liquidity trap, Krugman also tried to complete Hicks's analysis since, as highlighted by many economists, the IS-LM model lacked of investment, foreign trade, capital mobility and financial.

He starts the analysis of the introduction of investment with the following:

> "One way of stating the liquidity trap problem is to say that it occurs when the equilibrium real interest rate – the rate at which saving and investment would be equal at potential output – is negative."[52]

He follows by raising an issue: how can this happen in an economy where productive investment can take place, and the marginal product of capital[53], while it can be low, can hardly be negative? One possible answer is that this can happen in the case in which the equity premium[54] is very high. Another possible answer is that the rate of return does not only depend on the ratio between capital's marginal product and its price, but also depends on the expected rate of change of that price. Thus, if the prices are expected to be falling, investors could still have a negative rate of return despite the marginal product of capital being positive. If this concept is applied to land instead of capital, and an overlapping generation model is used (in which a generation only produces in the first period and only consumes in the second), it can be seen how, if population is expected to lower in the following years, then labor force and, as a consequence, the real price of land will decline. Then, "even though land has a positive marginal product, the expected return from investing in land can, in principle, be negative."[55] Krugman then concludes that a liquidity trap can occur notwithstanding there are productive investment projects.

Wherefore, Krugman proceeds analyzing the liquidity trap taking into account "international mobility of capital and goods" (that is an open economy, in which international trade is allowed). Many economists have suggested that a solution to the excess of savings over investments, in an economy

[52] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 150.

[53] This is the additional output that can be produced from the use of an additional unit of capital.

[54] That is the excess return that investing in the stock market provides over the risk-free rate, that thus represents the return investors require to cover for the additional risk they take by investing in such equity. Note that a high equity premium means high perceived risk from investing in the stock market.

[55] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 151.

where interest rates are zero (that is the liquidity trap condition), is that of investing this excess savings in foreign markets:

> "The general view seems to be that an open economy can always extricate itself from a liquidity trap, as long as there are profitable investment opportunities overseas."[56]

The problem with such strategy is political and refers to the fact that the economies with profitable investment opportunities have to accept the corresponding trade surplus. However, many economists in the 1990s have argued that, albeit there is large integration in markets, in developed economies (but not only) "the bulk of employment and value added is in goods and services that remain nontradable despite modern communications and transportations."[57] This implies, that capital export is not enough to escape the liquidity trap. Although, communication and transportation technologies in 1998 (when Krugman wrote this article) were not as advanced as they are today, this conclusion still holds true. If the share of nontradable goods and services is large with respect to tradable ones, then the domestic real rate can still be negative, despite world rates being positive.

Moreover, Krugman analyzed the effects of an expansionary monetary policy in an economy that produces and consumes only two types of goods, that are tradable and nontradable goods. In the case of tradable goods industry, a temporary rise in money supply won't have effects on prices in the long run. This is because prices and real interest rates are tied down by world capital markets, but also by the fact that it is a temporary policy. Thus, prices temporary increase but sooner or later will go back down to their "world" level (implying that investors will expect deflation). In the case of nontradable goods, a temporary expansionary monetary policy will bring both nominal and real interest rates down, and as a consequence rise both production and consumption levels. This is a result of the fact that nontradable goods' domestic consumption must be equalized to its production by real interest rates since this industry works just as a close economy (which is not the case for tradable goods).

> "The important point is that both for the exchange rate and for nontradable production, the zero constraint on the nominal interest rate can be binding. That is, even at a zero interest rate, the output increase and the nominal depreciation will have finite magnitudes- and the economy may not be able to go all the way to full employment."[58]

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[56] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 152.

[57] IBID, page 152.

[58] IBID, page 154.

Additionally, Krugman concludes that a monetary expansion will have no effects on current accounts, because as real interest rates on nontradable goods do not change, there is no reallocation between present and future consumption of those goods. He then underlines that this happens under the assumption of complete risk aversion of investors.

Moreover, Krugman continues in his analysis with the introduction of financial intermediaries and monetary aggregates. A graph, from Tenim 1976 (pp. 5), that Krugman put in his paper shows the divergence between monetary base and M2. Krugman highlights the fact that monetary base rose during the Great Depression while M2 fell. Many economists believed M2 (which comprehends cash, checking deposits, and easily convertible near money) to be the correct measure for money supply. The conclusions from such graph were two. The first introduced by Friedman and Schwartz was that "broad aggregate as M2 is the proper measure of the money supply, […] the Depression [1930] occurred because the Fed allowed broad money to fall so much, and the recovery was so long delayed because the needed increase in broad money was equally delayed."[59] The second conclusion is from Bernanke and others and, states that the drastic fall in the money multiplier was a symptom of financial disintermediation, that this was the cause of the slump, and that the Fed (Federal Reserves Bank) couldn't do much about it.

At this point, Krugman introduces the "cash-in-advance meets Diamond-Dybvig" framework, to see how financial intermediaries and monetary aggregates fill in the liquidity trap. In such framework, the demand for liquidity is determined by making individuals uncertain about future consumption needs. Only after they have made their illiquid investment commitment, they discover whether they are type one (that will derive utility from period one consumption) or type two (which will derive utility from period two consumption) consumers. The consumers, through financial intermediaries can smoothen the consumption among the two periods. The framework was initially introduced to understand the vulnerability of the banking system. However, Krugman used it to analyze the effect of the presence of financial intermediaries in a liquidity trap. At the beginning of each period a three steps process takes place:

> "(1) individuals trade currency for bonds in a capital market and are also able to make deposits at a class of banks, (2) individuals discover whether they derive utility from

[59] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 155, from Friedman Schwartz 1963.

> consuming in the current period, (3) those who do want to consume withdraw the necessary cash from their bank accounts."[60]

As long as the nominal interest rate is positive, individuals will have no incentive to hold cash. This because, just as Keynes explained in his liquidity preference theory, they can earn a positive interest rate from bond investments. Thus, individuals will hold just the necessary amount as deposit, to satisfy their needs in case they turn out to be type one consumers. In turn, banks will hold just enough of those deposits in reserves, to cover for possible withdrawals and, invest the rest in bonds (that earn a positive interest rate). Note that under such conditions, the economy will have no currency circulating and M2 (currency plus bank deposits, thus deposits) will be a multiple of base money (from the money multiplier). If the central bank increases base money in such environment, then such monetary aggregate (M2) will expand, leading both deposits and the price level (from the Quantity Theory of Money) to increase.

If instead the economy has zero nominal interest rate, then individuals will become indifferent between holding currency, bonds or deposit their cash. According to Keynes, when rates are at their minimum, individuals have absolute preference for currency. Likewise, banks will have no incentive in holding bonds under such circumstances. Under the extreme assumption that individuals will hold currency and the deposited money will be held as reserves by banks, then M2 is composed mainly by currency. Krugman claims three things can happen if, under such interest rate conditions, the central bank decides to increase base money. The first is that the additional base money is absorbed by consumers and cash substituted for bonds. In the second possibility, the additional base money is absorbed by consumers, that this time will substitute cash for deposits. It is crucial to say that this would have no effect on the monetary aggregate M2. The third effect is that the additional base money is absorbed by banks and held as reserves. This situation would imply no changes in the monetary aggregate M2. Only the first out of the above three effects would have positive implications for the economy, as it is the only case in which an increase in the monetary base leads to a rise in monetary aggregate M2 (which again is believed to be the correct measure for money supply). This, in the case in which the economy had positive nominal interest rates and the central bank increased base money, leads to higher price level. In the other two circumstances bank credit will be reduced (both because banks will prefer to hold reserves, and because of the lower deposits from individuals), the monetary aggregate would not change, and "there would be no effects on the price level, nor on output if prices

[60] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 156.

are sticky."[61] Thus, if there is a substitution in all three directions, under liquidity trap conditions such monetary base expansion will "(1) expand broad aggregate slightly, but only because the public holds more currency; (2) actually reduce deposits, because some of that currency substitutes for deposits; and (3) reduce bank credit even more, because banks will add to reserves."[62]

It is crucial to mention that those effect are predicted without assuming that banks are in trouble. This implies (to Krugman) that, under liquidity trap conditions, the credit crunch and the failure from the central bank to rise M2 (money supply) by increasing base money is not a problem related to the banking sector. Rather, it is a problem caused by the economic condition itself. These effects are predicted to be so even if the banking sector is in perfect shape.

Krugman then tries to address the problem related to fiscal policy intervention. As seen previously, a fiscal expansion to Keynes was the solution to exit such condition. While it works in theory, under the IS-LM model, there are two main queries raised by Krugman in the application. The first is a qualitative one, and questions whether a temporary fiscal expansion can lead the economy out of the liquidity trap. This is possible in the case of an economy with multiple equilibria, with the liquidity trap condition being an undesirable one. If it is so, then a temporary fiscal expansion may work. Even though it was thought to be the case in the Great Depression, this was denied by Romer 1992, that showed how the output gap (in that same period) was highly reduced by monetary expansion even before the intervention with fiscal policies. Specifically, the exit was attributed to the fact that higher expected inflation led real interest rates down to negative values. Nevertheless, if a temporary expansionary policy does not work in short time, the stimulus has to be extended, and here comes the quantitative question: how long should it last, and are the consequences in terms of government debt acceptable? This is indeed a case specific question, as it depends on the specific condition of the economy facing such issue.

[61] "It's Baaack: Japan's Slump and the Return of the Liquidity Trap", page 157.

[62] IBID, page 157.

Chapter 2. Liquidity trap in current days

2.1 Introduction

As previously mentioned in Krugman (1998) claim, central banks' ability to support economic activity by lowering key interest rates[63] is limited. This is due to the presence of a lower bound for interest rates. This won't enable the central banks to achieve their price stability objective through interest rate policies.

When the central bank finds itself in this condition, the risk is that of falling into a liquidity trap. This leads to a deflationary spiral, characterized by a fall in expected rate of inflation and a rise in the real interest rates. Those factors increase the debt burden of borrowers, weighing on economic activity and wages, which dampens demand from consumers and businesses and drives prices further down.

Bear in mind that all developed economies are borrowers. In particular a few examples are:

- US currently has a public debt to GDP ratio of 107%;
- Italy currently has a public debt to GDP ratio of 155%;
- Germany currently has a public debt to GDP ratio of 70%;
- Japan currently has a public debt to GDP ratio of 256%.

In this chapter the focus will be on the effectiveness of monetary policy interventions in the US and in the Euro area under effective lower bound conditions. Furthermore, it will analyze whether such interventions were or were not effective in stimulating the economy and reach the price stability objective the two central banks have set. In particular, emphasis will be given to the Great Recession and the Pandemic crises.

During the 2008 crisis (up until today), the two central banks[64], that couldn't operate through policy interest rates (due to the lower bound for rates) started making use of the so-called unconventional monetary policies. These can be divided into three categories. The first is that of quantitative easing (QE), it is used to influence prices of riskier and long-term assets. The second policy is that of support for the flow of credit. This has the aim of acting directly on the cost and availability of credit. Ergo, the economy doesn't get to face a credit crunch, which in a recessionary situation, and under liquidity trap conditions, could have a strong negative impact on the economy. Lastly, the third is the forward guidance tool. This is aimed at providing information on future monetary policy the central bank will

[63] That has been the key monetary policy tool used by the central banks in between the end of the XX beginning of XXI century.

[64] The Federal Reserve Bank (Fed) and the European Central Bank (ECB).

implement. In the past, the idea was that in order for monetary policies to be effective, those had not to be expected by individuals and firms. In more recent days, and in particular after the 2007 financial crisis, the idea was reversed. Currently it is thought that, to achieve the best results, some general information about future monetary policy has to be provided by central banks (based on the current economic outlook), to reduce uncertainty on the markets.

2.2 The liquidity trap in the US

From February 2009 to December 2013 the Federal Reserve Bank's balance sheet increased by around $3.5 trillion. The size of a central bank's balance sheet is used to get a sense of the type of monetary policy stance the central bank is adopting. When the size increases the central bank is injecting money into the economy, thus there is an expansionary monetary policy stance. Vice versa when the size of the central bank's balance sheet shrinks, the central bank is withdrawing money from the economy, signaling a restrictive monetary policy.

The Fed increased the size of its balance sheet through a specific program called "large-scale asset purchase" (LSAP), which is the name they gave to the quantitative easing (the European Central Bank gave a different name to the program, but the concept is that of quantitative easing).

In theory, the effects of this LSAP had to be two. The first was increased credit availability in private lending markets. Whilst the second was a downward pressure on real interest rates.

In normal times, an increase in growth of money by one percentage point is expected to raise the inflation rate by 0.54 percentage points. This outcome is based on the results of a linear regression study of the inflation rate on money growth in the precrisis period[65].

Between December 2008 and December 2013 US's money supply (M0) increased by 40.29%, that is an average year-on-year increase of 8%. Under the above estimate, it would be expected to have an inflation rate of 4.3% per year. As a whole, it had to be foreseen an increase in the price level of at least 40% in 2013 with respect to 2008, however this was not the case.

After the LSAP was announced as a policy tool by the Fed[66], the media and several Fed officials expressed some concerns on the new tool, scared that it could have led to rampant inflation. As already mentioned, it was not the case. The increased money supply didn't lead to that rampant inflation that scared many agents. The concern then moved to the possibility of the economy being

[65] "The Liquidity Trap: An Alternative Explanation for Today's Low Inflation", page 10.

[66] It was announced as an additional tool with respect to the widely used federal fund rate, that in the period we are discussing ranged between 0.25% and 0%.

falling in a Japanese-style deflation, that Krugman (1998) analyzed in depth and related to the analysis of the liquidity trap.

Different reasons were in fact given to explain the persistent low inflation rate although the LSAP was introduced. The current Secretary of the US Treasury, Janet Yellen said in 2009[67] that "inflation would not raise in a recession because of the little pressure on prices and wages to increase given that resources throughout the economy were underused."[68] An additional explanation given was that low inflation stems from the weakening of the money multiplier, since banks continue to hold excess reserves, instead of providing loans to the economy:

(12) $$m = \frac{1+c}{c+r+e}$$

Where m is the money multiplier; c is the currency to deposit ratio; r is the required reserves to deposit ratio, that is the amount of reserves the central bank requires commercial banks to hold; and e is the excess reserves to deposit ratio. Note the effects from the money supply equation:

(13) $$M = m * H$$

Here M is the money supply; m, as affirmed previously, is the money multiplier and is given by the above-described factors; and H is the base money, which is under control of the central bank.

If commercial banks tend to hold increased cash, then the excess reserves to deposit ratio increases, leading (everything else being equal) to a lower multiplier. Bear in mind that from equation (13) as m lowers, an injection of base money by the central bank has a lower effect on the money supply therefore, on inflation.

Another possible explanation is that of a liquidity trap. Taking into consideration Keynes and as more recently restated by Krugman, under a liquidity trap condition increased money supply is simply absorbed by the increased demand for money. It is important to recall, that "investors hoard the increased money instead of spending it because the opportunity cost of holding cash -the forgone earnings from interest rates- is zero when the nominal interest rate is zero."[69] Krugman further claimed that both the case in which the injection is absorbed by customers and deposited to banks (thus not invested in bonds), and the situation in which it is absorbed by banks and held as reserves

[67] At that time, she was President of the Federal Reserve Bank of San Francisco.

[68] "The Liquidity Trap: An Alternative Explanation for Today's Low Inflation", page 10.

[69] IBID, page 10.

(which has effects on the money multiplier) there are no actual changes in the money supply, or at least the effects are not as large as expected and sufficient to reach the monetary policy objective.
Furthermore, as the Fed started the LSAP (thus purchasing bonds), the demand for debt securities increased, thus leading to a rise in the prices of bonds. The consequence is that of further lowering the interest rates (due to such an excess demand). The result is that individuals' preference is even more shifted towards holding cash instead of low performing, risk-bearing securities. Moreover, note that here it appears a component of inelasticity of price expectations, as theorized by Hicks, which prevents individuals to purchase bonds. If the price level in the debt market is very high and the interest rates very low then, as investors expect interest rates to go back to higher levels in the future, they are bearish (thus believe prices will lower) and will sell securities and hold cash. This explains why we have assumed, in Krugman, that individuals will not substitute cash for bonds (which would have a positive impact on the economy) and will rather hold cash.
Be aware that, until money demand equals money supply, then inflation remains stable. Suppose now that due to a quantitative easing (such as the LSAP) the interest rate falls, then money demand increases by more than money supply. Due to such excess demand, the price level must fall to absorb this difference. Hence, an increase in aggregate demand for real money balances has to be accommodated by an overall decrease in the price level for any given money supply in the goods market.
Yi Wen[70] showed in 2013 how LSAP's pace would have led real interest rates down by 2 percentage points, but with insignificant impact on aggregate employment and fixed capital investment. It would have also reduced aggregate price level as well as it would have put strong downward pressure on inflation. This is due to portfolio rebalancing of investors that are now bearish. Under such conditions they in fact sell low-return risk-bearing securities to hold cash instead.
Why is low inflation bad for the economy? Low inflation rate makes money (cash) more attractive as a store of value. This condition makes a liquidity trap easier to occur and gives the central bank low room to act (due to the lower bound for interest rates and the fact that they are already low in the situation under analysis). Furthermore, "quantitative easing […] can reinforce the liquidity trap by keeping the inflation rate low (or real return to money high)."[71]
According to Yi Wen, the correct monetary policy in a liquidity trap condition is not that of lowering the policy interest rates (which most likely are already at the lower bound) or to inject more liquidity into the economy, but rather to raise expected inflation. Assume that the Fed starts selling assets then,

[70] Yi Wen is an American economist and is currently the Assistant Vice-President at the Federal Reserve Bank of St. Louis.

[71] "The Liquidity Trap: An Alternative Explanation for Today's Low Inflation", page 11.

the supply of debt securities would increase, leading (ceteris paribus) to lower prices and higher interest rates. This would make investor's opportunity cost of holding money larger and will lead investors to engage in portfolio rebalancing, whilst now towards debt securities (ergo buying bonds). Bear in mind that, if now the decrease in money demand is larger than the decrease in money supply, then the result is higher inflation, "when financial assets become more attractive than cash can the aggregate price level increases."[72]

Note that this policy may work under the condition of the economy already being in a recession. The fact is that expansionary monetary policy is actually called when the economy is in a recession. How to then exit from such liquidity trap?

The conclusion is the same that Krugman reached and proposed by Keynes, which is that of an expansionary fiscal policy.

However, the problem raised by Krugman (1998) still holds, how can developed economies raise their public spending in the current situation, where their debt levels are already very high?

This question will be answered in the conclusion.

2.3 The liquidity trap in the Euro area

The Euro area was not hit as heavily as the US by the 2007 financial crisis. In fact, European commercial banks were not as exposed as the US ones to the mortgage-backed securities. These were the real causes of the crisis, which lead to bank failures and a strong recession. Nevertheless, it had some effects on the already fragile European economy, that lead to the so-called sovereign debt crisis. Portugal, Ireland, Italy, Greece, Spain[73], and Cyprus faced large problems in placing their debt on the market since 2009. When the new Greek government found out that the previous balance sheet was manipulated, and their actual deficit was much larger than declared. For different reasons, all of the above countries faced the same issue. Investors believed their debt not to be sustainable anymore and this reflected in higher spreads[74]. The problem was that these countries couldn't support their economies (that were facing a recession due to the financial crisis) anymore due to some restrictions from the European Council. This caused the GDP to decline resulting in impacting the sustainability

[72] "The Liquidity Trap: An Alternative Explanation for Today's Low Inflation", page 11.

[73] Those four large European economies were named PIIGS in this period due to their fragile balance sheet and the fact that investors believed the public debt of those economies not to be sustainable.

[74] The spread is a measure of risk premium. It is the difference between the interest rates on the 10-years government bond of an economy compared to the same bond in terms of maturity of a benchmark, that in the case of the Euro area is Germany.

of the debt. As a matter of fact, the Euro area fell in a vicious circle that only the intervention of the European Central Bank was able to break, with the "Outright Monetary Policy" (OMT). This program established that the ECB was ready to buy government bonds of Euro area economies in case of necessity.

This move by the Governing Council was not made to solve the European problem nor their intention was that of utilizing such program. It was made to have investors stop betting against the euro, based on the assumption that, if they did, they would have bet against the ECB, which is highly unlikely. Consequently, the program was created to break the vicious circle and gain time to think of a permanent solution to the crisis.

By 2012, the policy interest rates in the Euro area reached the zero lower bound and moved to negative values since 2014. In 2015, the ECB launched the so-called "Asset Purchase Program" (APP, which is the European name given to the quantitative easing). A sort of quantitative easing was already implemented by the ECB (the "Security Market Program") although not with the intensity and scale of this new program. The APP continued with different intensities throughout all those years. In 2018, it was stopped for a while as the economy seemed to be responding well but was restarted one year later due to the worsening of the economic outlook.

With the Pandemic crisis of March 2020, the ECB launched a new very large quantitative easing, specifically designed for the pandemic and called "Pandemic Emergency Purchase Program" (PEPP).[75]

2.4 Empirical evidence of a liquidity trap in the US and the Euro area

This section will analyze, based on empirical evidence, how the two economies have responded to expansionary unconventional monetary policy (the quantitative easing in particular).

Starting from the US economy, there are different studies that reaching diverse conclusions on the matter.

Caggiano, Castelnuovo, Damette, Parent, and Pellegrino (2018) conducted an interesting study with the aim of identifying through a non-linear Threshold-VAR the response of a range of interest rates to money supply shocks, both under normal and speculative times. This study was conducted using

[75] It is important to say that the APP and later on the PEPP were not the only monetary policies in place in those years but, as we have seen although not in detail, there were also credit easing and forward guidance policies. We focus only on the APP and the PEPP because those were the actual quantitative easing tools employed.

two samples' data. The first referring to the Great Depression, while the second was conducted using data from the Great Recession.
Results conditional to the Great Depression show how:

> "Impulse responses associated to speculative period point to insignificant reactions of all interest rates we consider to a money supply shock. Differently, such responses are all negative and significant when normal times state is considered."[76]

The results, conditional to the Great Depression, from the non-linear Threshold-VAR model show how interest rates responded negatively to increases in money supply during normal times. This implies that, the increase in money supply did work in transmitting the monetary policy stance through the interest rate channel.
On the other hand, if speculative times are considered, the interest rates response to money supply shocks are insignificant. This means that an expansionary monetary policy of that kind does not work through the interest rate channel under speculative conditions. Note that this is consistent with a Keynesian liquidity trap under which uncertainty is the main driver of the liquidity trap. This does not allow injections of liquidity to have positive effects on the economy.
The second sample used is that of the Great Recession. Furthermore, the model was run in two different periods ergo, under normal and speculative times.
With respect to the previous sample utilized, the transmission mechanism linking monetary policies instruments to long-term rates is likely to have changed. "[…] The modeling structure employed to identify liquidity shocks with observations related to the Great Depression turns out to produce dynamic responses that are difficult to interpret via the lens of standard book monetary policy models."[77] Consequently, they adopted a different approach focusing on prices (the federal funds rate) rather than on quantities (M2) which led to clearer results confirming the presence of a Keynesian liquidity trap (thus in speculative times only).
An important facet the authors used in this second analysis is that of the so-called "Divisa M2" as a measure of the stock of money. Barnet (1980) highlighted the problem, in modern times, of using M2 as the measure of the stock of money[78]. This is because, M2 does not take into account the fact that agents have access to different liquid assets bearing different yields and with different abilities to

[76] "Liquidity Trap and Large-Scale Financial Crises", page 21.

[77] IBID, page 21.

[78] "Liquidity Trap and Large-Scale Financial Crises".

facilitate transactions (thus being imperfect substitutes). Divisa M2 helps identify monetary policy shocks even when the federal fund rate is present.

On the other hand, Debortoli, Gali, and Gambetti (2019) shows that US macroeconomic dynamics remain unchanged at the effective lower bound.

Additionally, Luhissier, Mojon and Jubio-Ramirez (2020), tests whether monetary policies remain effective in a low interest rate environment both for US, the Euro area and Japan, reaching similar results. This study distinguishes two periods, effective lower bound (ELB) times[79], and normal times[80].

For the Euro area the specific dates taken into account are mid-2012 to end-2018 for ELB times, and January 1999 to mid-2012 for normal times. The result reached from this research for the Euro area is that economic responses of economic variables (such as industrial production and prices) to monetary policy shocks, remain positive in both the circumstances analyzed. However, there is also evidence of the fact that the median response is much higher in normal times that it is in ELB times. The same conclusion was also reached for the US and Japan.

[79] ELB times refers to when the short-term rates have reached the effective lower bound.

[80] Normal times refers to when the interest rates fluctuate normally in positive territories.

Conclusion

To conclude, there is empirical evidence that shows that quantitative easing either do not work or have limited impact on macroeconomic variables when the zero-lower bound is reached. This seems to provide proof of the fact that the liquidity trap, as theorized by Keynes and further developed and readapted to modern days by other economists, actually exists.

With the outbreak of the 2020 COVID-19 pandemic, the various most developed central banks (this paper focused on the US and the Euro area situation specifically) have adopted highly expansionary unconventional monetary policies to support the economy. Why did they do so if these economies seem to be stuck in a liquidity trap thus, these policies are expected to have little or no impact on transmitting the monetary policy stance to the economy?

Different reasons may be valid to explain the choice. Certainly, even if quantitative easing has minor effect on macroeconomic variables, it still helps sustain the economy. Another reason to explain such choice is that of trying to break the liquidity trap the way Krugman proposed, therefore having investors and firms expect future inflation. In this way deflationary expectations are broken. Bear in mind that if people expect higher inflation, the cash will lose value and individuals will rebalance their portfolios moving towards securities. Moreover, higher expected inflation means that price level is expected to grow. This may lead to a bullish behavior of investors. However, this has to be supported by the credibility of the central bank in stating that it will continue with these expansionary policies until the economic outlook is good enough to state that the recovery is over. In any case it will take time. This is being done through forward guidance by central banks. The ECB has a mandate that allows some room in this sense, since it has the objective of keeping the inflation rate close but below 2%, to be achieved in the medium term. Since this is a vague indication on the time horizon, the ECB can be credibly "irresponsible" (to use Krugman's words) and allow the inflation to be higher than the target for some time.

The Fed has always acted promptly in changing its monetary policy stance to fight inflation when it got higher than the targeted 2%. However, in 2020, the Fed Chair Jerome Powell had to review the dual mandate, due to the fact that "natural" interest rates (federal fund rate) seem to have fallen. Resulting in being very close to the effective lower bound. The mandate now allows the Fed to target the 2% inflation rate in the long-run, and it was stated that the targeted inflation rate is an average of the annual inflation rates. Thus, following periods of very low inflation (such as the one currently facing) there can be periods in which inflation rate is higher than the 2% target. It is worth mentioning the similarity with the ECB mandate in regards of inflation objectives.

Another reason is related to Keynes's proposal of a solution to exit the liquidity trap, on which Krugman agreed[81] and that fades into the reason just discussed. It is that of having an increase in public expenditures by the government, thus making use of expansionary fiscal policies. But how is a quantitative easing related to fiscal policies?

This reintroduces the problem raised by Krugman, which is that the governments already have large debt stocks. Therefore, further rises with increased public expenditures could lead to another sovereign debt crisis, due to the unsustainability of the debt of the various countries. An interesting paper by Benigno, Canofari, Di Bartolomeo, and Messori (2021) assesses the impact of ECB's monetary policies implemented to face the pandemic emergency. After the President of the ECB Christine Lagarde on 12 March 2020, a few days after the pandemic outbreak, declared that it was not in the mandate of the ECB to sustain the European countries' debt stock. Further stating that no strengthening of the current policies were disposed. The spread among European economies increased, signaling some tensions in the debt market, and investors fear of a possible new debt crisis. Only after few days, the 18 March 2020, the ECB made a big step back with respect to the declaration made on the 12 March, and implemented strong pandemic specific policies, including a big quantitative easing program[82]. This resulted in a big decrease in the spread, which signals the importance of the unconventional expansionary monetary policy implemented. Italy's public debt to GDP ratio was increased by almost 25 percentage points with no tensions on the market.

The monetary policy was put to the service of fiscal policy expansion both in the Euro area and in the US, that are now up to launch ultra-expansionary fiscal policies packages.

On the 11th of March 2021, after the 117th US Congress passed it, US President Joe Biden signed the American Rescue Plan Act 2021, a $1.9 trillion bill of fiscal stimulus. This represents an incredibly strong expansionary fiscal policy, that amounts to around 8.6% of the current US GDP.

On the 21st July 2020, the European Council approved the so-called Next Generation EU, which is a €750 billion recovery fund package, that will operate from 2021 to 2023. Due to the different structure of the European union[83], the fiscal stimulus is not as large as the US one. In any case, it presents some important characteristics and novelties for the EU, from the fact that the fund will be raised through

[81] Recall that Krugman raised some problems concerning increase in public expenditure due to the fact that we can't know how long this will have to last to break the liquidity trap, and thus it may lead to too large government debt of the various countries adopting such strategy.

[82] The "Pandemic Emergency Purchase Program", also referred to as PEPP, is the pandemic specific quantitative easing measure implemented by the ECB the 18th of March 2020.

[83] The EU is composed by 27 countries with different political views, that has often led to some stalemate in centralized fiscal intervention and in the development of the economic governance of the union.

European bonds, to the fact that it is the first centralized fiscal policy of that large nature. Furthermore, the allocation of the fund won't be determined only according to the GDP of the economies, but also according to the asymmetric impact of the pandemic shock, and to the pre-existing fragilities. The Next Generation EU amounts to around 4.9% of the EU GDP.

These strong expansionary fiscal policies are expected to reduce individuals' fear of the future condition, whilst raising the inflation expectations of investors and "have the ball start rolling". In current days the US inflation rate has reached the maximum level of the past 13 years of 4.1% (annualized). This is expected to allow both the US and the Euro area to finally break and exit the liquidity trap.

The future problem will be the exit from such an extremely strong expansionary monetary policies, which can't be done all together. For this reason, a long exit process will most likely be needed.

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