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Kehrwald, Bernie

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THE EXCESS DEMAND THEORY OF MONEY

BERNIE KEHRWALD*

July 2014**

Abstract

This paper introduces a new monetary theory that is compatible with the Keynesian liquidity preference theory, the neoclassical loanable funds theory and the Post Keynesian endogenous money theory. It is very suitable for introductory textbooks since it gives a correct understanding of modern monetary systems. It can further be used to explain a series of phenomena.

Keywords: money, interest rate, liquidity preference, loanable funds, endogenous money
JEL classification: E40, E50, E51

1 Introduction

One of the most important prices in a market economy is the interest rate. However, there is no generally accepted theory of how the interest rate is determined. The Keynesian liquidity preference theory claims that the interest rate brings together the demand for liquidity and the money supply set by the central bank. The neoclassical loanable funds theory, on the contrary, suggests that the interest rate is the equilibrium price of capital, and hence determined by capital supply (savings) and capital demand (investments). The Post Keynesian endogenous money theory states that the interest rate is set exogenously by the central bank, i.e. that it is not determined by economic processes.

The contribution of this paper is twofold: First and most important, it introduces a model that can reconcile all three theories. Thereby, it brings together not only different streams of literature, but different schools of economic thought. Secondly, the provided model introduces a modern monetary system to the standard theory.

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* University of Munich/University of Bologna, email: bernie@kehrwald.com
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This is very useful for economic textbooks, since the model provides a correct understanding of modern monetary systems and how monetary policy works in a simple way. As the Bank of England (2014) points out, most textbook models are not suitable for this task, since they describe how modern monetary systems work inaccurately.

In this approach to monetary economics, the credit market is put to the center of the analysis, since credits are essential in modern monetary systems. The amount of money is defined as the excess demand for credits. It will therefore be called the excess demand theory of money.

The remainder of the paper is structured as follows: Section 2 introduces the excess demand theory of money. Section 3 shows how it is related to the liquidity preference theory, the loanable funds theory and the endogenous money theory, and how it can be embedded into economic textbooks. Section 4 introduces a modern monetary system to the model. Section 5 shows some applications. Section 6 concludes.

2 The Model

In this section, the new approach will be presented that has not been applied elsewhere to the best of my knowledge.

Imagine a closed economy with a central bank (CB) that undertakes refinancing operations with private banks at the beginning of a period. It gives any amount of credits to banks that are willing to pay a certain interest rate (full allotment). Each refinancing credit has to be paid back at the end of the period. Also, all other credit contracts in the economy are concluded at the beginning of the period with a lending term of one period. There is no money at the very beginning of the period. Assume for now that all money is cash.

There is a demand for credits, Cr^D, by the public that depends negatively on the interest rate, i. This is because more investment projects are profitable at a lower interest rate and more credits will be taken to finance investments if the interest rate falls. The demanders borrow the preferred amount of money from the private banks at the beginning of the period and spend it. The private banks have to borrow that amount from the CB, which creates the money. It then circulates unless someone brings it to a bank to place funds.

In addition, there is a credit supply, Cr^S, by the public. It is defined as the amount that the public wants to save for future consumption via credits to banks.[1] It depends positively on the interest rate. The rationale for this is that people want to save more money instead of spending it, if they get more interest for saving, given that income is constant. The savers produce goods and get paid for that at the beginning of the period. Directly after, they lend the amount of money that they want to save to the private banks. The private banks lend that amount to the CB. Thus, it cannot be used for transactions during the period, and it is not included in the amount of money.

The private banking sector is perfectly competitive and its only costs are the interest payments for the refinancing credits. The CB and the private banks have perfect information and there is no possibility of default.

The CB's task is to achieve an exogenous inflation target. It is assumed that there is an amount of money, M, that causes an inflation rate at its target. Hence, the CB achieves the

[1] Usually, the credit supply is defined as the amount of money that *banks* are willing to lend at a given interest rate. With the usual definition, however, one cannot make the link between savers and investors through the credit market, which is what this paper does.

target inflation rate by ensuring that the amount of money, M, circulates in the economy.[2] In general, a lower amount of money would lead to an inflation rate below the target, and a higher amount of money would cause an inflation rate above the target. In order to achieve its task, the CB can set the interest rate, i^{CB}, that the private banks have to pay for refinancing credits and that the private banks obtain if they lend money to the CB.

Further, the inflation expectations are fixed at the inflation target.

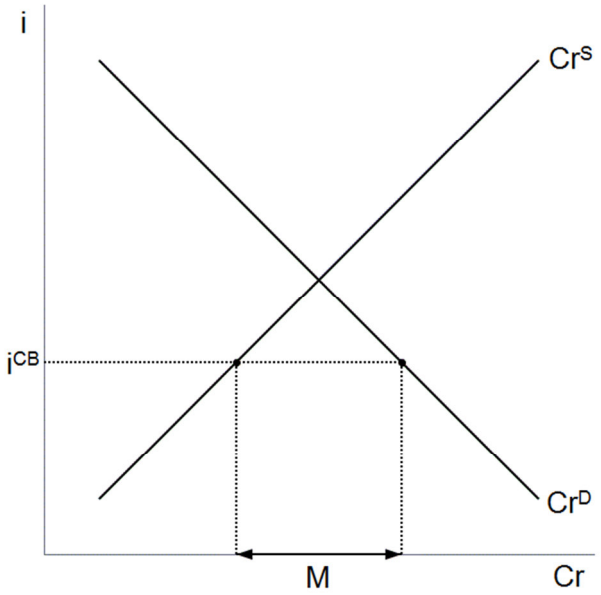
The timing is as follows:

1) At the beginning of the period, the CB sets the interest rate, i^{CB}.
2) Directly after, the demanders for credits borrow the amount Cr^D from the private banks and spend it. The private banks borrow that amount from the CB.
3) After some transactions, but still at the beginning of the period, the suppliers for credits lend the amount Cr^S to the private banks. The private banks lend it to the CB afterwards.
4) During the period, the amount of money in circulation determines the inflation rate.

Note that because of the idealized banking sector, the resulting market interest rate will be i^{CB} as well. If it was different, banks would make losses or there would be possibilities for arbitrage that drive the market interest rate back to i^{CB} immediately.

What interest rate does the CB set? If it sets the market-clearing interest rate at which Cr^D and Cr^S are equal, all the money that is borrowed by the public at the beginning of the period would be brought back to the banking sector immediately. No money would be available for transactions during the period and prices would fall. That is why the CB sets a *lower* interest rate. In particular, it sets an interest rate, i^{CB}, such that the *excess demand* for credits, $Cr^D - Cr^S$, equals the preferred amount of money, M, in circulation (figure 1).

Figure 1)

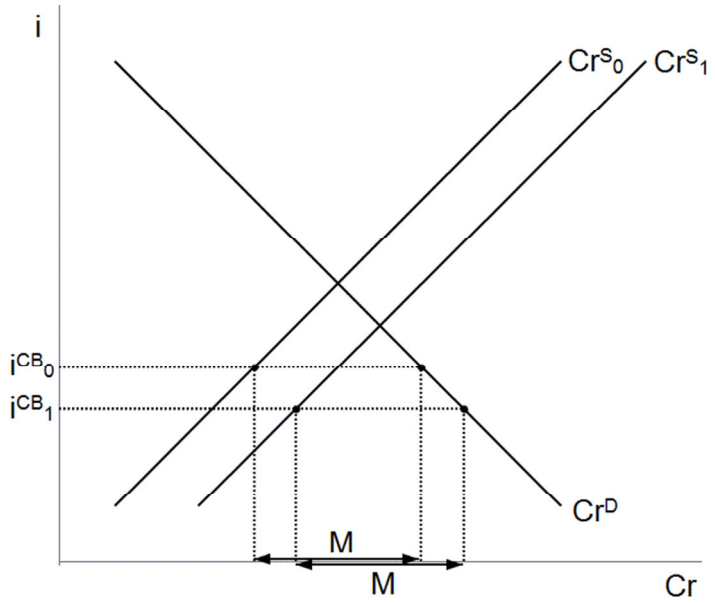


Note that this does not imply that the credit market is in disequilibrium, since the CB creates and lends out the amount of money for the credit demand that is not covered by credit supply.

[2] Note that in contrast to the usual definition, the amount of money, M, includes only money that circulates in the economy. The private banks' claims against the CB (reserves) are not included.

The model can explain how a different situation on the credit market causes a change in the interest rate: Consider an economy that was in equilibrium in the previous period, i.e. the interest rate $i^{CB}{}_0$ caused an amount of money that kept the inflation rate at its target. Then, imagine, for example, that the credit supply increases because people want to save more at a given interest rate, other things being equal. The Cr^S curve shifts to the right, from $Cr^S{}_0$ to $Cr^S{}_1$ in figure 2. With the same interest rate as before, this would lead to a decline in the amount of money. To keep the amount of money constant at quantity *M*, the CB has to *lower* the interest rate from $i^{CB}{}_0$ to $i^{CB}{}_1$. That way the inflation target will be achieved. The higher investment demand and the higher demand for consumer goods, caused by the lower interest rate, have to compensate for the general lower demand for consumer goods due to the original rise in planned savings. This results in an equilibrium with a lower interest rate, higher investments and an unchanged level of income.

Figure 2)



However, in the short term, the assumption of a constant level of income is very unlikely to hold. In fact, the economy will probably have to go through a slump, with lower income, if planned savings rise. The lower income lasts for the time (1) the CB has not yet recognized the situation and has not lowered the interest rate and (2) production has not shifted from consumer goods to investment goods. If people who were working in the production of consumer goods are dismissed, they will be unemployed with little or no income until they find a job in the production of investment goods.

However, in the medium term the economy will get back to its potential output since the CB stimulates demand via the lower interest rate. Hence, the assumption of a constant level of income is reasonable if the model is interpreted as a *medium-term* model.

Finally, it is important to note that investments also depend on the expected level of future income. It is thus crucial that the firms know that the low level of income is only temporary in order to reach the new equilibrium.

3 Comparison to the Traditional Theories

In this section, it will be outlined how the new model is connected to three existing theories: the Keynesian liquidity preference theory (LPT), the neoclassical loanable funds theory (LFT), and the Post Keynesian endogenous money theory (EMT). Keynes (1937a,

p. 241) initially believed that the LPT and the LFT are "radically opposed to one another." In contrast, there have been several attempts to show that they are basically the same, only adopting a different point of view, e.g. by Robertson (1937[3], 1938), Lerner (1938), Fellner and Somers (1941), Johnson (1951), Tsiang (1956, 1980), Ackley (1957), Patinkin (1958), Foley (1975) and Snippe (1985).

This section confirms those papers' view by showing that the new theory, the excess demand theory of money (EDTM), is identical with both the LPT and the LFT under certain assumptions, and that it can be seen as the "bridge" between the two. Furthermore, it will be argued that the new model is similar even to the EMT, the theory which is generally seen as being fundamentally different than the other ones. Finally, it will be shown how the EDTM can be incorporated into economic textbooks.

3.1 Liquidity Preference Theory

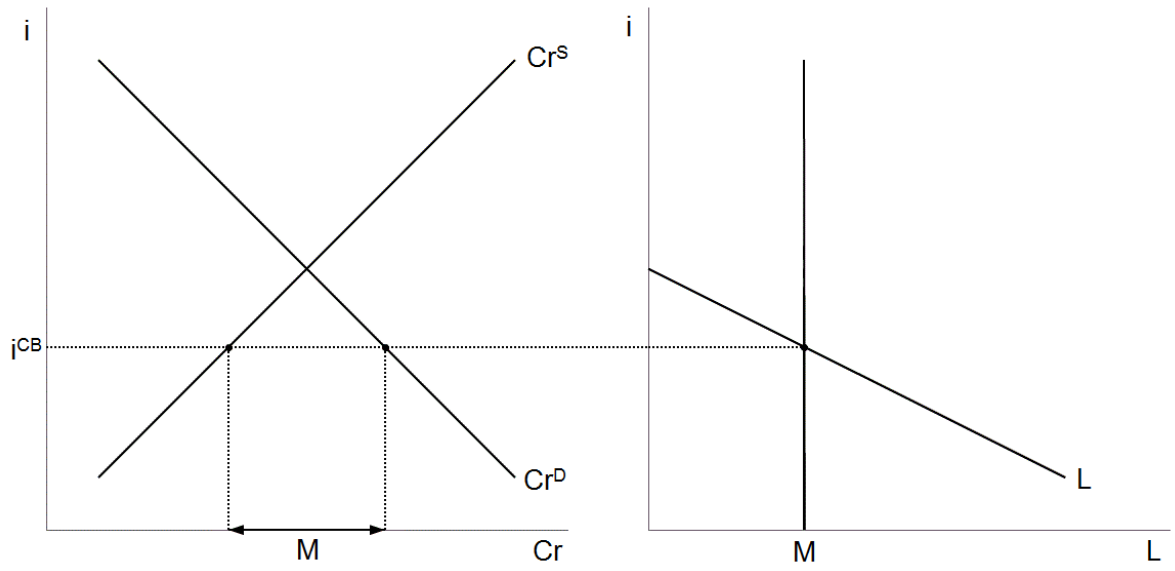
The LPT is the Keynesian theory of the interest rate. It was introduced in Keynes' *General Theory* (1936). In the LPT framework, it is assumed that there is a demand for money, or alternatively, a demand for liquidity, L, by the public that depends negatively on the interest rate, i.

The interest rate is determined by a market where the liquidity demand, L, meets the supply of money, M, set by the central bank. Alternatively, if it is assumed that the CB sets the interest rate, the amount of money is determined by the corresponding liquidity demand.

In the EDTM, the amount of money that is "demanded" by the public—and thus the correspondent liquidity demand—is the amount of money that is borrowed from the banking sector minus the amount of money that is lent to the banking sector: the excess demand for credits.

With the assumption that the LPT's liquidity demand, L, is equal to the EDTM's excess demand for credits, $Cr^D - Cr^S$, it is easy to see how the two theories are connected (figure 3).

Figure 3)



[3] in: Ohlin, Robertson and Hawtrey (1937), pp. 428–436.

The difference between the LPT, as described in the *General Theory*, and the EDTM is the rationale behind the liquidity demand curve. Keynes (1936, p. 167) argued that there is a trade-off between holding money and holding bonds. The advantage of money is that it can be used for transactions, i.e. that it is liquid. On the other hand, money does not bear interest. Bonds have the opposite properties: They bear interest but they are not liquid.

Therefore, the amount of money, that the public wishes to hold—the liquidity demand—is a decreasing function of the interest rate on bonds: If the interest rate on bonds—which is the opportunity cost of holding money—rises, people want to lower the amount of money in their portfolio and shift to bonds instead. In equilibrium, the interest rate on bonds has to take the value that balances the demand for liquidity and the money supply set by the CB. In other words, Keynes interpreted the interest rate as a *liquidity premium*.

As Stiglitz and Greenwald (2003, pp. 11ff.) show, this view is not accurate for the monetary systems of modern economies. Today, interest-bearing government bonds can essentially be used to conduct transactions. This means that they are perfectly liquid and can be seen as "money." Therefore, the trade-off between having either an interest-bearing bond or money does not exist any longer.[4]

In the EDTM, the rationale behind the liquidity demand and its dependence on the interest rate is different: Liquidity (money) is created when credits are taken to finance investments. Further, liquidity is "destroyed," when people save and thereby take liquidity out of the system. When the interest rate falls, more credit-financed investments are undertaken, which means that more liquidity is created. Further, a lower amount of liquidity is saved and therefore less liquidity is taken out of circulation.

Keynes (1937a) later admitted in his reply to Ohlin's criticism (1937a, 1937b) that the amount of planned investments affects the amount of the liquidity demand from the need to finance investments. Keynes wrote shortly after (1937b, p. 667): "I should not have previously overlooked this point, since it is the coping-stone of the [LPT]." Hence, Keynes moved towards the alternative interpretation of the liquidity demand.

Tsiang (1980, pp. 467f.) stated that Keynes' confession would "completely erode away" the *General Theory*'s "revolutionary stand" concerning monetary theory. In fact, a different interpretation of the liquidity demand makes it possible to reconcile the LPT with other interest rate theories.

To sum up, the LPT and the EDTM can be reconciled, if the interpretation of the liquidity demand is changed with respect to Keynes' *General Theory*. It has to be assumed that the liquidity demand is the amount of money that is created minus the amount of money that is "destroyed."

3.2 Loanable Funds Theory

The LFT is the neoclassical theory of how the interest rate is determined. It is assumed that there is a demand for loanable funds, or alternatively a demand for investments, I, that depends negatively on the interest rate, i.[5] That is because more investment projects are

[4] Of course, there still exist illiquid bonds which bear a liquidity premium. However, CBs generally conduct their monetary policy only through the interest rate on highly liquid bonds (e.g. T-bills) and therefore leave liquidity premia unchanged.

[5] For simplicity, there will be no distinction between the nominal and the real interest rate in this section. Assume therefore, that the inflation target is zero.

profitable and more will be undertaken the lower the interest rate is. It is further assumed that there is a supply of loanable funds, or a supply of savings, S, that depends positively on the interest rate. The higher the interest rate, the more people want to shift consumption to the future and consume less today.

Both planned investments and planned savings meet at a market, the market for loanable funds, where the equilibrium amount of investments, I^*, and the equilibrium amount of savings, S^*, are found by the interest rate, which equals i^* in equilibrium.

It will be shown that the LFT can be transformed into the EDTM if a certain behavior of the CB is assumed. To do that, a series of additional assumptions must be made.

First, the focus will be on investments.

In general, investments can be financed either with credits or with equity. In the following, all investments are treated as if they were financed with credits. This is possible since equity can be seen as a credit of the household, firm or government *to itself*, similar to Ohlin (1937b, p. 224).

Further, it is assumed that all credits are used to finance investments.

With these assumptions all investments are financed with credits, and all credits finance investments. Hence, the investment demand is equal to the credit demand—the LFT's I curve is identical to the EDTM's Cr^D curve.

Now, savings will be analyzed.

There are two kinds of saving.

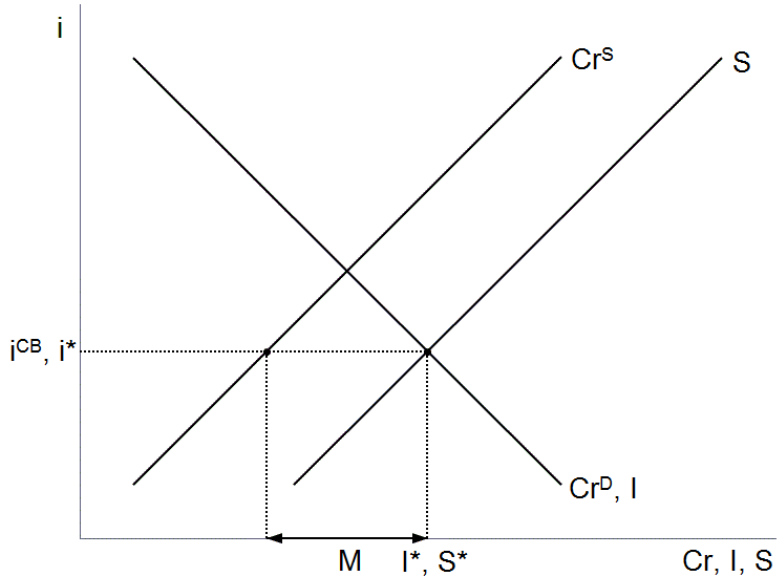
First, there is a conscious act of saving, which can take two forms. The first form is when households, firms or governments give credits to banks. This form of saving is the standard case of credit supply and is included in the Cr^S curve. The second form of conscious saving is financing investments with equity. This is also included in the credit supply, since saving done with equity is treated as a credit to the household, firm or government itself.

In addition, there is an unconscious act of saving, namely the possession of money. If a certain amount of money is being passed around every few days in order to pay for goods, everyone involved has been saving from the time he or she got the money until the time he or she bought something for it. Hence, unconscious saving is equal to the amount of money in the economy, because every coin or bank note is owned by someone who is unconsciously saving that amount for the time he or she has it. The character of money as a means of saving becomes even clearer in the case of bank deposits that will be introduced to the EDTM later. Bank deposits are used to conduct transactions, hence they are included in the amount of money, and in addition they are bearing interest.

To get the overall amount of savings one has to add conscious and unconscious savings, that is the credit supply and the amount of money. The LFT's S curve is equal to the EDTM's Cr^S curve plus the amount of money, M.

With all these assumptions, the LFT can be transformed into the EDTM, as it is shown in figure 4.

Figure 4)



However, the process in which equilibrium is reached in the LFT is different from the process in the EDTM. In the LFT, it is solely the market forces that drive the interest rate towards its equilibrium level. Further, there is no money. The LFT was derived thinking of a barter economy, where goods are traded against goods directly, and goods are lent and borrowed.

The results from the LFT are generally used to analyze monetary economies. This step is implicitly justified with the neoclassical result of the "neutrality of money," which states that money affects only prices, but not real measures like savings, investments or the (real) interest rate. Recent papers like Bertocco (2013) and Lindner (2013) argue that the insights from the LFT cannot be transferred to monetary economies. Also, Bibow (2000, 2001) and Hayes (2010) argue that the LFT is flawed and should be abandoned.

The EDTM can be seen as the specification of the LFT for a monetary economy, and it can partially disprove this criticism. The EDTM clarifies how savings and investments are balanced in a monetary economy, and how the market forces drive the interest rate towards its equilibrium level with a present CB.

A change in planned savings or planned investments would cause a deviation of the inflation rate from the target if the CB does not change the interest rate. Hence, the market "forces" the CB to change the interest rate in order to achieve the inflation target. A rise in planned savings, for example, would lead to an inflation rate lower than the target if the CB does not lower the interest rate. So the CB must intervene, and there will be more investments in the new equilibrium at a lower interest rate.

An alternative way of describing the CB's task is to adjust the interest rate on money to the "normal" rate of interest that was described by Wicksell (1907) and is determined by capital supply and capital demand.

The EDTM shows the conditions that have to be fulfilled for the "neutrality of money" to hold: The CB has to adjust the interest rate endogenously in a way that a certain inflation target is achieved. Then, the existence of money does not alter the fundamental mechanisms of the capital market—i.e. the determination of savings, investments and the real interest rate—in the medium term.

If the CB sets the interest rate higher, however, the economy might fall into a deflationary slump, which depresses output in the medium and long term. Instead, if the interest rate is set lower, soaring inflation, or even hyperinflation, can disturb the price mechanisms and cause serious damage for the economy in the medium and long term. In these cases, money is not neutral—not even in the long term.

Keynes criticized the LFT in the *General Theory* (1936, p. 177) because he doubted that the described mechanism "is a self-regulatory process of adjustment which takes place without the necessity for any special intervention or grandmotherly care on the part of the monetary authority." The EDTM proves him right. In a monetary economy, the process described by the LFT implies a certain behavior of the monetary authority, the CB. Gestrich (1944, p. 89f.) described this somewhat strange insight: In a monetary market economy there has to be a central authority to ensure that the capital market is working properly.

Apart from his criticism concerning the absence of a monetary authority, Keynes (1936, p. 179) criticized the LFT sharply due to a possible change in income:

> "The [LFT] seems to suppose that, if the demand curve for capital shifts or if the curve relating the rate of interest to the amounts saved out of a given income shifts or if both these shift, the new rate of interest will be given by the point of intersection of the new positions of the two curves. But this is a nonsense theory. For the assumption that income is constant is inconsistent with the assumption that these two curves can shift independently of one another. If either of them shift, then, in general, income will change; with the result that the whole schematism based on the assumption of a given income breaks down."

The criticism is based on Keynes' understanding of the LFT as a *short-term* theory. Indeed, in the short term, income will very likely change as a result of a different situation on the capital market. If you interpret the LFT as a *medium-term* theory instead—like the EDTM—the assumption of a constant level of income becomes reasonable.

Keynes was well aware of that point in the *General Theory* when criticizing the LFT and stated (p. 180): "at the best it would be plausible only in relation to long-period equilibrium and could not form the basis of a short-period theory."

In addition, Keynes' criticism of the LFT concerning income also applies to his own theory, as Hansen (1951) noticed.

In the case of Keynes' LPT, the liquidity demand, L, that determines the interest rate, depends on the level of income, and the level of income depends on the interest rate. That makes it impossible to think about the determination of the interest rate without thinking about income in a short-term analysis.

In fact, Hicks (1937) used the dependence between income and the interest rate in both theories to derive a short-term theory: the famous IS-LM model. With one equation from each theory (I=S and L=M) and two unknowns (interest rate and income), one can solve for both variables.

One problem with the IS-LM model is that it uses the flawed interpretation of the LPT. Another one is that the amount of money is assumed to be constant in the short term, which is not reasonable. A better approach for a short-term theory is to keep the interest rate fixed, and

treat the amount of money as endogenous, which leads towards the endogenous money theory.

3.3 Endogenous Money Theory

The EMT is the Post Keynesian monetary theory. There are two specifications of that theory: the original "horizontalist" approach and the more advanced "structuralist" approach. In the following, the horizontalist approach, put forward by Moore (1988), will be described and it will be shown that it is very similar to the EDTM.

The EMT assumes that there is a credit demand by the public, Cr^D, that depends negatively on the interest rate—similar to the EDTM. Further, there is a credit supply function. It is *not* defined as the credit supply by the public. Instead, it is defined as the amount of credits that the *banks* are willing to grant at a given interest rate. It will be denoted with Cr^S*. The credit supply is perfectly elastic at an interest rate which exceeds the CB rate by an exogenous mark-up, m.

The intersection of Cr^D and Cr^S* defines the equilibrium on the credit market—i.e. the equilibrium interest rate and the equilibrium amount of credit. The amount of credit is equal to the amount of money, $M*$ (net of reserves).

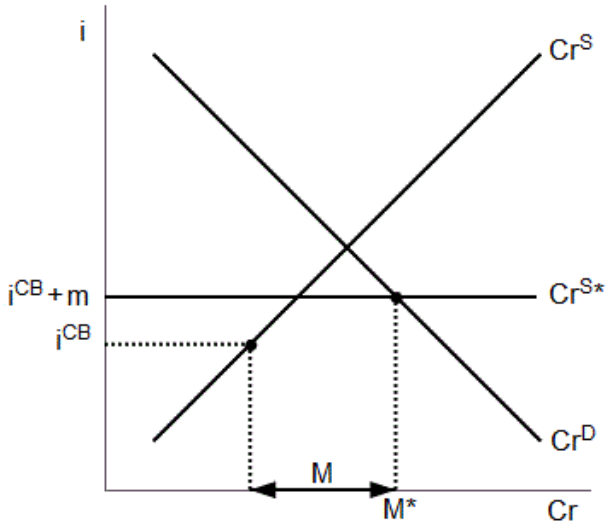
In many respects, the EDTM and the EMT are very similar. They both stress the crucial role of bank credits for money creation and therefore the endogenous nature of money; they incorporate the fact that bank credits create deposits—not vice versa; and they illustrate the insight that investments are necessary in order for people to be able to save.

Nevertheless, the two theories are not identical. In the following, the differences will be shown, and how they can be reconciled.

In the basic EDTM, there is no interest rate mark-up, since it is assumed that (1) there are no costs associated with banking, (2) there are no default risks, and (3) the banking sector is perfectly competitive. Relaxing any of these assumptions leads to a lending rate above the CB rate, and hence a mark-up. Thus, it is a useful extension to the EDTM to introduce a mark-up, m, that the banks charge on top of the CB rate for giving credits.

Figure 5 depicts the EDTM with a mark-up. Further, the relevant EMT curves are plotted (similar to the first quadrant in Pallay, 2013, p. 12).

Figure 5)



There is an obvious difference between the two theories: In the EMT, the amount of money, M^*, is equal to the full demand for credits. In the EDTM, instead, the amount of money, M, is equal to the credit demand *minus credit supply*—the excess demand for credits.

Since longer-term claims against banks cannot be used to conduct transactions, they should not be included in the amount of money. In that respect, the EDTM is superior to the EMT. Introducing a credit supply by the public, analogous to the EDTM's credit supply—which must not be confused with the credit supply by the *banks*—would be a good refinement to the EMT. With that refinement, the EMT and the EDTM are almost equivalent.

A minor difference is that the EDTM goes a step further than the EMT by making the CB's decision, how to set the CB rate, endogenous—whereas it is exogenous in the EMT. This is due to the different time horizons of the models. If one wants to analyze the short term, it makes sense to leave the CB rate exogenous. For a medium-term analysis, instead, the CB rate should be made endogenous.

To conclude, the EDTM can be reconciled with the EMT if one makes a refinement to each of the theories. The EDTM has to be extended by an interest rate mark-up; the EMT has to be extended by a supply of longer-term credits by the public.

3.4 Integrating the New Model into Economic Textbooks

Naples and Aslanbeigui (1996) examined which interest theories are used in introductory textbooks. They found that in most textbooks the LPT and the LFT are used parallel to each other. The LPT is used in general as a short-term model, the LFT as a long-term model. However, the connections between the two theories are not well understood, which leads to inconsistencies. The authors conclude that the result is a "confused, self-contradictory, and often incomplete whole" (p. 69).

This problem of textbooks still remains. One way to change the textbooks would be to replace the LPT by the EDTM. This would make it possible to describe an economy without a CB first, when introducing the goods market, savings and investments using the LFT. Later, when introducing money and a CB, it makes sense to directly introduce the EDTM. By doing so, the connection from savings and investments to the credit market and a CB can directly be made clear.

4 Introduction of a Fractional Reserve Banking System

Another problem with the current textbooks is that they generally describe the monetary system differently than as it works in reality, as the Bank of England (2014) points out.

In the monetary systems in place today, money consists mainly of bank deposits, which are created by private banks when they give credits. However, many textbooks state that banks can lend out money only after they receive deposits, which is de facto wrong. Further, they incorrectly describe the CB as fixing the amount of base money, which gets "multiplied up" by a constant factor into the overall amount of money.

The EDTM can help to overcome these flaws, since it is possible to introduce a fractional reserve system, which is the system in place in most countries worldwide.

The assumption that all of the transactions in the economy are conducted with cash will be relaxed. Instead, it is assumed that only the share, c, of the money in circulation is cash, with $0 \leq c \leq 1$. The other share, $1-c$, are bank deposits bearing interest. It is further assumed that the private banks create money by giving credits to the public. Further, there is a minimum reserve requirement for the deposits that banks have during the period: Each private bank has to lend an amount of θ times the deposits it receives to the CB, with $0 < \theta \leq 1$. The CB pays the interest rate i^{CB} for the minimum reserve.

The timing becomes the following:

1) At the beginning of the period, the CB sets the interest rate, i^{CB}, on base money, which it can create.
2) The amount Cr^D is created by the banking sector and lent out to the public. The private banks have to borrow the amount of demanded cash, cM, from the CB, which creates it. The rest, $Cr^D - cM$, is created as deposits by the private banks themselves by granting credits.
3) Still at the beginning of the period, the public uses the amount Cr^S of the deposits to give credits to the private banks. Thereby deposits are swapped into longer-term claims with a lending term of one period.[6] The longer-term claims are not considered as money. The remaining amount of deposits, $(1-c)M$, will be used to conduct transactions during the period. The private banks' minimum reserve requirement becomes $\theta(1-c)M$, which they have to borrow from the CB in addition to the amount of cash, cM. The banks lend the necessary minimum reserve to the CB.
4) During the period, the inflation rate is determined by the amount of money in circulation, M, consisting of the amount of cash, cM, that physically circulates in the economy, and the amount of deposits, $(1-c)M$, that circulates from one account to another.

In the following, it will be shown that the equilibrium interest rate for credits and deposits is equal to the interest rate that the CB sets.

First, consider the market for deposits.

If the market interest rate for deposits was lower than i^{CB}, it would be profitable for a bank to pay a little more than the market interest rate on deposits. That way, the bank can attract deposits from other banks which have to compensate the bank for that with base money. Since base money brings i^{CB} on the market, the bank would make a profit. Every other bank also has that incentive, hence the interest rate on the market for deposits will rise if it is lower than i^{CB}. However, it is not profitable for the banks to raise the interest rate for deposits above i^{CB}, because for that interest rate they can get base money from the CB.

Therefore, the interest rate for deposits will be i^{CB} in equilibrium.

The same logic applies for the interest rate that banks charge for credits, since the banks can try to attract credits instead of deposits. Hence, the market interest rate for credits from the public will also be i^{CB} in equilibrium.

Since the banks will have capital costs of i^{CB}, when they give credits, they cannot lend for less than i^{CB}. They also cannot charge more, since the perfect competition drives down the interest rate for credits lent out by the banks to i^{CB}.

[6] It is assumed that people who are indifferent between holding deposits and longer-term claims (because they do not want to conduct any transactions during the period) choose the longer-term claims.

To sum up, the interest rate that the CB sets determines perfectly the market interest rate for credits and deposits.

This extension of the model helps to understand the transmission mechanism of monetary policy in a modern monetary system.

If the CB lowers the interest rate (expansionary monetary policy), this has the following effects: A lower interest rate on base money lowers the private banks' capital costs. Therefore, they are willing to give credits at a lower interest rate. At a lower interest rate, more credits will be taken by the public, and therefore more money will be created by the private banks via the lending process. In addition, the supply of credits decreases with a decreasing interest rate, which implies that a smaller amount of the initially created money is transformed into longer-term claims and hence "destroyed." Due to these two effects, the amount of money in circulation increases. This causes the inflation rate to rise. Further, economic activity is stimulated.

Restrictive monetary policy works the opposite way: A higher interest rate on base money increases the private banks' anticipated capital costs when giving credits, hence the market interest rate for credits will increase. At a higher interest rate, fewer credits will be taken, and therefore less money is created by the private banks. Further, the increased interest rate attracts more savers, who swap their deposits into longer-term claims, which further reduces the amount of money. The lower amount of money in circulation slows down inflation.

Note that monetary policy is more effective the more interest-elastic are credit demand and credit supply (flatter Cr^D and Cr^S curves).

This view of monetary policy is compatible with the traditional view of aggregate demand and aggregate supply. A lower interest rate raises aggregate demand through two channels: (1) More credits are taken to demand goods, and (2) less money is placed with the banks and instead used to demand goods. On the contrary, a higher interest rate lowers aggregate demand through these channels. Aggregate demand in turn influences the price level, or inflation, given aggregate supply.

For a better understanding of the introduced measures, the private banking sector's aggregate balance sheet during the period is illustrated below for the simplified case in which banks are financed with credits only.

assets		private banks	Liabilities
credits to the public[7]	Cr^D	refinancing credits	$[c+\theta(1-c)]M$
minimum reserve	$\theta(1-c)M$	credits from the public	Cr^S
		deposits	$(1-c)M$

The amount of base money equals $[c+\theta(1-c)]M$. The "money multiplier," i.e. the ratio of the total amount of money to the amount of base money, equals $[c+\theta(1-c)]^{-1}$, similar to standard textbooks like Blanchard and Illing (2009, pp. 130–137).

It is, however, not true, that the CB sets the amount of base money, which gets "multiplied up" by a constant multiplier and thereby determines the amount of money, as described in most textbooks. The amount of money is determined by credit demand and credit supply,

[7] Credit is defined very broadly, including bonds and stocks.

which is influenced by the interest rate that the CB sets on base money. The actual amount of base money is then determined endogenously (see Moore, 1988).

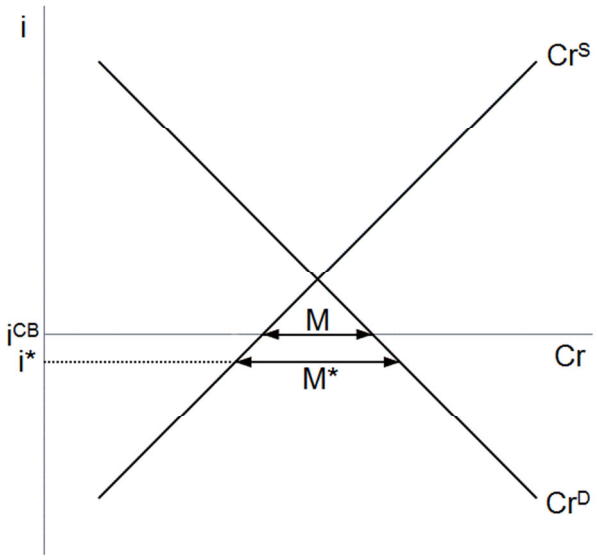
5 Applications

In addition to the insights about monetary policy in a modern monetary system, the model can be used to explain a series of phenomena. Some of them are introduced in this section.

5.1 Liquidity Trap

If there is high supply and low demand for credits, it is possible that the amount of money, M^*, that leads to an inflation rate at the target, requires a negative nominal interest rate, $i^* < 0$. However, the CB cannot set a nominal interest rate lower than zero. In this situation the CB is said to be in the "liquidity trap." The best thing it can then do is set an interest rate of $i^{CB} = 0$ that leads to an amount of money, M (figure 6).[8]

Figure 6)



This will nevertheless lead to an inflation rate lower than the target, or even deflation.

With a higher believably announced inflation target, it might be possible that the preferred nominal interest rate is positive, given a certain real interest rate. However, the CB cannot believably announce that it will raise inflation, because the market actors know that the CB has no possibility to prevent a low inflation rate with the use of its instruments.

In order to stabilize the level of output and to achieve the inflation target in this situation, either expansionary fiscal policy or expansionary wage policy is required. Expansionary fiscal policy increases the credit demand. Expansionary wage policy distributes income to those who would rather spend it than save it, and hence reduces the credit supply.

[8] In this case the "neutrality of money" does not hold. In a barter economy without money the real interest rate would become "sufficiently negative."

5.2 Quantitative Easing

Once the interest rate, set by the CB, is equal to zero, there is no possibility for the CB to increase the amount of money by lowering i^{CB}. However, the CB could buy claims from the private banks for more than the market price and thereby increase the amount of money (including reserves). This operation is called "quantitative easing."

The private banks would gladly trade the claims for an amount of money that is higher than the claims' expected return. However, they would mainly lend it back to the CB (as excess reserves), instead of giving credits to the public, since there is not enough credit demand to find suitable borrowers. A lot of money would get "stuck" in the banking sector, and the more relevant amount of money *net of reserves* might not change significantly. Hence, there would be no great effect on inflation or output.

There might be an effect only if the private banks expect that the CB keeps buying claims above true value. In this case, banks might give credits to questionable borrowers, with a negative expected return, and then sell the claims to the CB. This injected money would add to the amount of money in circulation and increase inflation. In addition, there might be an effect through reducing liquidity premia or reducing long-term rates. Nevertheless, these effects are very limited.

An obvious drawback of quantitative easing, in addition to the emerging asset price bubbles, is the potentially negative effect on CB profit. Furthermore, it might be difficult to find a good exit strategy for the CB once credit demand starts increasing, or credit supply starts decreasing, with a big amount of liquidity in the banking system.

5.3 Austerity and the Paradox of Thrift

In order to reduce the government's budget deficit, the neoclassical theory suggests that the government has to exert a policy of "austerity." This means that the government has to reduce its expenditures or increase tax rates, or both, until it has achieved the pursued budget deficit, a balanced budget or a surplus. The economic downturn related to that policy is generally seen as a short-term effect.

In the EDTM, a lower budget deficit means lower credit demand. That makes the CB lower the interest rate to keep the amount of money stable and avoid an inflation rate below the target. The lower interest rate triggers both investments and consumption that compensate for reduced governmental demand for goods in the new medium-term equilibrium with a lower budget deficit.

In practice there might be a temporary downturn, indeed, on the way to the new equilibrium, as described in section 2.

A completely different situation arises, however, if the CB is in the liquidity trap, i.e. the interest rate is zero in the beginning. In that case, the interest rate cannot be lowered and the process cannot work. Following this, austerity leads to deflation, or at least an inflation rate below the target, because the amount of money—given an interest rate equal to zero—will decline. It further leads to a substantial decline in income, because the missing governmental demand for goods is not replaced by private demand. Due to the multiplier effect, the declining income spreads to all sectors of the economy. In addition, unemployment rises because the firms that sell fewer goods have to dismiss their workers.

This phenomenon is called the "paradox of thrift": A planned increase in saving (or "thrift") does not lead to an increase in investments and hence actual savings, but to a decline in income *if the interest rate does not fall*. And if the CB is in the liquidity trap, the interest rate cannot fall because it is zero already.

In addition to the enormous damage for the economy, this process works against the original attempt to reduce the budget deficit. That is because tax revenues decline due to shrinking income and government expenditures (e.g. for unemployment payments) rise due to increasing unemployment.

The best example for the paradox of thrift presently is Greece. Austerity in Greece, together with the financial crisis, has caused real GDP to drop by 25 % since 2008. The inflation rate has been declining since austerity was imposed and is negative now. Still, there is no possibility for the ECB to lower the interest rate, because it is virtually zero already. Furthermore, unemployment is skyrocketing.

Nevertheless, the policy of austerity—even supported by cheap EU, IMF and ECB credits—did not solve the Greek debt crisis. At the end of 2011, it was announced that the Greek government would cancel half of its debt, which was, in fact, a default.

An additional problem is that due to the political incapacity to solve the crisis and the continuous decline in income, expected future income also declines. As a consequence, firms reduce their investments and households reduce their expenditures. This leads to even lower demand in the goods market and lower credit demand, causing the crisis to worsen.

Further, the average risk premium (a determinant of the mark-up) is very high due to the ongoing recession, which further discourages credit demand.

However, Greece is forced to pursue austerity.

5.4 Imbalances in a Currency Union

Once a group of countries starts a currency union and thereby fixes the internal exchange rates, every member gives up the possibility to adjust its relative price level via the exchange rate. A major task for economic policy in a currency union is therefore to avoid a divergence in the different countries' price levels and related current account imbalances. The price level in each country has to rise as fast as in the rest of the currency union.[9]

If economic policy is supposed to achieve an inflation target as well, it has to be made sure that the price level rises with the inflation target *in each country*.

Monetary policy can only ensure that the overall inflation rate across the currency union reaches the target since it can set only one interest rate for all countries. It is thus crucial to *coordinate* the national fiscal or wage policies in a way that the different inflation rates do not differ systematically.

The excess demand theory of money provides the most important guidelines for each country to influence its inflation rate. Expansionary fiscal policy in a country increases its inflation rate, given a certain interest rate, since it increases credit demand. Restrictive fiscal policy has the opposite effect. Expansionary wage policy reduces credit supply and thereby raises inflation. The contrary is true for restrictive wage policy.

[9] If it is assumed that the current accounts are balanced at the start of the currency union.

Unfortunately, these crucial connections were not understood by the policy makers in the euro zone. Some countries, like Germany, ran overly restrictive policies and undershot the average inflation rate consistently. Other countries, mainly in the south, ran overly expansionary policies and overshot average inflation systematically. This situation led to massive export surpluses in Germany, massive deficits in the south, a huge amount of debt between the different countries, and a possible breakdown of the euro zone.

The solution for the euro crisis is expansionary policies in the surplus countries in combination with relative restrictive policies in the deficit countries. Restrictive policies in the deficit countries alone will lead to a severe recession and deflation since the ECB is in the liquidity trap.

5.5 Monetary Policy

In the introduced model, the CB has to set the interest rate in a way that the amount of money reaches a certain quantity to achieve the inflation target. In practice, however, CBs no longer target the amount of money.

There are several reasons for this. First, it is very hard to measure or even predict the variables that are necessary to calculate the optimal amount of money in circulation.[10] In particular, the velocity of money—or the increase in the velocity of money—is very difficult to predict. Another reason is that it is not clear which claims should be included in the amount of money. CBs typically measure more than one amount of money. The ECB, for example, publishes three measures for the amount of money (M1, M2 and M3) in addition to the amount of base money (M0). Finally, it is arguably better for an economy to have a stable interest rate and a volatile amount of money, instead of having a stable amount of money and a volatile interest rate.

This is why CBs orientate themselves on interest rules depending positively on both actual inflation and real output, as Taylor (1993) showed. The inflation rate and real output are good indicators to distinguish if the relevant amount of money has changed. Assume, for example, that the amount of money declines because people save more by supplying more credits. If the interest rate does not change, there is (1) a negative effect on output because of missing demand and (2) a negative effect on prices because firms will lower the prices in the face of a lack of sales. If the CB observes that these two measures are declining, it knows that the interest rate has to be lowered—without considering the amount of money.

The policy of a CB can be simplified as follows: If the inflation rate is above the target (and real output higher than its potential), the CB raises the interest rate. If the inflation rate is lower than the target (and real output below its potential), the CB lowers the interest rate. If the inflation rate is at the target (and real output at its potential), the CB leaves the interest rate as it is.

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[10] Calculation of the amount of money that leads to an inflation rate at its target:

Quantity equation: $P_0Y_0 = M_0V_0 \Leftrightarrow M_0 = \frac{P_0Y_0}{V_0}$; $P_1Y_1 = M_1V_1$

$(1+\pi^T)\,P_0\,(1+g)\,Y_0 = M_1\,(1+v)\,V_0 \Leftrightarrow M_1 = \frac{1+\pi^T+g+\pi^T g}{1+v}\,\frac{P_0Y_0}{V_0} \approx (1+\pi^T+g-v)\,M_0$

P_t: price level during period t; Y_t: real output produced during period t; M_t: amount of money during period t; V_t: velocity of money during period t; t=0: previous period; t=1: present period; π^T: target inflation rate in period 1; g: real output growth rate in period 1; v: increase in the velocity of money between period 0 and 1.

CBs in practice behave *as if* they could monitor the relevant amount of money and *as if* they would adjust the interest rate in a way that the relevant amount of money reaches a certain value.

Modeling the CB's behavior as before is thus reasonable.

5.6 Hyperinflation

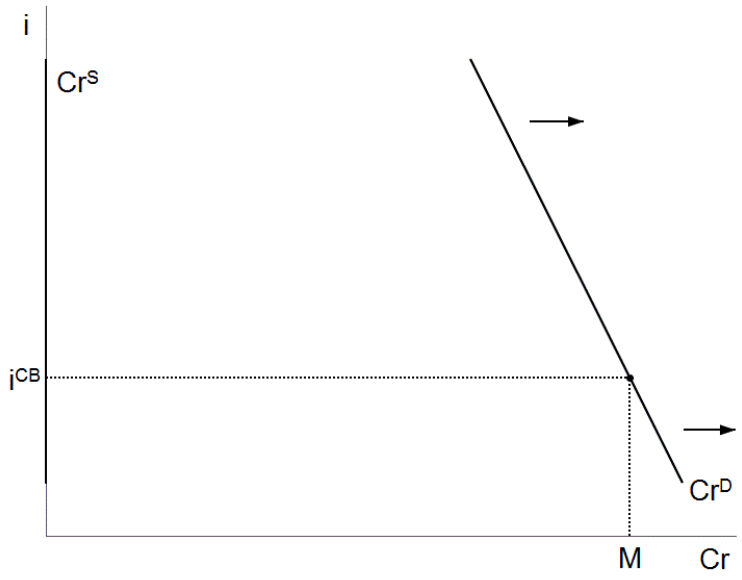
There are situations in which a CB behaves in a different way as described before: for example, if the government has problems financing its deficit and the CB is not independent, in the sense that it is not only concerned with achieving the inflation target. In that case, the CB might buy a large amount of government bonds regardless of the effect on prices caused by the so created money. The inflation rate will then rise highly above the target.

Savers will get a negative real interest rate on their claims, because they can buy fewer goods for the amount of money they get back. That will upset the savers' trust in the announced inflation target. If they expect inflation to be much higher than the target in the future, the expected real interest rate given a low or "normal" nominal interest rate i^{CB} becomes negative for saving by lending money to a bank. As a consequence savers do not lend money any more to banks, but use all of their money to conduct transactions. In order to save, they buy assets like gold, real estates or foreign currencies. The Cr^S curve shifts to the very left.

Furthermore, investors expect the real interest rate to be negative. So they will borrow money excessively because the back-payment is likely to be worth less in real terms in the future. This will add to the high and increasing governmental credit demand. That means that the Cr^D curve shifts to the right.

This behavior leads to an even higher amount of money in circulation and hence to rapidly increasing prices because neither output nor the velocity of money changes that quickly. In fact, the velocity of money will also be very high, because people will try to spend their money before prices rise again. In the next period the credit demand will rise even higher, because of the increasing prices and higher governmental credit demand, and so on. The Cr^D curve shifts further and further to the right and the economy will not converge to a stable equilibrium (figure 7).

Figure 7)



At some point, it is very inconvenient for people to pay with unstable money, and they might start using other means of payment to conduct their transactions. If this happens, it is possible that the monetary system collapses.

6 Conclusions

The excess demand theory of money gives an improved understanding of monetary market economies. At the core of the theory is the insight that that the money in circulation is not equal to the whole amount of the credits granted by the banking sector. Instead, the money in circulation is only the part of the credit demand that is not saved via credits to banks. In other words, the relevant amount of money is not equal to the full credit demand—but to the excess demand.

The excess demand theory of money is compatible with the Keynesian, the neoclassical and the Post Keynesian interest theory. It can be seen as the liquidity preference theory with an adjusted interpretation of the liquidity demand with respect to Keynes' original interpretation. Alternatively, it can be regarded as the loanable funds theory for a monetary economy with a CB that targets inflation. Finally, it can be seen as an adjusted endogenous money theory.

Further, it can explain how the transmission mechanism of monetary policy works within a modern banking system: A lower interest rate, for example, decreases the private banks' capital costs and hence fosters money creation via credits by private banks, which stimulates demand. In addition, it leads to less money being transformed into longer-term claims, and instead used to buy goods, which means further increasing demand.

Apart from that, the model shows that, if the CB is in the liquidity trap, monetary policy is not enough to keep the economy in equilibrium. In that situation, more planned savings do not trigger investments ("paradox of thrift"). It gives an explanation why quantitative easing does not have a big effect on output and inflation. It explains how to influence inflation without the use of monetary policy, which is especially important in a currency union. The model provides thereby crucial insights about what went wrong in the euro zone and what has to be done to save the euro. Finally, it shows which situations can lead to hyperinflation.

Due to its simplicity and its accurate description of the monetary system and the banking sector the model is very suitable for introductory textbooks.

References

Ackley, G. (1957): Liquidity Preference and Loanable Funds Theories of Interest: Comment, American Economic Review, Vol. 47, No. 5, September, pp. 662–673.

Bank of England (2014): Money creation in the modern economy, Quarterly Bulletin Q1.

Bertocco, G. (2013): On Keynes's Criticism of the Loanable Funds Theory, Review of Political Economy, Vol. 25, No. 2, April, pp. 309–326.

Bibow, J. (2000): The Loanable Funds Fallacy in Retrospect, History of Political Economy, Vol. 32, No. 4, Winter, pp. 789–831.

— (2001): The loanable funds fallacy: exercises in the analysis of disequilibrium, Cambridge Journal of Economics, Vol. 25, No. 5, pp. 591–616.

Blanchard, O., G. Illing (2009): Makroökonomie, Pearson Studium, 5th edition.

Fellner, W., H. M. Somers (1941): Alternative Monetary Approaches to Interest Theory, Review of Economics and Statistics, Vol. 23, No. 1, February, pp. 43–48.

Foley, D. K. (1975): On Two Specifications of Asset Equilibrium in Macroeconomic Models, Journal of Political Economy, Vol. 83, No. 2, April, pp. 303–324.

Gestrich, H. (1944): Kredit und Sparen, Walter Eucken.

Hansen, A. (1951): Classical, Loanable-Fund, and Keynesian Interest Theories, Quarterly Journal of Economics, Vol. 65, No. 3, August, pp. 429–432.

Hayes, M. G. (2010): The loanable funds fallacy: saving, finance and equilibrium, Cambridge Journal of Economics, Vol. 34, No. 4, pp. 807–820.

Hicks, J. R. (1937): Mr. Keynes and the "Classics"; A Suggested Interpretation, Econometrica, Vol. 5, No. 2, April, pp. 147–159.

Johnson, H. G. (1951): Some Cambridge Controversies in Monetary Theory, Review of Economic Studies, Vol. 19, No. 2, pp. 90–104.

Keynes, J. M. (1936): The General Theory of Employment, Interest and Money, St. Martin's Press for the Royal Economic Society, 15th edition.

— (1937a): Alternative Theories of the Rate of Interest, Economic Journal, Vol. 47, No. 186, June, pp. 241–252.

— (1937b): The "Ex-Ante" Theory of the Rate of Interest, Economic Journal, Vol. 47, No. 188, December, pp. 663–669.

Lerner, A. P. (1938): Alternative Formulations of the Theory of Interest, Economic Journal, Vol. 48, No. 190, June, pp. 211–230.

Lindner, F. (2013): Does Saving Increase the Supply of Credit? A Critique of Loanable Funds Theory, Macroeconomic Policy Institute, IMK Working Paper No. 120–2013.

Moore, B. (1988): Horizontalists and Verticalists: The macroeconomics of credit money, Cambridge University Press.

Naples, M., N. Aslanbeigui (1996): What does determine the profit rate? The neoclassical theories presented in introductory textbooks, Cambridge Journal of Economics, Vol. 20, No. 1, pp. 53–71.

Ohlin, B. (1937a): Some Notes on the Stockholm Theory of Savings and Investment I, Economic Journal, Vol. 47, No. 185, March, pp. 53–69.

— (1937b): – II, Economic Journal, Vol. 47, No. 186, June, pp. 221–240.

— , D. H. Robertson, R. G. Hawtrey (1937): Alternative Theories of the Rate of Interest: Three Rejoinders, Economic Journal, Vol. 47, No. 187, September, pp. 423–443.

Patinkin, D. (1958): Liquidity Preference and Loanable Funds: Stock and Flow Analysis, Economica, New Series, Vol. 25, No. 100, November, pp. 300–318.

Robertson, D. H. (1938): Mr. Keynes and "Finance", Economic Journal, Vol. 48, No. 190, June, pp. 314–318.

Snippe, J. (1985): Loanable funds theory versus liquidity preference theory, De Economist, Vol. 133, No. 2, pp. 129–150.

Stiglitz J. E., B. Greenwald (2003): Towards a New Paradigm in Monetary Economics, Raffaele Mattioli Lectures, Cambridge University Press.

Taylor, J. B. (1993): Discretion versus policy rules in practice, Carnegie-Rochester Conference Series on Public Policy, Vol. 39, December, pp. 195–214.

Tsiang, S. C. (1956): Liquidity Preference and Loanable Funds Theories, Multiplier and Velocity Analysis: A Synthesis, American Economic Review, Vol. 46, No. 4, September, pp. 539–564.

— (1980): Keynes's "Finance" Demand for Liquidity, Robertson's Loanable Funds Theory, and Friedman's Monetarism, Quarterly Journal of Economics, Vol. 94, No. 3, May, pp. 467–491.

Wicksell, K. (1907): The Influence of the Rate of Interest on Prices, Economic Journal, Vol. 17, No. 66, June, pp. 213–220.

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