The Excess Demand Theory of Money

Kehrwald, Bernie

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THE EXCESS DEMAND THEORY OF MONEY

BERNIE KEHRWALD*

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Abstract

This paper introduces a new monetary theory. A simple model is described in which a central bank sets the interest rate in a way that the excess demand for credits equals the preferred amount of money. It is compatible with the Keynesian liquidity preference theory and the neoclassical loanable funds theory and can be used to explain a series of phenomena. It is very suitable for introductory textbooks.

Keywords: money, interest rate, credit, central bank, savings, investments
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 a 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). This paper introduces a new theory that combines both views and gives a better understanding of the interest rate, the credit market, and the nature of a central bank. It will be called the excess demand theory of money.

The rest 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 and the loanable funds theory, and how it can be embedded into economic theory. Section 4 introduces a more realistic banking sector to the model. Section 5 shows some phenomena that it can explain. Section 6 concludes.

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* University of Munich, Department of Economics, email: bernie@kehrwald.com

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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 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.

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 that creates the money. It then circulates as cash unless someone brings it to a bank to place funds.

In addition, there is a credit supply Cr^S by the public. 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 a certain level of income.[1] The savers produce goods and get paid for that at the beginning of the period.[2] Directly after, they lend the amount of money 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 a certain inflation target. It is assumed that there is an amount of money M that causes an inflation rate at its target.[3] Hence, it is an equal target to implement the amount of money M in circulation. In general, a lower amount of money leads to an inflation rate below the target and a higher amount of money causes 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.

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.

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[1] A constant level of income is a strong assumption that will be justified towards the end of the section.
[2] The effect of the related transactions on prices is assumed to be negligible.
[3] General calculation of the amount of money that leads to an inflation rate at its target:

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

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

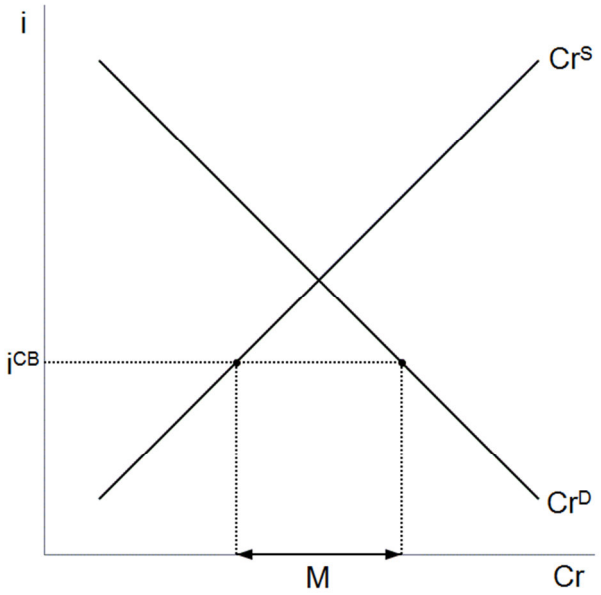
P_t: price level during period t; Y_t: real output produced during period t; M_t: amount of money during period t; V_t: velocity of money during period t; t=0: previous period; t=1: present period; π^T: target inflation rate in period 1; g: real output growth rate in period 1; v: increase in the velocity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

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 M 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).

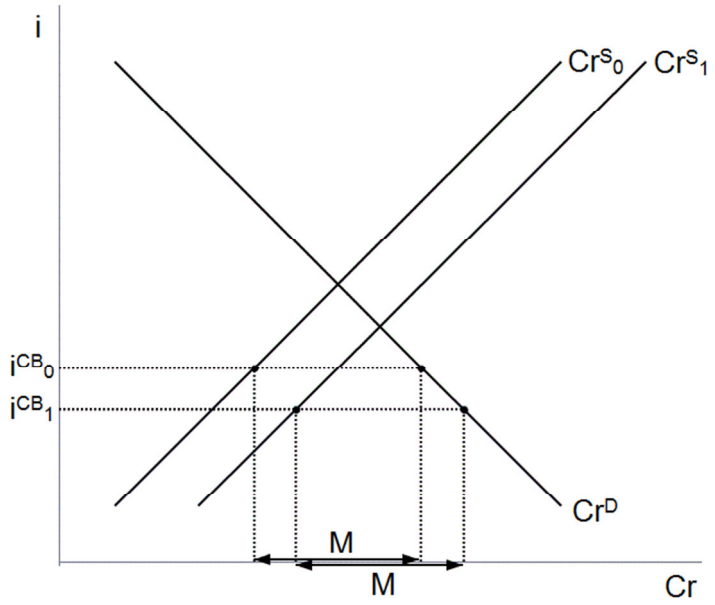
Figure 1)



The model can explain how a different situation on the credit market causes a change in the interest rate: Imagine that the economy 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, for example, the credit supply increases because people want to save more at a given interest rate. 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 that 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. Finally, the economy will be in equilibrium with a lower interest rate, higher investments and an unchanged level of income.

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. That is for the time (1) the CB has not yet recognized the situation and has not lowered the interest rate and (2) production shifts from consumer goods to investment goods. If people who were working in the production of consumer goods are dismissed, they

Figure 2)



will be unemployed with no or little income until they find a job in the production of investment goods.

In general, the economy could also converge to equilibrium with higher unemployment, lower income and an inflation rate at its target. Once income is reduced, prices might be stable with a lower level of income, because also aggregate demand is lower. That would imply that the equilibrium level of income and the equilibrium interest rate are undetermined – even in the medium term.

For that reason it is important to note that in practice CBs have to achieve a high output level or low unemployment as an additional target. That means that the CB chooses the equilibrium with the highest possible output level – or alternatively the lowest interest rate – given that the inflation target is achieved. The highest possible output level, given that the inflation target is achieved, can be seen as the potential output.

If there are enough qualified people to produce investment goods and if the production of investment goods is as labor-intensive as the production of consumer goods, it is assured that the potential output does not decline due to an increase in planned savings. Hence, with a lower interest rate, the dismissed workers or other unemployed find jobs in the production of investments goods, and the previous level of income can be restored in the medium term.

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 for reaching the new equilibrium, that the firms know that the low level of income is only temporary.

3 Comparison to Existing Theories

In this section, it will be outlined how the new model is connected to two existing theories: the Keynesian liquidity preference theory (LPT) and the neoclassical loanable funds theory (LFT). Keynes (1937a, p. 241) initially believed that these two theories 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[4], 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, through the new model's perspective the two other theories can be understood better. Finally, it will be shown how the EDTM fits into the economic theory.

3.1 Liquidity Preference Theory

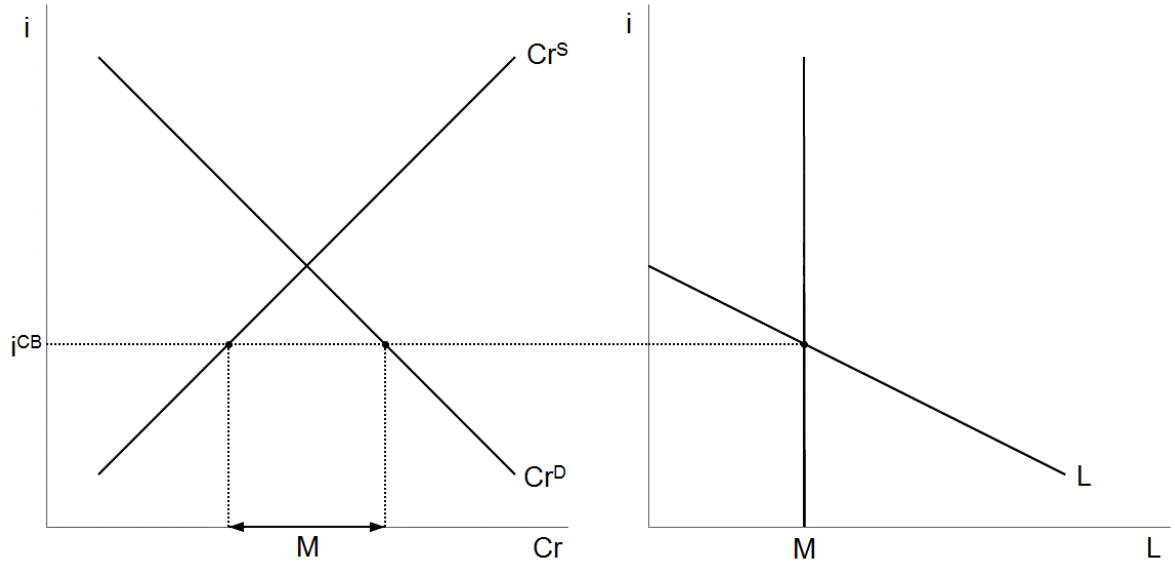
The LPT is the Keynesian theory of the interest rate. It was introduced in Keynes' General Theory (1936). In the LPT framework it is assumed that there is a demand for money, or alternatively a demand for liquidity L, by the public that depends negatively on the interest rate i.

The interest rate is determined by a market where the liquidity demand L meets the supply of money M, set by a 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)



However, that interpretation of the liquidity demand differs from Keynes' original interpretation in several respects. Davidson (1965) summarized what Keynes wrote about his intention behind the liquidity demand. Keynes named three motives for demanding money in the General Theory (1936, p. 170): (1) The "transactions-motive," (2) the "precautionary-

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

motive" and (3) the "speculative-motive." Keynes (1937a) further named (4) the "finance motive" in his reply to Ohlin's criticism (1937a, 1937b).

The "transactions-motive" states that money is used to conduct transactions. That is in fact similar to the intention behind the liquidity demand in the EDTM: Only the part of the originally created money, that is used to conduct transactions, is included in the amount of money. The rest is lent to the banking sector and hence not included.

Keynes (1936, p. 171) argued that the part of the liquidity demand used for transactions is "not very sensitive" to the interest rate, and he neglects such an effect later in the analytical part (p. 199). That view is not in line with the EDTM. If the interest rate rises, households spend less money and supply more credits. Thus, the liquidity demand declines.

As another part of the liquidity demand Keynes named money held for "precautionary" purposes. It is argued that households have a desire to hold a certain share of their total resources in money as precaution. According to Keynes, a rise in the desire to hold money for precaution in favor of supplying credits would cause the interest rate to rise. That is not in line with the EDTM. The EDTM shows that this part of the liquidity demand is not relevant for the determination of the interest rate in the medium term, because it is not circulating in the goods market and thus irrelevant for prices and the interest rate that the CB sets.

What happens if households decide not to bring their savings to a bank, but to hold that amount of money at home instead? This has neither an effect on prices nor on the level of output. In this case, the velocity of money declines which raises the amount of money that is required to keep inflation at its target. On the other hand, the amount of money rises to exactly that amount due to the additional demand for "precautionary" money. Consequently, the CB does not change the interest rate and tolerates the additional amount of money, because it does not threaten the inflation target. Also the amount of credits that is given by the banking sector stays the same.

The only difference in real terms is caused by the fact that less money is brought back to the banks and hence less money is placed with the CB by the private banks. Due to that, the CB gets a higher seigniorage profit, because it has to pay less interest to the private banks. On the other hand, the households give away interest payments by an equal amount. Instead of having interest-bearing claims against private banks, they only have money that is bearing no interest.

Next, there is the "speculative-motive" of holding money. Households are said to hold money for speculative purposes if they expect the interest rate to rise and do not lend a certain amount of money to a bank because they are waiting for a better deal.

Here, the same reasoning as for "precautionary" money applies. If the households' desire to hold money to speculate with rises, but they do not use it for transactions, the deflationary decline in the velocity of money compensates for the inflationary rise in the amount of money, with an unchanged interest rate. As a consequence, the CB can leave the interest rate as it is to achieve the inflation target.

Keynes argued in the General Theory (1936, p. 199) that mainly because of the "speculative" money, the liquidity demand depends negatively on the interest rate. The EDTM shows that "speculative" money has nothing to do with the determination of the interest rate in the medium run.

However, Keynes' thinking was not wrong, it was just intended for a different analysis: the determination of the short-term interest rate. In the short period in which the CB does not

undertake refinancing operations, the amount of money is fixed and the interest rate fluctuates as a result of changes in the supply and demand for money on a daily basis. In this framework a rise in the desire for "speculative" money in favor of supplying credits is likely to cause the interest rate to *rise*.

Keynes' reasoning on "precautionary" and "speculative" money also applies for a situation in which the CB is undertaking refinancing operations with a variable-rate tender procedure and the amount of money is not adjusted to a higher willingness to hold money in favor of spending money, for example. Keynes' theory is also accurate if the CB is undertaking refinancing operations with a fixed-rate tender procedure but has not adjusted the interest rate to a new situation on the credit market, as the amount of money will fluctuate freely according to changes in the liquidity demand.

Hence, in a short-term analysis Keynes' approach to include "precautionary" and "speculative" money into the liquidity demand is perfectly accurate. Only for the determination of the interest rate in the *medium term* should the liquidity demand be interpreted other than Keynes proposed.

At last, there is the "finance motive" of demanding liquidity. Keynes (1937a) admitted that the amount of planned investments also affects the amount of the liquidity demand through the need of financing investments, and he wrote shortly after (1937b, p. 667): "I should not have previously overlooked this point, since it is the coping-stone of the [LPT]." If you go one step further and assume that planned investments depend on the interest rate, the effect of the interest rate on the liquidity demand through investments becomes very clear: If the interest rate rises, planned investments decrease, thus the liquidity demand decreases.

The same logic applies to the EDTM. Planned investments depend negatively on the interest rate and contribute to the demand for credits and hence to the excess demand for credits, 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, the confession makes it possible to reconcile the LPT with other interest rate theories.

To sum up, the LPT and the EDTM are identical, if the interpretation of the liquidity demand is adjusted to a medium-term analysis. It has to be assumed that the liquidity demand depends negatively on the interest rate: on the one hand because a rise in the interest rate makes people want to spend less money and bring it to a bank instead to supply credits, and the other because a rise in the interest rate causes fewer investments to be profitable and hence less liquidity to be demanded for financing investments. The observation that people are willing to hold more money, if the interest rate is low, because then the opportunity cost of having a means of payment to speculate with instead of an interest-bearing claim is lower, is *not* relevant for the determination of the interest rate in the medium term.

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. That is because more investment projects are 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 will shift consumption to the future and consume less goods today.[5]

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, that 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. That 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.[6,7]

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.

In the following, savings will be analyzed.

There are two kinds of saving.

First, there is a conscious act of saving. That is if 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. Another form of conscious saving is financing investments with equity. That 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 we have 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.

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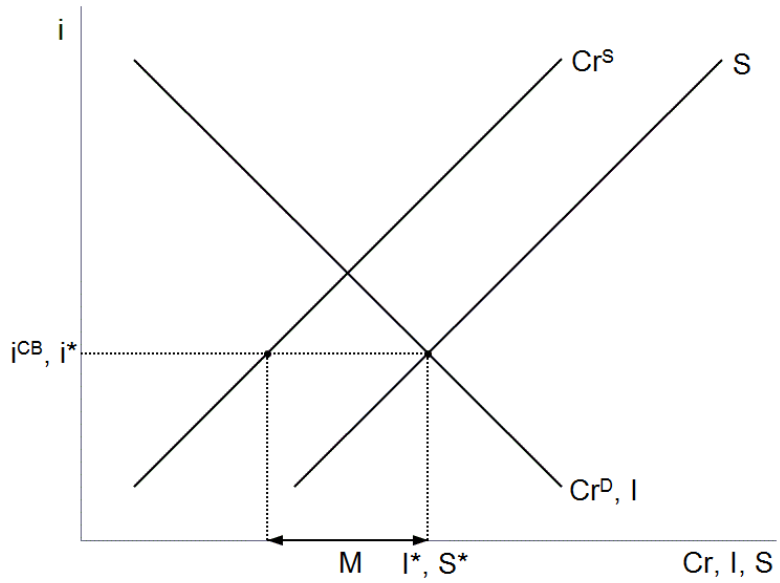
[5] Supply and demand for loanable funds can also be seen as supply and demand for capital.

[6] If you want to allow for consumer credits, you would have to subtract the amount of consumer credits from the amount of total credits to get to the investment demand.

[7] If you want to allow for financial credits, i.e. credits to buy financial assets, you would have to subtract the amount of financial credits from the amount of total credits to get to the investment demand.

Figure 4)



However, the process in which equilibrium is reached in the LFT is different to the process for the EDTM. For the LFT, it is solely the market forces that drive the interest rate towards its equilibrium level. Further, there is no money. It was derived thinking of an economy where goods are traded against goods directly, that disappear once they are consumed. Recent papers like Bertocco (2013) and Lindner (2013) argue that the LFT is not transferrable to an economy where money is injected by a CB and people trade in money. Also Bibow (2000, 2001) and Hayes (2010) argue that the LFT is flawed and should be abandoned.

Bertocco (2013, p. 317) stated:

> "according to the LFT, only money that is saved can support investment, and it is implicitly assumed that the money that is used to purchase consumer goods is destroyed and meets the same fate as the goods that are consumed. But the money that is used to purchase consumption goods does not disappear from circulation, just as the saved money does not disappear, and it is not clear, for example, why the money used to purchase goods cannot be used to finance investment decisions"

Lindner (2013, p. 31) similarly stated:

> "However, common to those models […] it is still capital *goods* which are lent and borrowed, not money. The loanable funds are thus always literally funds that are increased by household saving. The problem then is how to coordinate the transfer of capital goods via the capital market to their most efficient use. But the idea of such a limited saving fund is not applicable to an economy in which *money* is lent and borrowed. Since money does not vanish by being consumed and invested but stays in circulation and can in principle finance *any* amount of spending in a period, those models cannot be applied to a world with money." [original italics]

The EDTM can be seen as the specification of the LFT for a monetary economy and can disprove this criticism. Regarding the EDTM, it becomes very clear 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 its target, if the CB does not change the interest rate. Hence, the market "enforces" a change in the interest rate, if the CB wants to achieve its 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.

These insights confirm the view of the "neutrality of money": In general, the existence of money does not alter the functionality of an economy, i.e. the determination of savings, investments and the real interest rate – if the CB adjusts the interest rate endogenously in a way that a certain inflation target is achieved.

An alternative way of describing a 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.

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 credit 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 his General Theory (1936, p. 180) when criticizing the LFT and stated: "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 Keynes' theory and the dependence

between income and the interest rate to derive the famous IS-LM model, which has been dominating macroeconomic theory ever since.

3.3 Integrating the New Model into the Economic Theory

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 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). To rectify this failure of economic theory the LPT could be replaced by the EDTM, for example, in introductory textbooks. That way it is 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 More Realistic Banking Sector

In this section, the model will be extended by introducing a more realistic banking sector.

The assumption that all of the transactions in the economy are conducted with cash will be relaxed now. Instead, it is assumed that only the share c of the money in circulation is cash, with $0 \leq c \leq 1$. The rest $1-c$ are bank deposits bearing interest. It is further assumed that the private banks can use money from credits or deposits to give credits to the public. However, there is a minimum reserve requirement. 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 same interest rate for that minimum reserve as it asks for when giving refinancing credits.[8]

At the beginning of the period, the public borrows an amount Cr^D from the private banks. The amount cM will be circulating in cash. $(1-c)M$ is brought back to the banks via deposits and circulates from one account to another. The amount Cr^S is brought back to the banks via credits. The private banks have to borrow the complete amount of cash cM plus the necessary minimum reserve for the deposits $\theta(1-c)\,M$ from the CB. Finally the banks lend the necessary minimum reserve to the CB.

With the additional assumption that banks are financed with credits only, the private banking sector's aggregate balance sheet can be illustrated as below:

assets		private banks	liabilities
credits to the public	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 money, that is created by the CB, called high powered money, equals $[c+\theta(1-c)]M$. The money-creation multiplier, i.e. the amount of money that is created out of

[8] Note that the previously introduced basic model is the special case with $c = \theta = 1$.

one unit of high powered money, equals $[c + \theta(1-c)]^{-1}$, similar to standard textbooks like Blanchard and Illing (2009, pp. 130-137).

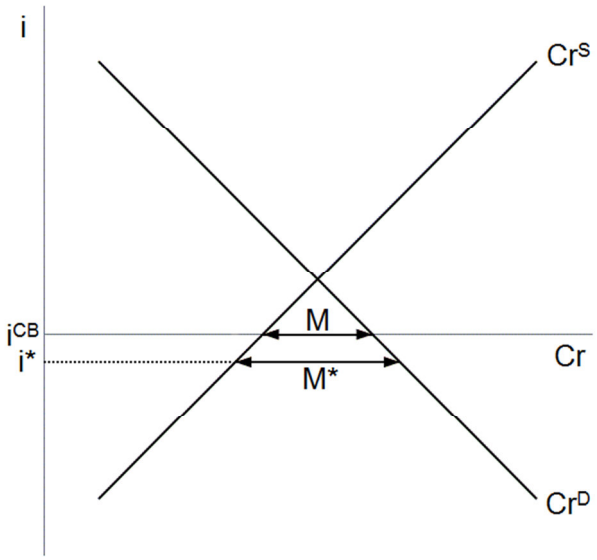
5 Applications

Besides the insights about the credit market, its connection to the capital market and the nature of a CB, 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 its 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 do then is to set an interest rate of $i^{CB} = 0$ that leads to an amount of money M (figure 5).

Figure 5)



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 announce believably to 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 expansive fiscal policy or expansive wage policy is required. Expansive fiscal policy increases the credit demand. Expansive wage policy distributes income to those who would rather spend it than save it, and hence reduces the credit supply.

5.2 Quantitative Easing

Once the interest rate is equal to zero, there is no possibility for the CB to increase the amount of money any further and stimulate the economy in the model. That is because it is assumed that there exist only riskless credits. If there were potential debtors with a possibility of default, the market interest rate for correspondent claims would still be higher than zero, because a risk premium would be charged. Vice versa, their market price would be lower than the net present value of the promised payout. Then, the CB could buy claims like that from the private banks for more than the market price and thereby increase the amount of money (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 prefer to keep the money or lend it back to the CB instead of giving credits to the public. A lot of money would get "stuck" in the private banking sector and hence there will be no great effect on inflation or output.

The private banks would only extend credits if they expect that the CB would buy claims above true value in the future; in this case, banks could give credits with a negative expected return and then sell them to the CB for profit. This injected money would add to the amount of money in circulation and increase inflation.

An obvious drawback of that policy, 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 once credit demand starts increasing, or credit supply starts decreasing, with a big amount of liquidity in the private 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 whole 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 mechanism 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, that 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 was 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 will 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.

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 wants to achieve an inflation target as well, it has to make 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 the inflation rate. Expansive fiscal policy in a country increases the inflation rate given a certain interest rate since it increases credit demand. Restrictive fiscal policy has the

[9] If it is assumed that the current accounts are in equilibrium at the beginning of the currency union.

opposite effect. Expansive wage policy reduces credit supply and thereby raises inflation. The contrary is true for restrictive wage policy.

Unfortunately these crucial connections were not understood by policy makers in the euro zone. Some countries, like Germany, ran overly restrictive policies and undershot the average inflation rate constantly. Other countries, mainly in the south, ran overly expansive policies and overshot average inflation systematically. The consequences are massive export surpluses in Germany, massive deficits in the south, and a possible breakdown of the euro zone.

The solution for the euro crisis is expansive 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.

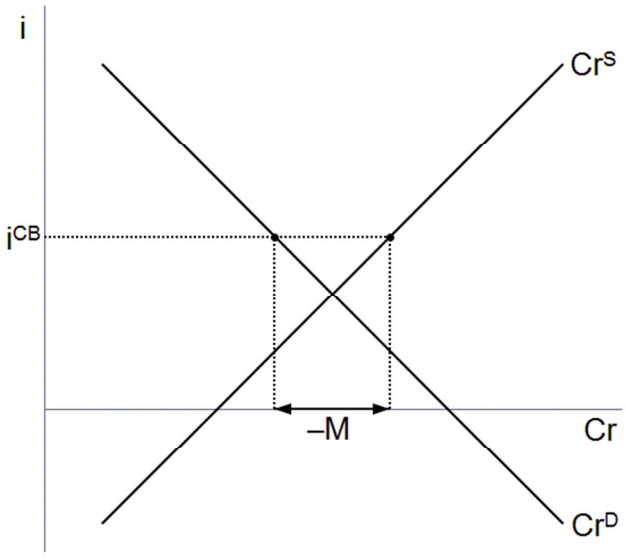
5.5 Negative Amount of Money

In the model it is possible that the CB sets an interest rate i^{CB} so high that it causes the planned credit supply to exceed the planned credit demand. Then, the amount of money M would be negative.

In a closed currency area it is impossible that more money is lent to the banking system than borrowed, simply because the banking system is the only source where money comes from in the first place. Even if the credit supply is equal to the credit demand there would be no money in the economy to conduct transactions.

A different situation arises, however, in a currency union like the euro zone. In that case there are several countries that can create the currency. If there is high credit supply and low credit demand in a country in a currency union – and for some reason the private banks do not lend a lot of money to foreign countries – it is possible that the public in this country lends more money to its banking system than it borrows from it.[10] The private banks in turn lend the excess of money to the CB. The amount of money that this country contributes to the total amount of money in the currency union is then negative (figure 6).

Figure 6)



[10] It is assumed that all households, firms and governments conclude credit contracts with their domestic banking system only.

Cr^D now means the domestic economy's credit demand, Cr^S means the domestic economy's credit supply. M is the amount of money that the domestic banking system contributes to the total amount of money in the currency union. i^{CB} is the interest rate that is set by the common CB.

To conduct transactions, money that is created in other member countries of the currency union can be used. In these countries, the credit demand has to greatly exceed the credit supply, so that an additional amount of money can be created there.

Beginning in 2012, Germany had a negative amount of money, with the German private banking sector being a net creditor to its CB, the Bundesbank. This memorable situation was described by Sinn and Wollmershäuser (2012). The money that was used to conduct transactions within Germany was created completely abroad, mainly in southern Europe, and came to Germany because of the massive current account imbalances. In addition, the private banks did not give a lot of credits to foreign countries due to the uncertainty caused by the financial crisis.

5.6 Monetary Policy

In the 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. Nowadays, CBs look at the inflation rate (and real output) directly to achieve the inflation target, without considering the amount of money.

This is because in practice it is very hard to measure or even predict the variables that are necessary to calculate the optimal amount of money in circulation. Especially the velocity of money – or the increase in the velocity of money – is very difficult to distinguish. 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 high powered money (M0).

This is why CBs in practice 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. If, for example, people save more by supplying more credits and 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 optimal policy of a CB can be described as follows: If the expected medium-term inflation rate is above its target (and real output higher than its potential), the optimal monetary policy is to raise the interest rate. If the expected medium-term inflation rate is lower than the target (and real output below its potential), the optimal monetary policy is to lower the interest rate. If the expected medium-term inflation rate is at its target, the CB has to analyze if a lower interest rate would cause inflation to rise above its target in the medium term. If the answer is yes, the optimal policy is to keep the interest rate at its present value. If the answer is no, the optimal policy is to lower the interest rate.

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 (and that the output level is as high as possible given that the inflation rate is at its target).

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

5.7 Hyperinflation

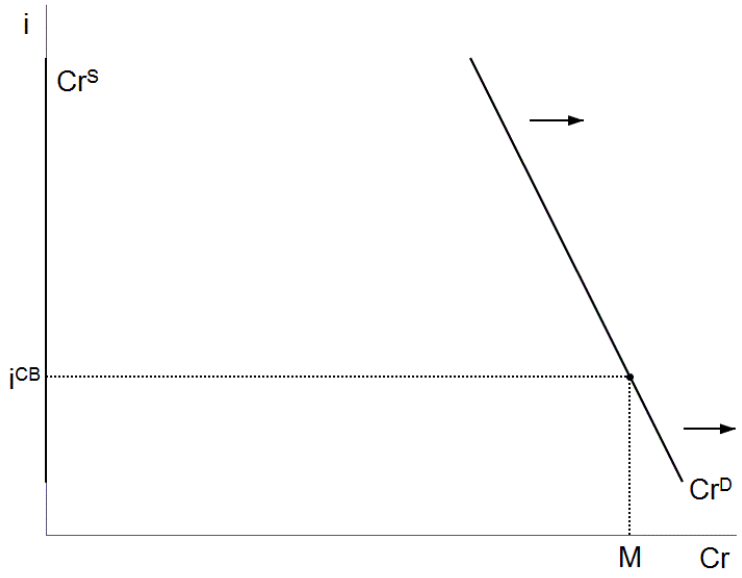
However, there are situations in which a CB behaves in a different way: for example, if the government has problems financing its deficit and the CB is not independent, in the sense that it is not solely concerned with achieving the inflation target. In that case, the CB might buy a large amount of government bonds regardless of the effect on prices caused by the so created money. The inflation rate will then rise highly above its 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, the 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 does 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 combines the Keynesian and the neoclassical interest theory. It aids in understanding both of them better, and it can further enrich economic theory as well as remove certain flaws. The model gives an improved understanding of how the credit market and the capital market work and how they are connected to the banking system in a monetary economy. In addition, it can be used to explain a series of phenomena related to money and the credit market, such as the liquidity trap, the paradox of thrift and hyperinflations. Due to its simplicity it is very suitable for introductory textbooks.

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