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## **Negative Interest Rates on Excess Bank Reserves as a Policy Tool – Theory Overview and Experiences from Europe**

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## ABSTRACT

### 1 INTRODUCTION

June 2014 marked another addition to the list of unconventional measures taken by the European Central Bank after the financial crisis when as the first major central bank it lowered its deposit facility rate to negative territory (see Bräuning & Wu (2017)). The unprecedented move to use negative rates was partly in conflict with already established economic theory, eg. Zero-lower bound, and promoted a lot of discussion and research on the revision of the assumptions of these theories and also on the effectiveness of this policy tool.

As of now the ECBs deposit rate has sunk into negative 40 basis points and the Negative Interest Rate Period (NIRP) has lasted for 5 years in the countries under ECBs governance and even longer in some other European countries with sluggish growth driving the economy forward for now. Excluding other unconventional measures, it begs to question what have been the effects of this policy and how exactly have these effects transmitted to the real economy. For this we review in this paper the channels that deposit-rate uses to transmit monetary policy through commercial banks to real economy and the main theories most relevant to this policy tool, which have also come under a lot of debate during the NIRP.

The goal of this paper is to deconstruct the established chain of effects created by adjustments in deposit rate by examining existing literature on the theories and previous assumptions related to the subject and reviewing them with recent empirical research from the NIRP-period to see the reasons behind the decision to apply negative rates and whether the results of this policy have been as expected. We will leave outside of our scope the other unconventional measures taken by ECB and other central banks or the total effects to the real economy itself as we specifically focus only on the deposit rate and the channels which it uses transmit policy changes to real economy through bank lending. We will also limit the geographical scope to Europe and use empirical results from European Monetary Union area and some members of European Union with their own currency and negative deposit rates. These countries include Switzerland, Denmark and Sweden. The paper is structured as follows:

First, we take a short general view on the variety of unconventional measures and make the difference between the deposit and other policy rates used by central banks to clarify the definition of this policy tool and separate it from other similar tools. We end the introduction of the subject by taking a peek into the motives behind decision of lowering the rate to negative territory from the viewpoint of different European central banks.

Next, we introduce the theoretical framework for zero lower bound and two transmission mechanisms of monetary policy also known as the interest rate channel and credit channel, the latter dividing further into balance sheet channel and bank lending channel. We exclude from our scope of the study the portfolio channel and exchange rate channel.

In the empirical literature review section we recap how the short nominal interest rates were lowered into negative territory by four central banks in Europe, The European Central Bank, Swiss National Bank, Danmarks Nationalbank and Swedens Riksbank, and then review empirical findings in contrast with established theoretical framework to find out, whether the implications of binding zero lower bound are correct when inspecting from deposit rates point of view and what are the effects on the transmission channels. In the end of this paper we hope to have a more thorough understanding of the deposit rate as a policy tool and better position to argue whether the zero lower bound is as binding as implied by the theory. We start with the overview of unconventional measures taken during the last decade.

## **2 DEPOSIT RATES AS A PART OF UNCONVENTIONAL MEASURES**

### **Overview of Unconventional Measures Taken**

As a reaction to the sudden lack of trust between commercial banks, central banks all over the world implemented different measures to prevent the effects of financial crisis from spiraling out of control. Central banks had responded by easing the monetary conditions with conventional measures, but new methods were needed as the results from these measures didn't have enough impact. Most sovereigns resorted to quantitative easing with programs such as large-scale asset purchase programs (LSAPs) in United States or Securities Market Programme (SMP) in Europe (Eser & Schwaab (2016)), but to further signal the continuity of eased monetary policy new tools, such as forward guidance, were brought along. The decision to lower deposit rates to negative territory was a part of this set of tools and since each of them had different objectives, identifying the typical characteristics of the deposit rate is necessary to see the role of this tool in the big picture of unconventional measures, as well as describing the reasons why different sovereigns decided to implement it.

## **Policy rates / Lending Rates**

Central banks in Europe and elsewhere adjust their policy rates depending on the economic situation and even though the general term of “policy rate” is often used when describing central banks actions, there might be confusion to which policy rate they refer, as the features vary across the central banks. For this reason, we separate the properties of different policy rates and specify different rates used in different economies.

Policy rates can be generally divided based on whether the rate is used for deposits or lending and whether they are for short-term or long-term operations. Sometimes the deposit rate and lending rate are even combined – as in case of Riksbanks main policy rate, the repo rate, which is a rate of interest at which banks can either deposit or lend for a period of 7 days, whereas the term deposit rate is used only for overnight deposits in Riksbank. In comparison Federal Reserve’s main policy rate, the Federal Funds Rate, describes the average interest rate at which commercial banks lend overnight their surplus balances in the federal reserve accounts to other banks, a so-called interbank rate. Compared to Sweden’s main policy rate, it is not used for deposits at all and is a much more short-term rate which makes these two rates almost incomparable.

As the properties of the central bank’s main policy rates differ sometimes greatly, authors usually do not specify the rate that they are referring to but use general terms such as policy rate or nominal interest rates, when describing general changes in the interest rate level in academic papers. For example, Jobst and Lin (2016) use the term “marginal policy rate” which ECB moved to negative territory, but there is no specification what rate this marginal policy rate is referring to. This might be easily confused with ECBs marginal lending rate which has not been negative, like the deposit facility rate. Examples like this call for clarification since especially in case of the theory of zero lower bound it is critical to know whether we are referring to the deposit rate or lending rate when discussing the implications of going negative. However, when describing directional changes in monetary policy, the too-vague references can be more easily forgiven as deposit and lending rates usually move in the same direction within a certain margin. In ECB’s case the difference between main refinancing operations rate and deposit facility rate has varied but stayed within one percent margin whereas Riksbank has more strictly declared the deposit rate to be normally fixed at 0.75 percent lower than the repo rate. (Tarviiko sveitsistä myös esimerkkiä ja transition lopetus?)

## **Deposit rate**

As seen, the different policy rates used for lending differ sometimes greatly, but the often-overlooked deposit rate is as much of a policy tool as the lending rate as we see next. We cover the general

properties of the deposit rate and review how they were lowered below zero in the economies included in our study.

A deposit rate usually does not have similar short-term and long-term versions as lending rates and although commercial banks offer possibility to deposit for a fixed term, central banks generally have one deposit rate for overnight deposits. The differences might arise from how the bank treats the deposits that are required to deposit in the bank and reserves in addition to these required reserves. In ECBs case they use their main lending rate, the MRO-rate, for all required reserves and the deposit facility rate for all excess reserves. Therefore, the deposit rates can be divided to interest on required reserves, i.e. IORR, and interest on excess reserves, an IOER-rate, from which the former in ECBs case is positive, encouraging to meet the reserve requirements, and the latter negative, penalizing for excess reserves. The core reasons for why these two incentives were in place are numerous and are discussed later in this paper but some preliminary motives have been identified for ECB, and other central banks that decided to go negative.

### **Motives for Setting Negative IOER-Rates**

Several central banks in addition to ECB decided also to go negative during the period of 2011 to 2015, but as every economy has its own features, it is meaningful to inspect the variety of motives between central banks in Europe.

Denmark was the first country to go negative in 2012 and according to Turk (2016) Denmark, which pegs its currency to Euro, had incentives to penalize capital inflows and to prevent currency speculation. The next one to go negative was the European Central Bank in 2014 and there has been some discussion whether the decision was a truly a new and separate measure to induce monetary easing when other unconventional measures had reached their limit, as Demiralp (2017) suggests, or whether it was only part of forward guidance, strengthening the expected future level of low interests as Jobst and Lin (2016) present. Switzerland followed shortly ECB and Demiralp (2017) sees that the motives were similar to Denmarks, as the Swiss currency was under a lot of speculation during the recent years, making Switzerland to introduce an upper bound for currency appreciation in 2011. The introduction of negative rates in Switzerland coincided with the removal of the appreciation cap from Swiss franc (tähän lisää). The last of the central banks reviewed here, Swedens Riksbank, lowered its policy rate negative in 2015, using it to strengthen the credibility of its inflation target (Turk (2016)).

Several economies, especially the smaller ones, seem to have had some incentives related to their currency but ECB had different challenges. According to Arteta (2016) the ECBs purchase program was beginning to be constrained by decline of the net supply of eligible assets and the commercial banks were also hoarding excess reserves, preventing the transmission of lending to households. Arteta (2016) also provides a more overall view of the common reasons behind negative rates in Europe, by suggesting that spare capacity was still present in many advanced economies, inflation level was under targets and downside risks to growth were in sight, all which enabled for another policy tool to be added to combat the possible deflation.

### **3 THEORY OF TRANSMISSION AND CONSTRAINTS OF THE DEPOSIT RATE**

Economic theory has an established set of monetary policy transmission channels and although some of them have been under debate (see Bernanke (1995)), whether they can be described as real channels or merely amplifying factors, the original theories presented in this section still hold firm ground when monetary policy transmission mechanisms are discussed. The channels presented in this section are the ones most relevant to the deposit rate and were the deposit rates positive, these channels would be the only theoretical framework needed for this paper. However, as the rates have gone negative, presenting the theoretical framework for zero-lower bound and liquidity trap is also necessary as they play an important role how these channels operate during the NIRP.

#### **Origin of Zero Lower Bound and Liquidity Trap**

The definition of liquidity trap and zero lower bound has varied over time and sometimes these two terms have been mixed and used to describe the same phenomena. The term liquidity trap connects according to Boianovsky (2004) more strongly to the original definitions used by Keynes and Hicks where the interest rate floor was seen positive, whereas more recent approach sees the interest rate floor being at level of zero, therefore favoring the term zero lower bound. Eggertson and Woodfords (2003) definition of the liquidity trap and zero lower bound which are derived from the Wallace Irrelevance Proposition, was the most cited ones during their time but the original ideas presented by these authors can be traced back all the way to the 1930's to the traditional definitions of John Maynard Keynes and John Hicks. .... In this paper we separate these two phenomena and use the zero-lower bound as the base for our inspection of negative deposit rates.

## Theory of Zero Lower Bound

Hicks (1937): “If the cost of holding money can be neglected, it will always be profitable to hold money rather than lend it out, if the rate of interest is not greater than zero. Consequently, the rate of interest must always be positive.”

Introducing negative deposit rates has been an unorthodox move and to further understand the restrictions imposed by zero lower bound we use McCallums (2000) breakdown of zero lower bound to prove that, in addition to the logical assumption of consumers withdrawing their deposits in case of penalizing negative deposit rates, the lower limit to deposit rates derive from a budget constraint of an utility function. McCallum presents the equation followingly:

Households seek to maximize the following utility function:

$$u(c_1) + \beta u(c_2) + \beta^2 u(c_3) \dots$$

Constrained by the following sequence for  $t = 1, 2, \dots$

$$f(n_t, k_t) - tx_t = c_t + k_{t+1} - (1 - \delta)k_t + (1 + \pi_t)m_{t+1} - m_t + (1 + \pi_t)(1 + R)^{-1}b_{t+1} - b_{t+1} \\ + w_t(n_t - 1) + \psi(c_t, m_t)$$

Where:

$c$  = consumption during period  $t$

$f(n_t, k_t)$  = output from labor ( $n_t$ ) and capital ( $k_t$ )

$\delta$  = capital expenditure

$\pi_t$  = inflation  $\left(\frac{P_{t+1} - P_t}{P_t}\right)$

$m_t$  = real money balance at the start of period  $t$

$tx_t$  = lump – sum of taxes net of transfers from the government

$b_{t+1}$  = number of bonds purchased at period  $t$  for the price of  $(1 + R_t)^{-1}$

$\psi(c_t, m_t)$  = Reflects transaction

– facilitating properties of money (transaction costs)

Following the notation of McCallum (2000) and abridging some of the steps we focus on the last term of the equation  $\psi(c_t, m_t)$  and further diving in to the dynamics of this term, we can assume that increase in consumption increases the need of resources for the transaction services of money i.e.

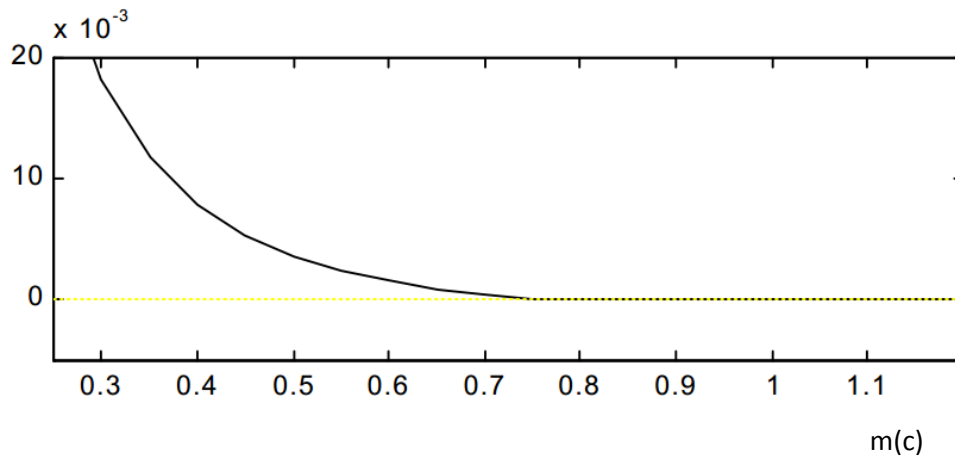
$\left(\frac{\partial(\psi(c_t, m_t))}{\partial(c_t)} > 0\right)$  and on the other hand an increase in the real money balance decreases the need and

the cost for these transaction services due to availability of cash on hand ( $\frac{\partial \psi(c_t, m_t)}{\partial m_t} < 0$ ). These transaction costs can be thought to be either direct costs of acquiring financing, “shoe leather costs” or lost time caused by not having the cash available.

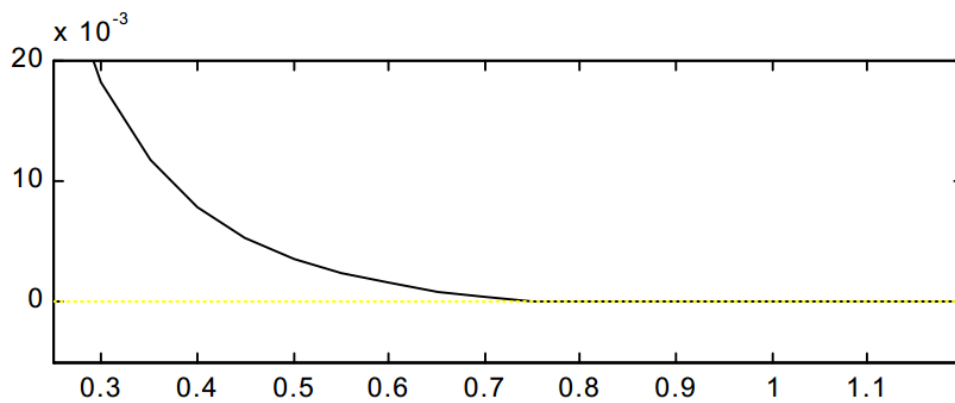
Next McCallum (2000) combines first order conditions with a market-clearing condition  $m_t = M_t/P_t$  producing the following equality, presented also by Friedman (1969),

$$R_t = -P_{t+1} \frac{\partial \psi(c_{t+1}, m_{t+1})}{\partial M_{t+1}}$$

which implies that interest rate  $R_t$  would be always positive, if the condition  $\psi_2 < 0$  would hold strictly. McCallum (2000) finds this implausible and presents that the marginal service yield, which can be also described as the inverse of marginal service cost  $-\psi_2$ , from holding money decreases as the amount increases compared to consumption, therefore making the  $\psi_{22} > 0$  over an extended range. After a certain point the marginal service yield drops to zero when no additional benefit is gained from holding extra money producing an upwards concave curve for the utility gained from holding real money similar to following:



With this McCallum (2000) provides a theoretical yet elementary example of how due to decreasing marginal service yields the amount of money held by household determines  $R_t \geq 0$  creating an effective ZLB for the one-period interest rate  $R_t$ . However, the author recognizes that due to storage costs related to large amounts of money, the interest curve could break the zero-lower bound but would remain only a few basis points in the negative territory in then-conceivable circumstances.



tee uusi kuva

This slight fall below the zero due to the holding cost of money is generally accepted by other authors and this lower-than-zero-bound has been also described as the effective lower bound.

Transition liquidity trappiin:

## Liquidity Trap

IS-LM kehikko kuva tähän ja havainnointi

Krugman (1998) defines the liquidity trap as a situation in which nominal interest rates are at or near zero therefore making conventional monetary policy ineffective. This is due to private sector viewing money base and bonds as perfect substitutes which is in accordance with Keynes' idea of liquidity preference becoming absolute at certain interest rate level. According Krugman this also makes it impossible for the interest rates to go negative because then money would dominate bonds as an asset. Buiter (2003) also sees that additional monetary easing by increasing real money balances would be pointless in the environment of zero interest rates, as the private agents would not change their investment or saving behavior due to the opportunity cost of holding currency being zero.

The ways to get out of this liquidity trap are not numerous, as conventional measures don't seem to have any effect, but as a resolution for economies caught in a liquidity trap and unable to lower the nominal rates furthermore, Krugman (1998) recommends creating expectations of inflation, which leads to a decrease in real interest rate and possible increase in real activity. Eggertsson and Woodford (2003) mainly agree with Krugman's definition of liquidity trap and the recommendation of increasing expectations of inflation and the statement that the zero lower bound is a genuine constraint in monetary policy.

As the definition of liquidity trap is part of a larger IS-LM framework, more thorough analysis how to derive it would be too inconvenient for the purpose of this paper, so we leave it to the definitions presented above. Liquidity trap is either way relevant in tandem with zero lower bound when inspecting the empirical results to see whether negative deposit rates are one of these unconventional measures that could be credited for breaking out of the trap. But for this purpose, we need to also define the transmission channels of monetary policy.

### **3. TRANSMISSION CHANNELS OF MONETARY POLICY**

We present three different mechanisms through which the adjustments in policy rates transfer to the real economy. These channels are not the only ones presented in economic theory nor are they equally important when comparing them from deposit rates point of view but all of them play their roles in the process and it is necessary to address them in order to see the broader picture especially when covering the channels related to bank lending. Although broader picture is necessary, we also limit our scope by excluding some transmission channels, which transfer the policy changes to prices and exchange rates, as they are not that relevant to bank lending but describe more broader effects in the economy. For the presentation of traditional interest rate channel and credit channel we use the definitions established by Mishkin (1996) and these definitions, as dated they are, have been under a debate but still hold their place in the basic economic theory. These channels give us a reference point which we can use to compare the empirical results to see whether they have operated as intended or if the negative rates have somehow affected these mechanisms.

#### **Traditional Interest Rate Channel**

TÄHÄN MYÖS KUVA IS-LM KEHIKOSTA?

Similarly, as the liquidity trap, traditional interest rate channel also bases on the Keynesian IS-LM view of how monetary policy transmits to real economy. The greatest difference between the IS-LM view and credit channel is that traditional interest rate channel takes into account the real interest rates in addition to nominal rates. Since the model puts more emphasis on the real and long-term rates rather than short-term nominal rates, this gives more room for the short-term nominal rate to move, even below the zero. The nominal interest rates are not entirely unnecessary though, since in this channel an impact in short-term nominal rates causes also an impact to real rates through sticky prices. This move in real rates is assumed to affect directly to spending and investments therefore transmitting to the real economy. The assumption is that low interest rate environment encourages companies to invest but also households to spend on durable expenditure and housing, which could also be

considered as investments. These long-term asset purchases however proved to cause controversy with empiric results.

## **Credit Channel**

One of the most notable papers regarding the idea of credit channel was first published by Bernanke and Blinder (1988) as they raised some discrepancies in the IS-LM-model, but it wasn't until later, when Bernanke (1995) properly defined this channel. One of the discrepancies in the traditional model was that according to the IS-LM-model monetary policy shocks should have more effect on the short-term interest rates than long-term rates but on the contrary the empirical results say that these shocks mainly affect the purchases of long-term assets. This led to the presentation of two extensions to the traditional interest rate channel. Bank lending channel and balance sheet channel. Both of them are considered by Bernanke to be amplifying factors to the traditional interest rate channel, rather than completely separate or substitutive channels. In addition to the level of significance, different alternatives to the definitions have also been presented, one of them being the division to the broad and narrow credit channel, as presented by Oliner & Rudebusch (1996), who see empirical evidence for the existence of broad credit channel which acknowledges other sources of external financing part of the theory, not just the loans extended by banks, as would be in the narrow bank lending channel. Whether the credit channel is an independent channel or an amplifying factor, it is nevertheless relevant to inspect them in tandem with the traditional interest rate channel as they together explain the possible routes of monetary transmission. We use the definitions presented by Mishkin (1996) yet leave possibility for further speculation of their accuracy to the discussion section. TOISTOA?

## **Bank Lending Channel**

The mechanisms of bank lending channel and balance sheet channel both originate from the bank's special role as a solver of asymmetric information in the markets, but the chain of events triggered by monetary policy adjustments are different.

Bank lending channel explains the increase of investment and spending caused by expansionary monetary policy to be due to the assumption that increasing bank reserves also automatically increases the quantity of bank loans available and that these loans transfer to investments and spending. This assumption is more relevant when there are no substitutive fund sources for bank lending, so the effect should be less potent in economies with market-based financial systems and larger share of big businesses that gain funding from stock and bond markets instead of banks. This channel can be described as the narrow credit channel, which puts more emphasis on the banks as the generator of loan even though other external sources of funding are available. Oliner & Rudebusch

(1996) speak for the broad credit channel, which takes into account also the external finance premium caused by balance sheet changes.

### **Balance Sheet Channel**

The transfer mechanism of balance-sheet channel can be seen inverted compared to bank lending channel. The adjustment of interest rate is assumed to effect bank lending indirectly by making the businesses appear less or more risky to lend to. First, the interest rate adjustments affect the profitability of businesses by lowering or increasing the total interest costs and secondly it affects also the calculated present value of assets due to the variation of the discount factor used in the present value calculations. These two effects overall affect the net worth of the company and in case of expansionary monetary policy this net worth increases, which in turn decreases the agency costs related to the information asymmetry in bank lending therefore increasing the quantity of loans and investments made. This decrease in the external finance premium, the cost of acquiring financing, causes the companies to seek more loan from external sources, such as banks, which in turn boosts economy.

These three different channels all operate from the same starting point, the adjustment of nominal interest rate, but together they explain the same phenomenon from different points of views and how the monetary policy transmits to the economy. As we have covered the properties of the deposit rate, possible transmission mechanisms and the restriction suggested by theory, we can start inspecting the empirical results to see what might have been the effects of these negative rates.

## **4 EMPIRICAL FINDINGS**

(ehkä ekana transmission mechanismien muutos ja sit profitability ja behaviour?)

For this section we review the results of empirical studies conducted in the area of European Monetary Union during the period of negative interest rates and we inspect how the negative deposit rates have affected the transmission mechanism presented above and if the negative rates have affected bank lending as suggested by the theory. We also present possible changes in the behavior and risks related to banking sector to see if there are any adverse effects that could be resulting from breaking the zero-lower bound on central banks deposit rate.

### **Bank Behavior and Profitability**

After the introduction of negative deposit rates in central banks, changes to the same direction have been identified similarly in the deposit rates of commercial banks, but there has been reluctance to transfer these rates completely to negative territory for different reasons. Demiralp (2017) presents

that in addition to the possible withdrawal of deposits in case of negative deposit rates, banks also have other cost inducing factors that could prevent them from lowering the rates negative. One of them could be institutional legal barriers and taxation issues in some jurisdictions when applying negative rates, but also company specific issues, such as the IT-systems not recognizing negative rates, could be an obstacle. This reluctance squeezes the margins of the banks and also affects their profitability. Jobst (2016) raises concern of the effects deriving from a general low interest rate environment and presents that the higher asset values and increased aggregate demand might not in the long run be enough to compensate for the profit losses of banks. In addition to the profit erosion, Arteta et Al (2016) present that aggressive risk taking might increase in the search for yield.

When examining the effect on bank profitability, Turk (2016) presents that based on financial statements from Swedish and Danish banks there has not been significant weakening of profitability during the era of negative interest rates. The interest income has expectedly declined, but it has been offset by cost-cutting and increased fees. Lopez's (2018) cross country analysis results from European and Japanese banks comply with Turk's view of steady profits and Arteta et Al (2016) also find no signs of financial instability, although they raise concern for the potential consequences on the long run. Heider, Saidi and Schepens (2017) claim that these potential consequences could be more imminent with high-deposit banks, as they take more losses from the narrowing of interest margins than low-deposit banks, but there has been also countering results from Lopez et al (2018), who see that high-deposit banks are not more vulnerable to negative rates than low-deposit ones. As for now, in a recent bank lending survey by ECB (2018) a majority of commercial banks agreed that the negative deposit facility rate has affected considerably their net interest income but had a slight positive effect to the volume of loans.

[https://www.ecb.europa.eu/stats/ecb\\_surveys/bank\\_lending\\_survey/pdf/ecb.blssurvey2018q4.en.pdf?63ba47ba8381869b17969ebbf7608da1](https://www.ecb.europa.eu/stats/ecb_surveys/bank_lending_survey/pdf/ecb.blssurvey2018q4.en.pdf?63ba47ba8381869b17969ebbf7608da1)

Transition?

## **Bank Lending**

Even though the low interest rate environment should generally encourage loan taking there have been mixed results from different economies. Turk (2016) finds a parallel relationship with the declining lending rate and interest rate in Sweden, whereas in Denmark the lending rate was mostly unchanged during the time of substantial rate cuts but in the end also declined. Demiralp (2017) on the other hand received results of increased lending throughout the euro area. The lending rate can also vary depending on the nature of the bank. Heider, Saidi and Schepens (2017) for example found

that high-deposit banks lend less during the period compared to low deposit banks and according to Demiralp (2017) banks in more “vulnerable” countries such as Greece, Ireland or Spain had higher increase in loan extension compared to banks in less-vulnerable countries. When inspecting the rate at which commercial banks extend loans, a demand-supply framework should be kept in mind, as the amount of loans extended comprises of the sum of demand and supply. A factor to affect demand should be

kesken

### **Transmission of Monetary Policy**

Bräuning & Wu (2017) has similar results as Demiralp of increased loan origination and also points that price changes in riskier assets become more volatile during NIRP-period. Jobst and Lin (2016) describes the credit expansion caused by negative rates in the Euro area to be “modest” at best but see more improvements in the overall financial conditions.

Arteta et Al (2016) see possible adjustments in the transmission channels of monetary policy, partly to positive but they see also possible negative aspects. As for the traditional interest rate channel penalizing cash hoarding with negative deposit rate the commercial banks might be encouraged to weigh more on long dated bonds therefore lowering the real interest rate more effectively and causing more activity in the real economy. (lisää tähän)

For the bank lending channel Arteta et Al (2016) fear that although cash hoarding penalty should encourage lending, the lower profitability and diminished capital base of the banks might cause reluctance to lend more and also an increase in the rates to cover possible losses caused by negative rates. Bräuning & Wu (2017) oppose this view as their study concludes that in all countries in the Euro area the introduction of negative rates has increased the transmission of policy rate cuts to loan origination and rates, especially in loans with longer maturities.

## **5. DISCUSSION**

After reviewing the theoretical transmission mechanisms related to deposit rate and comparing the several empirical results of different studies, we can conclude that lowering deposit rates to negative

territory has been somewhat successful monetary policy move, although it has met some resistance in the banking sector. The resistance can be traced back to theory of zero lower bound, which has prevented the negative rates from transferring completely but yet remains unclear if the zero lower bound is as binding as thought to be.

The literature covered in this paper mostly addressed the negative interest rates at least from some perspective, but a considerable amount of them failed to specify the exact interest rate they were referring to in the texts. We reviewed the main policy rates of different central banks and almost all of them had different properties, therefore making it harder to compare what would be the effects of going through the zero-lower bound as the outcomes vary greatly between loan rates and deposit rates. In case of deposit rates, the zero-lower bound in theory presents a genuine restriction if utility maximizing consumers withdraw all their deposits to counter the penalty of negative deposit rate. This has not been completely tested empirically, since banks did not transfer these negative deposit rates all the way to consumers, but we can see that the negative rates transferred smoothly to interbank rates, which shows that banks are willing to use negative rates when lending to each other. The reason why central banks can impose negative interest rates to commercial banks is that the banks do not have a similar option of withdrawing their deposits mainly due to the sheer amount of cash and the storage costs related to them. The option to “switch” central banks is not as easily done as consumers can switch between banks.

The different positions banks and consumers are when comparing the ability to withdraw their deposits raises a question if there are possible solutions to transfer the negative rates all the way to consumers, encouraging spending or investments – effectively eliminating the zero lower bound. One of the most radical ideas would be the solution presented by Buiter (2009) – removing cash from the society and therefore forcing the consumers to the same position the banks are currently. Buiter also presented other less radical ideas, such as placing a tax on currency or introducing a second currency and discounting them by manipulating the exchange rate, but implementing these solutions would be problematic due to the administrative costs related to them. At the current time even though electronic currency dominates physical currency these ideas still seem a bit far-fetched and other solution to diminishing growth should be looked from elsewhere.

By shifting the focus from how to break the zero lower bound to how we could utilize the transmission channels presented in this paper, **other solutions can be found** to boost economy in times of need with the interest rate levels at zero or negative. One of **the possible solutions can be found** by inspecting how the zero lower bound affects other types of interest rates, such as refinancing rate or lending rate. We suggest that the interest rate for loans is not restricted by the zero-lower bound at

all. A simple example is when we think of Friedmans concept of helicopter money – transferring money straight to the economy and bypassing the banking sector. Helicopter money can be thought also as a bullet loan with negative interest rate of 100 percent, and if the central bank were to give these self-reimbursing loans to the consumers, there would not be similar strict limit or difference between whether the interest rate is positive or negative 0.1 or 100. The consequences of risk and inflation in the economy would intensify when moving towards negative 100 percent interest, but on less negative levels there is no similar “strict” restriction as with deposit rate, because the zero-interest rate “paid” on cash does not play any role in the decision-making process of lending – only in deposits. Noteworthy is that if this helicopter money would be distributed via banking sector by making these self-reimbursing loans, then there might be differences between the rates given for consumers due to the profit margins of banks, but competition should drive the market rates at least close to the original interest rate given by the central bank.

(lisää kohta että talletuskorko täytyy olla aina pienempi kuin lainauskorko)

This previous example shows the point emphasized already many times in this paper, that if the effect of zero lower bound is this different depending on the type of interest rate, then it should be clarified in the economic theory how zero lower bound only takes effect when discussing about deposit rates.

#### TRANSMISSION CHANNELEISTA :

The monetary transmission channels presented by Mishkin (1996) in this paper showed that there are different ways the deposit rate changes can transmit to the real economy and we suggest that the uncertainty, cash hoarding and increased balance sheets of the commercial banks caused by the financial crisis have brought changes to the rules of law of these channels – not the introduction of negative rates itself. Another point to be made out is that these channels, especially traditional interest rate channel, also play part when mapping the transmission of changes in lending rate and therefore it is important to emphasize that if it were not for the financial crisis’ aftermath that changed the rules of law, there would not be a certain specific channel that deposit rate operates through, if there is no need to adjust the levels banks have excess reserves in the central bank. In certain sense the thought of traditional interest rate channel being the main transfer mechanism and the criticism received by credit channel of being merely an amplifying factor would normally be correct. But during the last decade we suggest that the importance of bank lending channel has increased greatly and at the same time it can be also seen as “broken”.

We identified the bank lending channel, which had one critical assumption and it is that increasing banks reserves automatically transmits to lending. So, when the banks refused to transmit these new

reserves to real economy, we can say that the bank lending channel was broken before the introduction of negative rates, and the penalty of negative rates was used specifically to unclog this transmission route. This calls for a review of the theory regarding bank lending channel since it seems to operate entirely differently when banks face great uncertainty and reduce lending, even if their reserves grow. It could be argued that negative deposit rates should be therefore used only if there is an accumulation of reserves in commercial banks or in the economy, otherwise the economy can be boosted with negative lending rates, as suggested in the previous section with helicopter money.

The traditional interest rate channel and balance sheet channel both are overshadowed by the bank lending channel when referring to the deposit rate.

The negative rates did not transfer completely to the customers therefore narrowing the margins banks could use to make profit but in the end seems like in Europe the banks have adjusted their costs and fees to counter this problem.

Liquidity trap? Miltä riskit ja tuotot näyttää mikä tulevaisuus.

The last question to be discussed is related to the liquidity trap and the future of European economies. As seen, the negative deposit rate has been only a part of the measures taken to get economy back on its track and European economies have indeed grown for almost a decade but worrying is that another downturn seems imminent with the monetary policy being still lax. The question is how can the economy be helped if majority of the measures taken are still being used – have we fallen into a liquidity trap as described in this study? The answer is.....

Krugman's (1998) definition of liquidity trap has been correct in that the conventional measures are not sufficient when nominal interest rates are close to zero, but the notion that negative interest rates are not possible because money would dominate bonds as an asset, has been incorrect. Both in 2016 and now 2019 a record high number of bonds according to Financial Times have had negative yields and investors are prepared to pay a price for them. The possible explanation might be that zero is not the effective lower bound and there has been support for this thought, that the rates could still go a bit more negative (tähän oli joku lähde.....) This might not be the case in long-term, according to McAndrews (2015) who sees that prolonged period of negative interest rates might force the investors

to innovate new means of lowering the holding costs associated with storing physical money, therefore moving up the effective lower bound closer to zero.

Kesken...

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