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Master Thesis

Negative interest rates

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Table of contents

1 Introduction

In the aftermath of the financial crisis of 2008, several affected countries lowered their policy rates substantially as a way to stabilize the economy and decrease negative output gap. Central banks initiated large scale asset purchases, also called quantitative easing (QE), including purchases of private assets, such as corporate bonds, asset backed securities and equities. Hence, many countries reached policy rates close to zero, also called the zero lower bound. However, over time they failed to reach the wanted economic outcomes, with respect to indicators such as inflation, employment and output (IMF, 2017).

With fiscal policy initially after the crisis in 2008 being expansionary, including large scale stimuli packages, increasing public debt levels have for many governments exhausted the possibility of expansionary fiscal policy because the goal to control budget deficits have taken precedence. Therefore, it has fallen on the central banks to influence the economy through monetary policy (ibid).

Holding policy rates at or above the zero lower bound, hence implies that the central banks' ability to use monetary policy as a tool became exhausted after policy rates reached zero in the aftermath of the crisis. This have lead many central banks to experiment with negative interest rate policies, hence breaking the zero lower bound (ibid).

The countries who have implemented negative interest rate policies in the recent years are: Sweden, Japan, Denmark, Switzerland, Bulgaria and the euro area, each with different stated motivations (ibid).
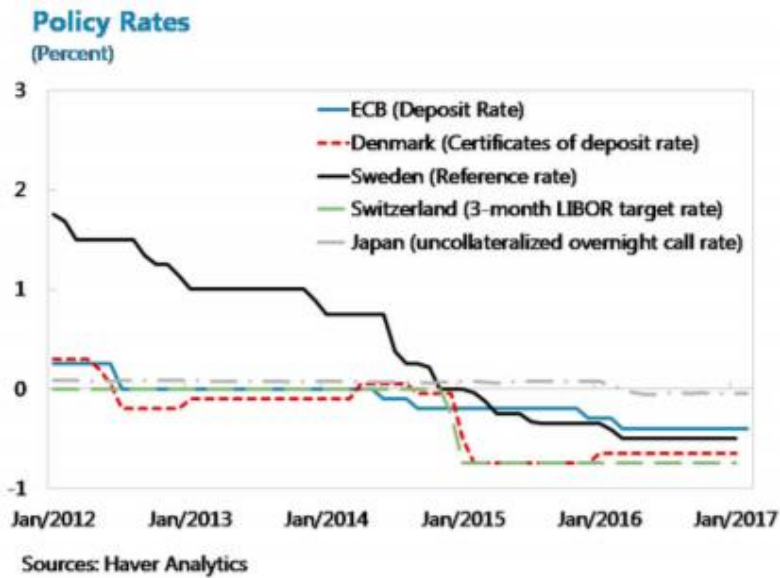
Figure 1. Policy rates for selected countries. (IMF 2017 p.4)

The first country to implement negative interest rate policies was Denmark in 2012, followed by several other countries. Common for all where inflation below the target, and hence a wish to increase inflation. Also for the case of Denmark, who maintain a peg towards the Euro, defending the peg were a core reason. Switzerland's goal was twofold: Both to support growth and inflation and to reduce the attractiveness of the Swiss franc, hence stemming appreciation pressures (ibid).

2 Motivation for research

Following the lacking effect of monetary and fiscal policies on economic variables, and the ongoing low interest rates worldwide raises the question on other ways on stimulating the economy. In this regard finding conclusive evidence on other stimuli is important in determining its effect and its importance in stimulating the right variables in the economy.

3 Preliminary outline

At the moment our research aims to highlight how negative interest rates have affected banks transmission mechanism (i.e the link between the

monetary policy and macroeconomic indicators). In the first part of the thesis, we will describe monetary policy and its traditional theory in positive interest territory. We will look into how positive interest rates affect the economy to build a solid framework before delving into NIRP regime. In the second part we will present empirical findings by looking into the experiences from other economies which have enforced a negative policy rate, and how this have affected their transmission mechanism. In the last part we will compare these results to establish whether theory is in accordance with empirical findings.

4 Overview of literature and key theory

4.1 Why do people hold money? Money preference function

One unresolved question in macroeconomic theory is why people hold money, even though it does not pay interest (Heijdra, 2009, p. 14). Theory suggests that there exist three main motives, the transaction motive, the precautionary motive and the speculation motive. The transaction motive is quite intuitive. Household's income is given at certain intervals, for example salaries being paid once each month, but people at the same time prefer to smooth consumption over the month, hence people hold money to use between pay cheques. The precautionary motive is just that households hold reserves to pay for unforeseen expenses. The speculative motive implies that households hold money to use in the event of unforeseen opportunities for buying consumer goods at good prices or good opportunities for investment (Dedekam, 2004).

One can easy represent this through a simple liquidity preference function $l(y,r)$, as a function of output and interest rate, increasing in y and decreasing in r.

A very basic, explicit function can be:

$$M^D = l_y y + l_r r \qquad l_y > 0, l_r < 0$$

Where M^D is demand for money. If we solve this equation with respect to r we get:

$$\boldsymbol{r = \frac{1}{l_r} M^D - \frac{l_y y}{l_r}}$$

This gives us the LM curve (L stands for liquidity and M for money), and shows equilibrium Interest rate as a function of output (Dedekam, 2004).

4.2 Zero Lower bound

From December 2008 to December 2015, the target rate for the standard instrument of U.Ss monetary policy, the federal funds rate, was fixed at 0 to 0.25 percent, a level that was by the Federal reserve viewed as an effective lower bound (B.S Bernanke & Reinhart, 2004). This based on an assumption that nominal interest rates is bounded below by zero, also referred to as the zero lower bound. This is also in line with standard economic models, who assumes that the nominal rate of interest must be non-negative (Walsh, 2017).

To understand why we can consider a typical budget constraint for the representative household.

$$y_t + \frac{(1+i_{t-1})b_{t-1}+m_{t-1}}{1+\pi_t} + \tau_t = c_t + b_t + m_t$$

Can be written as:

$$y_t + (1 + r_t)d_{t-1} + \tau_t = c_t + (\frac{i_{t-1}}{1 + \pi_t})m_{t-1} + d_t$$

Where $1 + r_t$ is the real interest rate $= \frac{1+i_{t-1}}{1+\pi_t}$

Recursively solving this equation forward gives:

$$d_{t-1} + \sum_{i=0}^{\infty}\prod_{j=0}^{i}(\frac{1}{1+r_{t+j}})(y_{t+j} + \tau_{t+j}) \geq \sum_{i=0}^{\infty}\prod_{j=0}^{i}(\frac{1}{1+r_{t+j}})\left[c_{t+j} + (\frac{i_{t+j-1}}{1+\pi_{t+j}})m_{t+i-1}\right]$$

This intertemporal budget constraint requires that the household's current assets plus the present discounted value of current and future income be greater or equal to the present discounted value of current and future consumption, plus the cost of holding money.

However, if the interest rate i, is negative, the household does not face a bounded budget constraint (Walsh, 2017, p. 510). In this scenario, the household can increase both consumption and money holding without limit and without violating the budget constraint. As long as the marginal utility of consumption is positive, which is assumed, the household can increase both consumption and the holding of money. Taking interest rates as given, the household will have an unbounded demand for money, and the maximization of the utility function does not have a bounded solution. Hence, at a negative nominal interest rate, demand for money should be infinite (ibid, p.511).

While the standard models impose a zero lower bound, we obviously today know that negative nominal interest rates have been observed. One way to explain how negative nominal interest rates is possible is to assume a cost of holding cash. An example of this would be costs tied to things such as storage and safeguarding. This way one can dissuade households hoarding cash in the event of negative nominal interest rates (ibid, p.512).

4.3 Liquidity traps

The situation when the nominal interest rate equals its lower bound, conventionally assumed to be close to zero is called a liquidity trap. A liquidity trap is in Keynesian economics described as a situation where injection of cash by the central bank into the private banking system fails to decrease interest rates, and hence makes monetary policy ineffective. This is caused by households hoarding cash because they expect an adverse event such as deflation, insufficient aggregate demand or war. Hence, fluctuations in money supply fails to create fluctuations in prices (Walsh, 2017).

Since money yield a nonpecuniary utility that bonds do not, and bonds pay a nominal interest rate that money do not, if the interest rate is very low, then households would become indifferent between holding money and bonds (Walsh, 2017, pp. 512-513). The liquidity preference function would in this case become perfectly elastic (Heijdra, 2009). This can be shown if we look at the LM curve derived in 4.1. The slope is $-l_y/l_r$, wich is decreasing in l_y. If l_r becomes big enough the LM curve becomes horizontal. In this case, an increase in money supply does not affect interest rates, and monetary policy becomes ineffective (Dedekam, 2004, p. 246).

4.4 Review of literature

As proposed above, most macro models explicitly impose a zero lower bound on the interest rates set by the central bank. However, new research tries to model this effect by adapting a new Keynesian DSGE model, allowing the interest rate to go below the traditional lower bound. In a working paper by Eggertsson, Juelsrud, & Wold (2017), they raise the question whether negative interest rates have a contractive affect. Important for the paper is the fact that banks with high deposits shares have lower credit growth; which hampers banks reaction to lending rates. Furthermore, as holding cash can

be costly in form of safekeeping in a private or public safe, this implies that there exist a lower bound on deposit rates in negative territory. This means that hoarding cash might not be an option in the existence of storage costs when deposit rates are negative, at least in the short run.

By using impulse responses, the paper models how an exogenous decrease in marginal utility of consumption affect the policy rates set by the central bank. For comparison they construct three different models. A Standard model where there is a lower bound on both policy rate and deposit rate. A frictionless model, where both policy rate and deposit rate can go below zero by the same amount. And lastly the negative model, where only policy rates can go below zero, and deposit rates are bounded at zero.
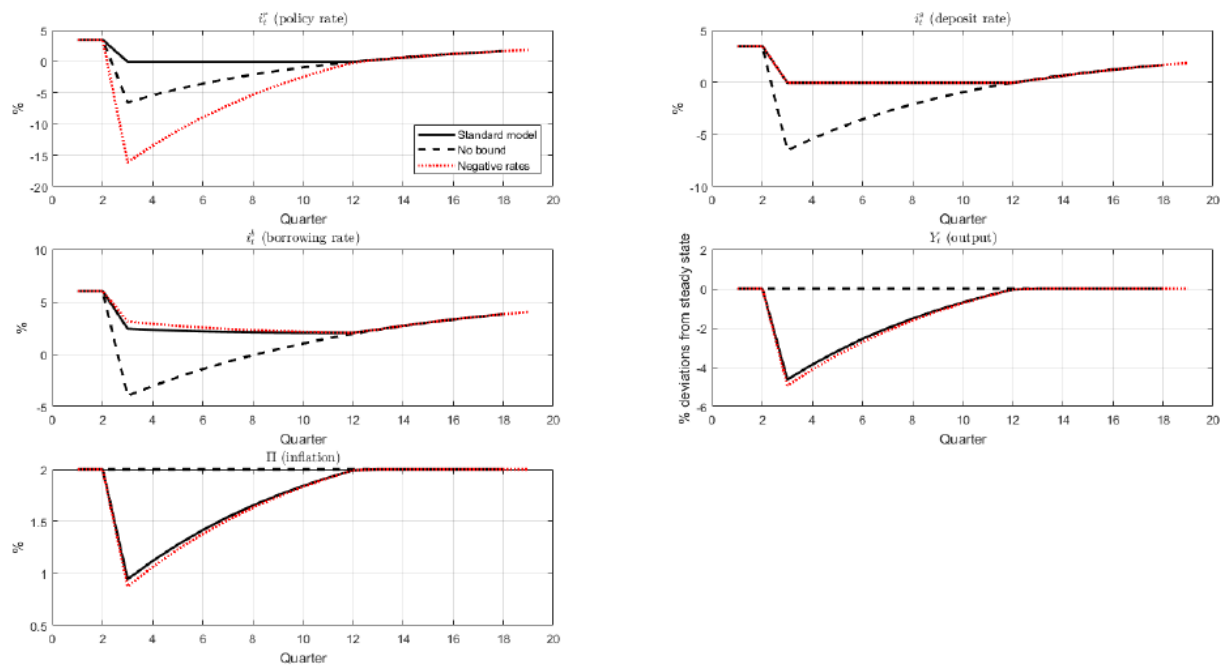

Figure 2 Impulse responses. (ibid p.29)

Endogenously the central bank reacts by lowering the policy rate to the exogenous shock. Given the type of model we can see different reactions in the market regarding output and inflation.

Looking at the graphs it seems to be little difference between the standard case and the negative rate model. However, in the negative case, the red dashed line drops little more in output and inflation than the standard case (black line). Reason is because, banks hold cash in reserves so they can ease intermediary costs (i.e. fees), and when they are charged for holding these reserves, banks profits are lower in the frictionless model. This decline in banks' profits is translated into a decrease in aggregate demand, and is the reason why negative rates reacts more than in the standard model. The authors considers this to be potentially contractionary. Furthermore, to compensate for the loss in profits the model also depicts that borrowing rates increase when policy rates are negative. This is in line with empirical findings for Sweden and Switzerland, where interest rates increased at the news of negative policy rates. However, this could also be a pricing problem as there is no consensus towards how to price in this environment. More on this in empirics.

Bernanke (2007) discussed in a speech given at the federal reserve bank of Atlanta, that banks should lend more and take less risk when policy rates is reduced. Furthermore, when interest rates are lowered, banks net worth increases. This is because the lower policy rates is translated into the debt side of the balance sheet of banks. By increasing the debt value in PV terms, the difference between the asset side and the debt side increases their net worth. This in turn relaxes the banks financial constraint, and consecutively increase lending and reduce risk taking. Other literature by Heider, Saidi and Schepens (2016) recognize that after ECB set deposit facility rates below zero to -0.1% in June 2014, banks with high deposits focused their lending to more riskier firms in the form of syndicated loans (i.e group of lenders cooperate to form a single loan to one borrower).

Contrary to Bernanke's view. Lowering of the policy rate should increase net worth of the banks. However, when it goes into negative territory (which is a

case of lowering the policy rate) the opposite happens. Reason is that banks are reluctant to impose negative rates to their depositors in fear of cash withdrawals, thus lowering of short-term debt no longer occur. Consequently, banks find it more difficult securing funding from outside options, thus lending decrease. This in turn reduces banks incentive of cautious behavior, and riskier loans to previously credit constrained firms occur in form of syndicated loans. Furthermore, this new environment has caused the volatility on stock return to increases and CDS spreads to widen for the high deposit banks, also "safe" borrowers shift from high deposit banks into low deposit banks. Since high deposit banks can lend to credit constrained firms, it prevents them from being rationed out from the market. Empirically, firms receiving loans from high deposit banks are able to downpay loans taken after june 2014, and are no less profitable than firms lending from low deposit banks.

4.5 Comparing remarks

Findings from the paper by Heider, Saidi and Schepens (2016) is conflicting to what is found in Eggertsson, Juelsrud, & Wold (2017) working paper where negative interest rates are possibly contractionary. On the one side Eggertsson, Juelsrud, & Wold mean that this is so because of the transmission cost that subdue profits when introducing negative interest rates (modelled above). On the other side Heider, Saidi and Schepens conclude that negative rates can seem contractionary at first sight. However, they do find that credit constrained firms, that were not able to borrow before, now experiences a higher growth rate of investment which might "stimulate the economy in an unexpected, but crucial way" (Heider et al., 2016, p. 29). However, the long-term effects of undertaking riskier loans are still unclear, especially with regards to financial stability, and its implications for stable growth.

5 Empirical

Several countries have had negative interest rate policies for a few years now, and one can start to analyze the result of the policies. Key is to analyze the implications of NIRP for monetary transmission mechanisms and bank behavior. Questions particularly arises to the way banks set its interest rates, both on deposits and on lending, and whether one can observe a lower bound on these. Data is primarily from IMF policy paper "Negative interest rate policies-initial experiences and assessments" (2017).

5.1 Effects on deposit rates

Deposit rates mostly remains positive, although seem to have been reduced substantially for some countries (Particularly the euro area and Sweden). There seem to exist a zero lower bound on deposits, one can imagine due to both the danger of cash hoarding, and consumers being unwilling to pay money for depositing cash. However, in some cases banks have charged negative rates on large deposits with presumably higher cash storage costs. Banks has also bypassed the effective lower bound on retail deposits by imposing higher fees (ibid, p.18).
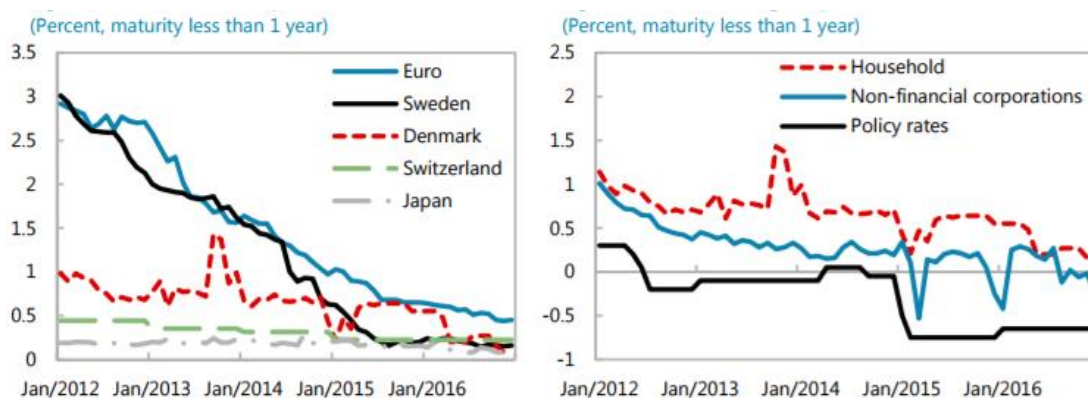

Figure 3 Left: Household deposit rates. Right: Rates on large deposits, Denmark. (IMF 2017 p.19)

When it comes to household deposits there seem to exist a zero lower bound, but rates on large deposits can be negative (At least in Denmark).
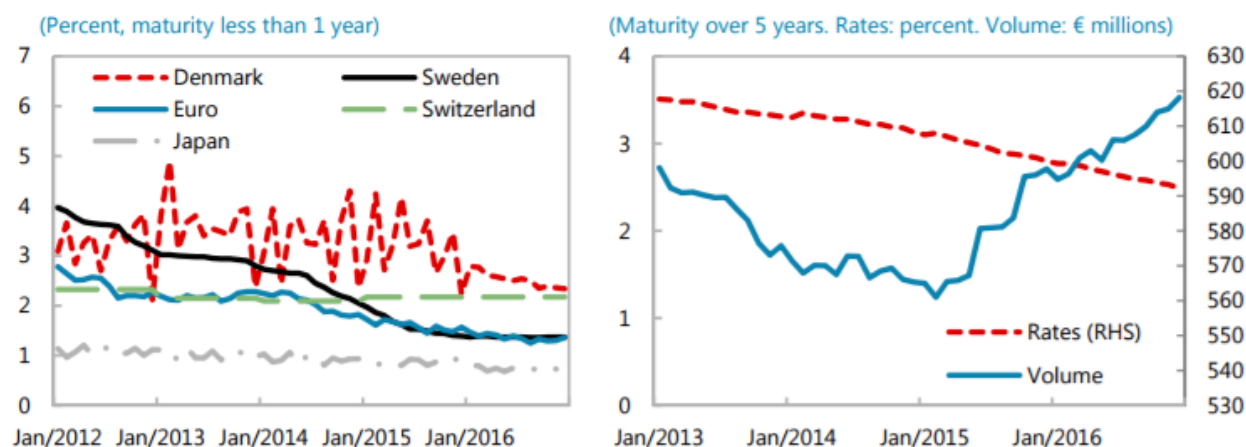
5.2 Effect on lending rates

Figure 4 Left: Lending rates. Right: Mortgage rates and lending volumes in Euro area. (IMF 2017 p.19)

Lending rates have declined somewhat in all the countries where NIRP have been implemented, they however remain positive. Countries within the euro area with higher shares of flexible rate loans, such as Portugal, Spain and Italy saw higher pass-through of policy rates to lending rates. The figure on the right shows that although long-term mortgage rates in the euro area have stabilized since the middle of 2015, lending volumes have increased, not contracted. This might be because NIRPs induce banks to search for yield (ibid, p.18).

5.3 Effect on Exchange rates

It should first be noted that measuring the effect on exchange rates is difficult, as many factors influence this. In the IMF policy paper on negative interest rate policies they examine the effect on exchange rates in the immediate aftermath of the implementation of NIRPs for the countries mentioned earlier. This examination gives mixed results on the exchange rates. In many cases there have been some depreciation in exchange rates. However, they do

point out that overall, movements in exchange rates appear to have been short lived (ibid, p.19).

5.4 Effect on banks net interest margins

Banks net interest margins seem to show resilient patterns. In Japan and the euro area they have declined somewhat, though not significantly. In Denmark and Sweden margins have remained stable, while in Switzerland they seem to have increased. The IMF policy paper points towards different reasons across countries. In japan and Switzerland banks benefit from a tiering system aimed at reducing the amount of reserve balances subject to negative rates. In Denmark lower policy rates have not been entirely passed through to lending rates, while in Switzerland mortgage lending rates temporarily increased.
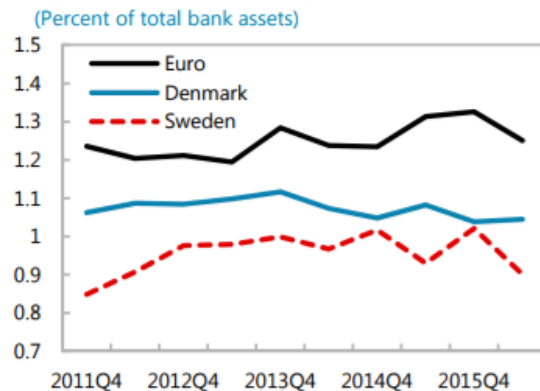
(Percent of total bank assets)

Figure 5 Net interest margin as percentage of total bank assets. (IMF 2017 p.22)

Overall, there do not appear to be a clear visible relationship between policy rates and banks net interest margins over time.

5.5 Effects on banks profitability

The IMF policy paper points toward bank profit being mostly unchanged. Where interest margins have taken a small hit, Japan and the euro area as pointed out above, profits have been buoyed by other factors (ibid, p.23).

13

These including a mix of higher lending volumes, fees and commissions, cost cutting measures, capital gains and lower provisioning costs warranted by borrowers with improved balance sheets (ibid, p.24).
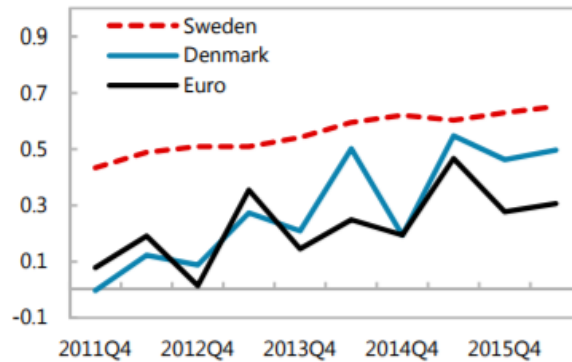

Figure 6 Return on bank assets. (IMF 2017 p. 22)

However, the IMF paper does point out that if NIRP should persist or rates be cut further, bank profits could eventually be constrained.
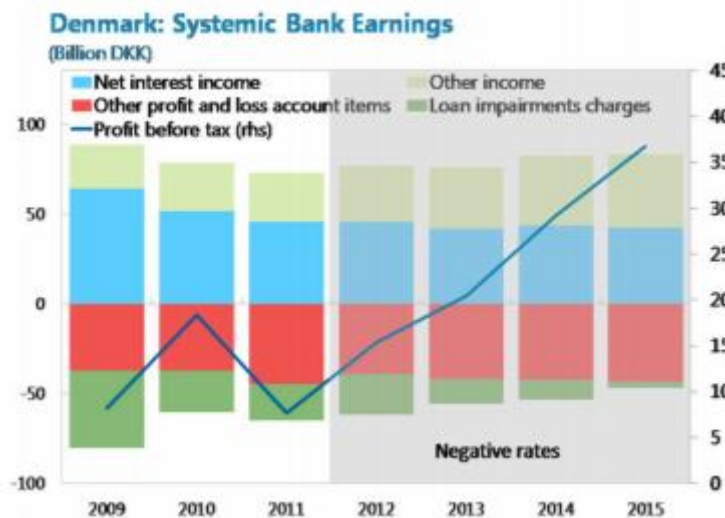

Figure 7 Systematic bank earnings. (IMF 2017 p.29)

We see that in Denmark profits appears have increased after setting negative rates, due to "higher fee income and low impairment charges" (ibid, p.29).

5.6 Effects on some macroeconomic indicators

Inflation or the outlook for inflation seem to have improved for the case of the euro area, Sweden and Switzerland, while in Japan headline and core inflation has continued to fall.

In Denmark, appreciation pressures towards its currency have been reduced and the peg towards the euro has been successfully defended. In addition, it should be pointed out that there do not appear to be any signs of cash hoarding in any of the countries pursuing NIRPs (IMF, 2017).

6 Conclusion

In conclusion, we see that there exist some conflicting views regarding how negative interest rates affect economic factors, which makes NIRP an interesting case to study. The main concern between scholars is whether NIRP is expansionary or contractionary?

7 References

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