EFFECT OF NEGATIVE INTEREST RATE POLICY (NIRP) ON BANK PROFITABILITY: CROSS-COUNTRY ECONOMETRIC STUDY

by

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Abstract

The Negative Interest Rate Policy (NIRP) introduction was dictated with an expansionary motive of the central banks. Unconventional monetary policy is still not fully analyzed, and there are no signs that in the future policy rates might become positive. This essay investigates the impact of NIRP on bank profitability, Return on Assets (ROA). The difference-in-difference estimation method showed a small and insignificant decrease of ROA of banks in those countries where NIRP was conducted. Two effects contribute to this result. First, net interest-related income dropped for the treatment group banks. Secondly, banks offset a reduction of interest-related profits by an increase in non-interest income, which includes commissions and fees.

1. Introduction

The global financial crisis of 2007-08 depressed worldwide economies. Stimulation of economies was one of the aims of central banks and governments. In addition to fiscal policies, central banks had also conducted monetary policies, which included unconventional measures. These are massive asset purchases from open markets (quantitative easing), forward guidance, and, recently, negative interest rate policy. In June 2014, European Central Bank (ECB) announced that it will lower the deposit facility rate below zero. The similar cuts into negative territories were followed by the central banks of Sweden, Denmark, Switzerland, and Japan.

Reasons for introducing NIRP differed across central banks. European Central Bank lowered the deposit facility to keep the inflation rate at a targeted level (Draghi 2014, Bech and Malkhozov 2016). Similarly, the central bank of Sweden (Sveriges Riksbank) adopted NIRP to support inflation and long-term inflation expectations (Riksbank 2015). On the other hand, the Swiss National Bank (SNB) introduced negative rates to fight domestic currency appreciation. A similar justification was used by the central bank of Denmark (Beck and Malkohozov 2016; Eisenschmidt and Smets, 2018).

Negative Interest Rate Policy refers to a reduction of the central bank policy rate into negative territory. Generally, a policy rate is an interest that a bank receives from holding reserves in the central bank accounts. Thus, if the policy rate is negative, then a central bank is taxing banks for depositing excess reserves. Theoretically, instead of holding excess reserves, banks would move liquidity into the real economy sectors. Increasing lending volumes and investments are the ways of directing money into the real economy. Stimulated lending volumes would increase credit taken by the population, which results in greater aggregate demand. This effect is also strengthened by a lower bank lending rate. By virtue of

higher aggregate demand, the nominal price levels would increase too. For example, ECB used key policy rates as an instrument for stabilizing inflation at rates "below, but close to 2%" (Draghi, 2014).

NIRP affects the nominal rates, but the real economy rates will also be affected. For example, a decrease in policy rates will decrease real interest rates (Jobst and Lin, 2016). A rise in the short-term inflation rate would stimulate inflation expectations in the long run. Since nominal and real short-term key rates decrease, other key market interest rates, such as lending and deposit rates, will go down. Additionally, as market rates are declining, the yield of assets will also decrease. Therefore, the investment and capital inflow should go down, affecting the exchange rate of domestic currency with respect to other currencies.

However, Negative Interest Rate Policy can have a drawback and negative consequences. Many publications focus on ineffective pass-through of NIRP to deposit rates. It seems that retail deposit rates are bound at 0. Banks do not drive deposit rates into the negative area because it will no longer be beneficial for the customer to keep money in deposit accounts. Large and sudden cash withdrawals will hurt the banking system.

Unlike deposit rates, lending rates track quite closely policy rates. That is, lending rates should decrease after the NIRP introduction. However, if banks are very competitive and lending rates are already low, a further reduction of lending rates would reduce interest-related income. Additionally, as market rates go down, the yield of investment and asset purchases may decrease. Banks might search for alternative ways of obtaining profits to preserve profit levels, including increased risk-taking behavior (Arteta et al., 2016).

Therefore, it is important to analyze the impact of the Negative Interest Rate Policy on bank profitability. Firstly, unlike other unconventional measures, NIRP has a direct impact on a bank's balance sheet. Secondly, if banks can preserve profits, policy transmission could

be more effective. For example, if lending rates are sufficiently high, then increased credit volumes can offset a reduction in profits due to decreased lending rates. Besides, the gap between interest-related income and expenses might shrink insignificantly.

This master thesis aims to estimate the effect of NIRP on bank profitability. The Return on Assets (ROA) is chosen as a measure of profitability. ROA is a ratio of net income to total assets. Besides, this paper analyzes components of net income separately; Net Interest Income (NII), Net Non-interest Income (Non-NII), and commission/fees. The Difference-in-Difference (DID) estimation will be used to estimate the impact of policy and provide comparable results. The estimation results showed that ROA dropped by an insignificant and small quantity. Two opposing effects explain these results. Firstly, Net Interest Income decreased. Secondly, banks increased net non-interest income to offset the reduction of profits in interest-related activities. Commission and fees contribute the most to the increase of non-interest income. The decrease of interest-related profits to some extent erodes bank ROA. This master thesis contributes literature in the following ways. Firstly, it will complement limited literature regarding the empirical analysis of NIRP impact on bank profitability, which uses the DID estimation strategy. Secondly, the long observation period allows identifying long-term trends in the impact of NIRP on bank profitability after policy introduction. In particular, a four-year post-NIRP period can provide extensive information about profitability development.

The paper is organized as follows. Section 2 will present the existing literature on the NIRP effect on bank profitability in countries where the policy was adopted. Section 3 will discuss transmission effectiveness and its implication for profitability. In addition, the theoretical model, which maps interest rates and bank balance sheet to bank profits, will be presented. Section 4 introduces an empirical methodology. Sample dataset description is

provided in section 5. Section 6 analyzes the empirical results of the regression model. Finally, section 7 concludes.

2. Literature review

Before the introduction of the Negative Interest Rate Policy, a sufficient amount of academic articles have been discussing the effect of low, close to zero, policy rates on bank profitability, especially in the Euro Zone. Further, they discuss the possibility of entering negative territory. For example, Borio et al. (2015) conducted an econometrical framework analysis of the impact of monetary policy at a low or close to zero policy rate. The paper analyzed the impact of such policy on a bank's income statement components, namely: net interest income, non-interest income, loan loss provision. In addition, the authors analyze the changes in ROA (return on assets). Increased lending volumes can be achieved by lower credit standards and decreased lending rates; thus, it may have a positive impact on interest income. However, already low borrowing rates will limit the effect. Because further reduction might hurt interest income. The econometric framework supports an aforementioned mechanism, as the model showed that the relation of policy rates and ROA is positive. Results are affected by the fact of high lending rates at the time of analysis. The later work, by Borio and Gambarcorta (2017), partly supports the effectiveness of low policy rates in stimulating lending growth. Lending rates and credit volume are less responsive if policy rate reduction is conducted at already low levels. Their results showed that unconventional monetary measures did not significantly improve lending growth in 2010-14. Also, Borio et al. (2015) point out that prolonged stay in a low or close to zero interest rate area might negatively affect bank profitability. The short-term rates combined with a flatter yield curve might magnify the prolonged negative impact. On the other hand, Altavilla et al. (2018) conducted an econometrical analysis where they include realized and expected aggregate economic variables, and the endogeneity of monetary policy. Their results showed that the policy rate

does not significantly impact if the endogeneity of policy and macroeconomic regressors are considered. Moreover, the authors suggest that in the short run, bank profits can be squeezed. However, in the long run, improved economic conditions can offset the reduction of profits. This conclusion shows the importance of macroeconomic conditions as a potential channel of stabilizing banking sectors in the presence of low (close to zero) policy rates.

The implementation of NIRP by central banks of major economies, which include ECB, Denmark, Sweden, Switzerland, and Japan, gained increasing attention from academic economic society. To my knowledge, unfortunately, there is a lack of academic publications that focus on the impact of NIRP on bank profitability in the cross-country analysis, which employ a difference-in-difference (DID) estimation strategy.

Molyneux et al. (2019) conducted a cross-country DID econometric analysis of the impact of negative nominal rate policy on bank profitability. The panel dataset included 33 OECD countries throughout the period from 2012 to 2016. The authors report a decline in profit margins for those banks in economies where NIRP was adopted. Specifically, they report a 16.41% drop in NIMs. The Net Interest Margin (NIM) is the ratio of net interest income to total earning assets. Molyneux et al.'s (2019) article's critical aspect is that the effect of NIRP can be amplified or negated by the bank and country-specific variables. The authors point out that a reduction in NIM could be amplified by a level of competition, especially for smaller banks. As lending rates decrease, the profit margins continue to squeeze. On the other hand, the authors state that large banks can hedge profit by diversifying investment and lending activities. Banks, which model is oriented towards an "interest operating profile," might significantly reduce profitability. Lopez, Rose, and Spiegel (2020) suggest that profits can be preserved by an attempt to increase non-interest income and commissions/fees. Also, the authors conducted an econometric analysis using a larger dataset span from 2010 to 2017. The estimated impact of NIRP on bank profitability, however, is

small and insignificant. The deeper analysis revealed two forces that impact the regression results. First, non-interest income offsets the decline in net interest income. Second, bank size and characteristics are crucial. Large banks can diversify asset portfolios and change banking models to counterbalance the decrease in profits. Molyneux et al. (2019) also add that large banks may become less reliant on retail deposit funding, while smaller may find struggle to do so. The existing empirical literature showed different results. However, they suggest a similar strategy of preserving profits. These measures include an increase in non-interest income and commission/fees. Additionally, banks can change operational models to conserve profit.

Despite the lack of publications oriented to cross-country econometric analysis of NIRP impact employing DID estimation, many academic publications focus on NIRP impact to specific or group of countries.

Scheiber, Silgoner, and Stern (2016) reported no sign of a significant drop in banks' profitability in Denmark, Sweden, and Switzerland. They explain this outcome by a significant decrease in interest-related expenses. At the same time, interest income dropped by a smaller amount. Raising commissions and fees also accounts for an insignificant and low drop in bank profits. Additionally, the authors stress the possibility of cash withdrawals if retail deposit rates go negative. Because customers may find keeping money in deposit accounts no longer beneficial. However, retail deposit rates did not go negative, and no substantial cash withdrawals happened. On the contrary, Madaschi and Nuevo (2017) report that the bank profitability continued to improve after introducing nominal negative rates in Sweden and Denmark. Similar results are reported in the Monetary Policy Report by a Riksbank (2016). Madaschi and Nuevo explain (2017, 7): "The improvement in Swedish banks has been driven mainly by a rise in bank operating incomes, while in Danish banks it mainly reflects the fall in operating expenses". Focusing on Switzerland, Basten and Mariathasan (2018) stated that Swiss retail banks handled pressure from NIRP and maintained

profitability. And in some cases, increase it. The authors continue that bank structure and model determine the level of resilience of profitability of Swiss banks. As an example, the authors state that Swiss wealth management banks could face significant harm. On the other hand, Marika and Markov (2019) show that net interest income has not narrowed significantly for the case of Switzerland and the European Zone. Moreover, in Europe, the NIM sensitivity on policy rates has been very low. NIM would fall only by 0.07% for every 0.5% key interest rate policy decrease. The minor sensitivity could potentially explain why some academic articles show a small change in NIM. An increase in commission/fees can offset the decrease of net interest income. Additionally, interest-related expenses can drop, so that the decrease of net interest income is small. A rise in non-interest income, including commission/fees, indicates that profit losses are repaid by customers (Basten and Mariathasan, 2018).

Dell'Ariccia, Haksar, and Mancini-Griffoli (2017) report an estimated impact of NIRP on banks' NIMs in the European Union. The impact is slightly negative but not significant. The NIMs stayed at a stable level of 1.2% until the 4th quarter of 2015. Nevertheless, the authors highlight that there are concerns in the long run, specifically in the EU. Because the longevity of negative rates would flatten yield curves. Thus, a prolonged negative policy rate will decrease capital and assets yield in the long term (Dell'Ariccia, Haksar, and Mancini-Griffoli, 2017). Arteta et al. (2016) state that the effect of NIRP on bank profitability still needs to be studied. However, the authors point out the existence of a negative effect on bank profitability at low, or close to zero, nominal interest rates. The authors explain the resilience of profitability by stressing that the banking model and overall health of the economy are determining factors of the impact of unconventional monetary policy on the banking sector. Authors stress that prolongation of negative rates in the economy could impose a risk to financial stability through increased risk-taking and squeezed profit margins. However, Jobst and Lin (2016) point out that there are no signs of negative effect on profits of European

banks. Coeuré (2016) presents strategies for preserving profit levels. Increased lending activity and non-interest-oriented operations can sustain profit levels in the EU. Despite the small and insignificant impact reported by discussed pieces of research, the ECB survey (2016) showed that 81% of banks in the eurozone reported a decline of NIM. Around 45% of banks reported a decline in lending activities. The report suggests that profitability is at threat. Additionally, this signals that banks are reluctant to decrease lending rates. This scheme would decrease interest-related income. Moreover, some banks could not modify the banking model and preserve profits by reducing interest expenses. Overall, it can be concluded that banks in the European Union could somehow maintain the level of profits after the introduction of NIRP in 2014. However, there is a piece of evidence by ECB report and academic publications that prolonged negative rates can post a threat to bank profitability. Therefore, financial stability can be threatened if net interest income continues to shrink.

The aforementioned publications provide practical interpretations and results of the impact of NIRP on bank profitability. Some academic articles provide theoretical models of the impact of NIRP on banks and the economy. Eggertsson, Wold, and Juelsrud (2017), in the macro-model, including banking sectors, showed that the negative rates can be contractionary, and bank profits could decrease. The model includes the household of different types, patient and impatient, with a utility maximization problem over a lifetime period. Firms use labor as the only input of production function. And perfectly competitive banks are part of the model. The crucial result is that despite expansionary incentives, NIRP is contractionary. Additionally, the bank profitability can decrease. In the consecutive research by Eggertsson et al. (2019), it calibrated a similar model for the Swedish economy. The authors reported that NIRP could impose a negative effect on bank profitability. Campos (2019) presented a DGSE model of a bank's profit maximization problem with an introduction of households, the intermediate goods market, and firms. The author states that reducing policy rates in a

positive region is more effective than similar action but in negative territory. Summing up, theoretical models show that NIRP can be contractionary.

The literature review shows that negative interest policy is a modern and widely discussed topic of concern regarding banking sectors and economic-financial stability. The negative rates adopted by the central bank of major economies attract much academic attention. The previously discussed paper will help me set up, understand, and construct the econometrical model.

3. Transmission channels and implication for bank profitability

Despite the unconventional nature of NIRP, a similar operational framework applies to the negative rates when transmitted to the economy (Angrick and Nemoto 2017). However, Bech and Malkhozov (2016) note that several adjustments in the legal and operational framework have been made prior to the NIRP introduction. Overall, the transmission mechanisms are similar to policy rate cuts in the positive territory (Bech and Malkhozov, 2016).

Numerous publications argue that the retail deposit rates are relatively sticky. The importance of deposit rates comes from the fact of reliance of banks on deposit financing. Potentially, deposit rates could be binding at 0% since agents see an alternative to withdraw liquidity if rates go negative. Because individuals do not lose value in cash, assuming that inflation rates are low and the cost of holding physical cash is zero. Eisenschmidt and Smets (2018) discuss that banks see household deposits as a source of long-term stable funding source, and their attractiveness started to rise during the financial crisis. Table 1, adapted from an article by Eisenschmidt and Smets (2018), shows the average deposit rates and share of deposits as a liability for different countries in the Euro Zone. Indeed, deposit rates are close to zero. However, we do observe the different liability portfolio shares. The total average

deposit share is 0.283, which is 28.3%. For banks in Sweden, around 47% of the liability portfolio is a deposit share (Eggertson et al., 2019). The smaller degree of stickiness of other market rates, except deposit, allows to assume that liability portfolio will respond similarly. For EU and Sweden, the deposit share is less than 50%. It can be concluded that since deposit shares of liability are less than 50%, generally, liability portfolio difference should not be a problem for the analysis.

Lending rates, in comparison, are less sticky. Angrick and Nemoto (2017) reported that lending rates have been declining after the introduction of NIRP in the EU. Further supported by Figure 1. Additionally, Jobst and Lin (2016) noted the fact of decreased credit standards, which results in greater lending volume. However, already low lending rates do not allow a bank to reduce its lending rate further, without hurting profits from interest-related activities.

To sum up, the transmission mechanism to most market lending rates was somewhat effective. However, the effect can be diminished by a high level of bank competition and pre-NIRP low economy lending rates. Additionally, the anticipated reduction of profits may not result in reduced lending rates. Potentially, lending rates may increase, which is the case of mortgage rates in Switzerland (Bech and Malkhozov, 2016).

Figure 1[1]. Yearly average bank lending rate in the EU

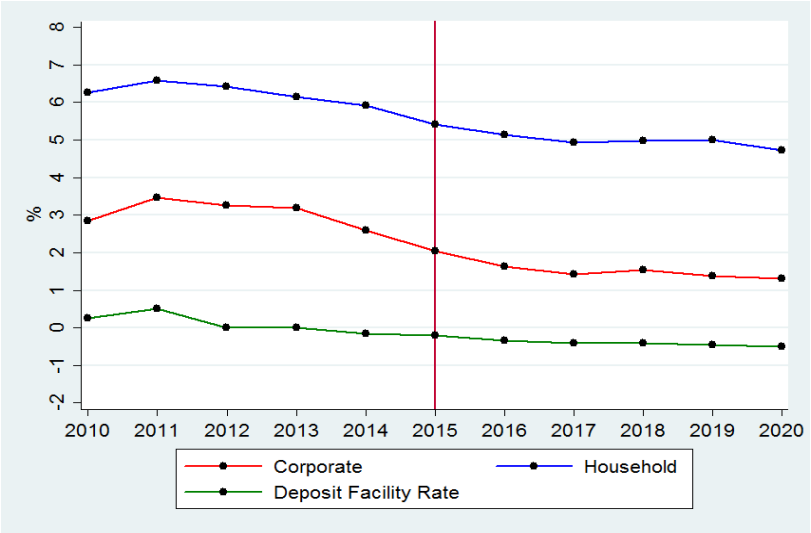


Table 1[2]. Average deposit rates in the EU in 2014.

Country	Deposit rate	Share
Malta	0.940	0.510
Austria	0.565	0.192
Slovakia	0.226	0.457
Germany	0.165	0.203
Finland	0.070	0.177
France	0.032	0.244
Netherland	0.009	0.206
Slovenia	0.981	0.398
Estonia	0.118	0.274
Spain	0.880	0.297
Ireland	0.422	0.226
Italy	0.251	0.282

[1] Source: https://www.euro-area-statistics.org/bank-interest-rates-loans?cr=eur&lg=en&page=0&charts=M..B.A2Z.A.R.A.2250.EUR.N+M..B.A2B.I.R.A.2250.EUR.N+M..B.A2B.I.R.A.2250.EUR.N&template=1 and the ECB

[2] Eisenschmidt, Jens and Frank Smets. 2018."Negative Interest Rates: Lessons from the Euro Area" *Central Banking, Analysis, and Economic Policies Book Series*, *Monetary Policy and Financial Stability: Transmission Mechanisms and Policy Implications. Central Bank of Chile* edited by Alvaro Aguirre, Markus Brunnermeier, and Diego Saravia, vol 1: 13-42. https://ideas.repec.org/h/chb/bcchsb/v26c02pp013-042.html.

To provide additional intuition of how the interest channel works and its implication for bank profits, I will try to map the bank's balance sheet variables the profits through bank interest rates. In order to do this, I will consult the theoretical framework of Eggertson et al. (2017) and Eggertson et al. (2019). Both works show that deposit rates are bound at zero. However, the previous statement is induced by the assumption that the marginal cost of holding money is zero. To relax this assumption, the cost of holding of money is given by function $S(M_t) = \gamma M$, where $\gamma > 0$. Hence, the new lower bound on deposit rates is given by $-\gamma$.

A bank chooses how much loans to give, l_t, how many deposit account to have, d_t, how much liquidity to hold at the central bank account, R_t, and how much physical money to hold, m_t. i^r denotes interest on reserves, i^s is an interest on deposit accounts, and i^b denotes an interest on loans. The storage cost of money is given by function $S(M) = \gamma M$, and physical cash does not earn interest.

Profits z_t are paid to the owner of a bank at time t. Bank holds enough money on the balance sheet to repay the deposit account holder in the next period. So, the following must be true.

$$(1 + i_t^s)d_t = \left(1 + i_t^b\right)l_t + (1 + i_t^r)R_t + m_t - S(m_t)$$

Next, authors introduce the intermediation cost function $\Gamma(l_t, R_t, m_t, z_t)$. The function Γ increases in the number of loans provided. While it decreases in reserves held in the central bank and liquidity held in cash. Finally, the authors present static profits of banks in the following way.

$$z_t = \frac{i_t^b - i_t^s}{1 + i_t^s} l_t - \frac{i_t^s - i_t^r}{1 + i_t^s} R_t - \frac{i_t^s + \gamma}{1 + i_t^s} m_t - \Gamma(l_t, R_t, m_t, z_t)$$

From the above expression, it is possible to analyze the impact of NIRP on bank profitability. The first thing to notice is the difference between lending and deposit rates. The difference provides, to some extent, the essence of the development of net interest income. Table 1 reports, the deposit rates are close to zero, and Figure 1 shows that lending rates are decreasing. Hence, through the interest rate channel, net interest income shrinks, thus hurting the bank's profits. To compensate for losses, a bank might increase lending volumes. But, the intermediation cost function, $\Gamma(l_t, R_t, m_t, z_t)$, increases, reducing the bank profits. Next, NIRP incentivizes banks to withdraw excess reserves from central bank accounts. Reduction in reserves increases profits, but also increases $\Gamma(l_t, R_t, m_t, z_t)$.

Eggertson et al. (2017) provide a functional form of the intermediation cost function, but empirical estimation does not provide any information regarding the function $\Gamma(l_t, R_t, m_t, z_t)$. Besides, the dataset does not contain observations for the monetary amount of reserves held on the central bank account and physical cash.

The following section develops an econometrical analysis framework based on existing literature and theoretical framework.

4. Methodology

The Difference-in-Difference (DID) estimation has been widely used to analyze the impact of policy intervention. For example, Molyneux et al. employed a similar estimation strategy to assess the impact of NIRP on bank profitability. The DID estimation methodology allows capturing the average effect of unconventional monetary policy on banks in treatment group countries. The following difference-in-difference estimation model will be used to study the impact of NIRP on bank profitability:

$$Y_{ijt} = \beta_0 + \beta_1 YearNIRP_{jt} + \beta_2 NIRP_{ij} + \beta_3\left(YearNIRP_{jt} * NIRP_{ij}\right) + \beta_4 X_i + \beta_5 X_j + \alpha_i + \epsilon_{ijt}$$

where:

- $\boldsymbol{Y_{ijt}}$ is a Return on Assets (ROA) of bank *i* at time *t* at country *j*.
- $\boldsymbol{YearNIRP_{jt}}$ is a dummy variable which is equal to 1, if country *j* has adopted NIRP at time *t*.
- $\boldsymbol{NIRP_{ij}}$ is a dummy variable which is equal to 1, if bank *i* has been exposed to NIRP in country *j*.
- $\boldsymbol{\beta_3}$ is DID estimator. It estimates the average effect of NIRP policy between control and treatment group countries and banks.
- $\boldsymbol{X_i}$ is a vector of bank-specific regressors.
- $\boldsymbol{X_j}$ is a vector of country-specific regressors.
- $\boldsymbol{\alpha_i}$ is an unobservable bank fixed effect.
- $\boldsymbol{\epsilon_{ijt}}$ is an error term.

The Return on Assets (ROA) is chosen as a measure of a bank's profitability. The ROA is a ratio of net income to total assets. The numerator of ROA captures major parts of bank profits. These are net interest income and non-interest income, which include commission and fees. Therefore, NIRP can have an impact on all of the components of net income. Specifically, existing publications discuss that net interest income might drop. On the other hand, banks can compensate losses by an increase in non-interest income. However, ROA itself does not allow to capture the aforementioned effect. Thus, net interest income, non-interest income, and commissions/fees will be analyzed separately to investigate the aforementioned effects.

Other profitability measures could provide a better estimation of the bank's profit development. For example, Net Interest Margin (NIM) would provide a better response of interest-related profits due to the introduction of NIRP. NIM is a ratio of net interest income to total earning assets. NIM could potentially provide a better estimation of bank response to NIRP. Since diversifying asset portfolio is the potential way of preserving profits. However, the dataset does not explicitly provide observations of interest-bearing assets and does not report some components that may allow to calculate the total amount of such assets explicitly. But, NIM does not capture the changes of non-interest income of the banks. In this regard, ROA can provide a preferable result of the impact of NIRP.

Moving to bank-specific variable descriptions, the set of regressors includes variables that capture the bank's structure.

- **Cash Ratio** is a ratio of cash and cash equivalents to total current liabilities.
- **Reserves** variable is a total monetary amount left aside for potential credit losses.
- **RACR** is a Risk-Adjusted Capital Ratio proposed by Basel III regulatory framework (BIS, 2010).
- **Debt to Asset** is a ratio of total debt to assets.

The **Cash Ratio** shows how effective a bank can pay off its liabilities with only cash or cash equivalents. To some extent, the ratio is a risk indicator of a bank. In case of a shutdown or crisis, the cash ratio represents the ability of a bank to repay its liabilities in a short time by cash only. Cash Ratio controls for a potential cash rush from customers. Since if deposit rates are close to zero, some customers might find withdrawing money beneficial instead of keeping cash in a bank deposit account.

The **Reserves** variable represents the total monetary value saved for non-performing and bad loans. The reduction of the policy rate in the negative territory may have a similar

impact on lending rates. To preserve profits, a bank may increase lending volumes and reduce credit standards. The reduction of credit standards will increase the probability of bad and non-performing loans. Thus, **Reserves** variable controls for such bad credits given.

The **RACR** is a summation of capital Tiers 1 and 2. Tiers are used as a tool to assign risk to a bank's balance sheet. Generally, Tier 1 is more valuable to a bank than Tier 2. Since it includes the bank's capital equity[3]. The total RACR must be at least 8 percent (BIS, 2010). This variable controls for the level of riskiness of a bank. Since some publications show that banks might become risky because of the search for alternative profits.

The **Debt to Assets** is a ratio of a bank's total debt to total assets, which provides additional information about the level of riskiness of a bank. Debt to Asset ratio greater than 1 shows that the bank does not have enough assets to sell to repay its debt. Hence, a financial institution could be considered risky.

In the regression model, **Reserves** and **Debt to Asset** are reported as a ratio to total assets.

Another set of bank-specific explanatory variables capture the total demand for loans and deposits from individuals, firms, corporations, and other banks.

- **Deposits-Customers** represent a total monetary value held on a bank's deposit accounts by individuals, firms, and other corporations.
- **Deposits-Banks** is the total value of deposits held on account for other banks.
- **Loans** is the total monetary value of loans made to firms and individuals.

[3] https://wrds-web.wharton.upenn.edu/wrds/query_forms/variable_documentation.cfm?vendorCode=COMP&libraryCode=compd&fileCode=gfunda&id=capr3

The **Deposits-Customer** captures the total amount of cash held on deposit account by individuals and firms. Existing literature discussed the stickiness of retail deposit rates, which potentially affect the total monetary value of deposits. In the presence of NIRP, banks may anticipate the reduction of deposits. Since some customers may find it disadvantageous to keep money in deposit accounts. Additionally, deposits are an attractive source of bank funding.

The **Deposits-Banks** variable depicts the monetary value that other banks hold on the current bank's deposits account. Unlike retail deposit rates, interbank rates can go negative. It is an additional source of financing banking activity. For example, the interbank interest rate on short-term loans was negative from around 2015 to 2020[4].

The **Loans** represent a total volume of lending activity to firms and individuals. As noted in the literature review, increasing lending volumes might offset the reduction in returns from loans given to firms and individuals. Therefore, banks are expected to increase credit volume to offset the reduction in lending rates.

The aforementioned variables are reported as a ratio to the total assets.

Moreover, the thesis paper will discuss the evolution of profit-related variables: commissions/fees, non-interest income, and net interest income after the introduction of NIRP. For such analysis, I employ several additional income variables. These are **Net Interest Income, Net Non-interest Income,** and **Commissions/fees.**

The **Net Interest Income (NII)** is a total monetary profit from interest-related channels. Simply speaking, Net Interest Income is a difference between interest-related income and expenses. Both components of NII are directly related to lending and deposits.

[4] https://tradingeconomics.com/sweden/interbank-rate

Specifically, deposits comprise some part of interest-related expenses. Since retail deposit rates are low and other components of bank liability respond to NIRP less sticky, interest-related expenses can remain at a somewhat constant level. However, interest-related income may decrease due to NIRP. Thus, the gap between interest-related income and expenses may shrink. It is assumed that **NII** may decrease. If it is true, then this would suggest a decrease in profit that the bank earns through interest channels.

The **Net Non-Interest Income (Non-NII)** is a total monetary profit generated through non-interest activities, which includes **Commissions/fees**. Net Non-interest income includes all monetary profit that is not attributed to the bank's net interest income. Existing literature discusses that rising non-interest income can offset the reduction in interest-related income. If banks in the treatment group tend to increase non-interest income and commission/fees, this would suggest a positive sign of the **Non-NII** variable. The **Commissions/fees** variable controls for the total monetary amount charged by a bank for its services. Potentially, banks may rise commissions and fees for their services to customers. If this is the case, an additional channel may exist. NIRP may be transferred to customers not through lower lending rates, but higher fees and commissions charged by a bank. To some extent, it was discussed by Eggertson et al. (2019), where the authors suggest that an increase in fees would lower the "effective deposit rate".

In addition to bank-specific variables, I include country-level explanatory variables.

- **GDP Growth** is a yearly growth rate of realized GDP.
- **GDP** is a natural logarithm of realized GDP calculated yearly.
- **GDP variance** is a variance from the mean GDP of a given period.
- **Inflation** is Consumer Price Index calculated yearly.
- **EU** is a dummy variable that takes value 1 of a bank *i* is in the Euro Zone.

The inclusion of independent macroeconomic variables is dictated by the fact of the importance of macroeconomic conditions. Several publications discussed noted the importance of overall economy health for the operation of the banking sector. For example, Swiss banks could retain profitability. The economic boom may overshadow the negative impact of NIRP.

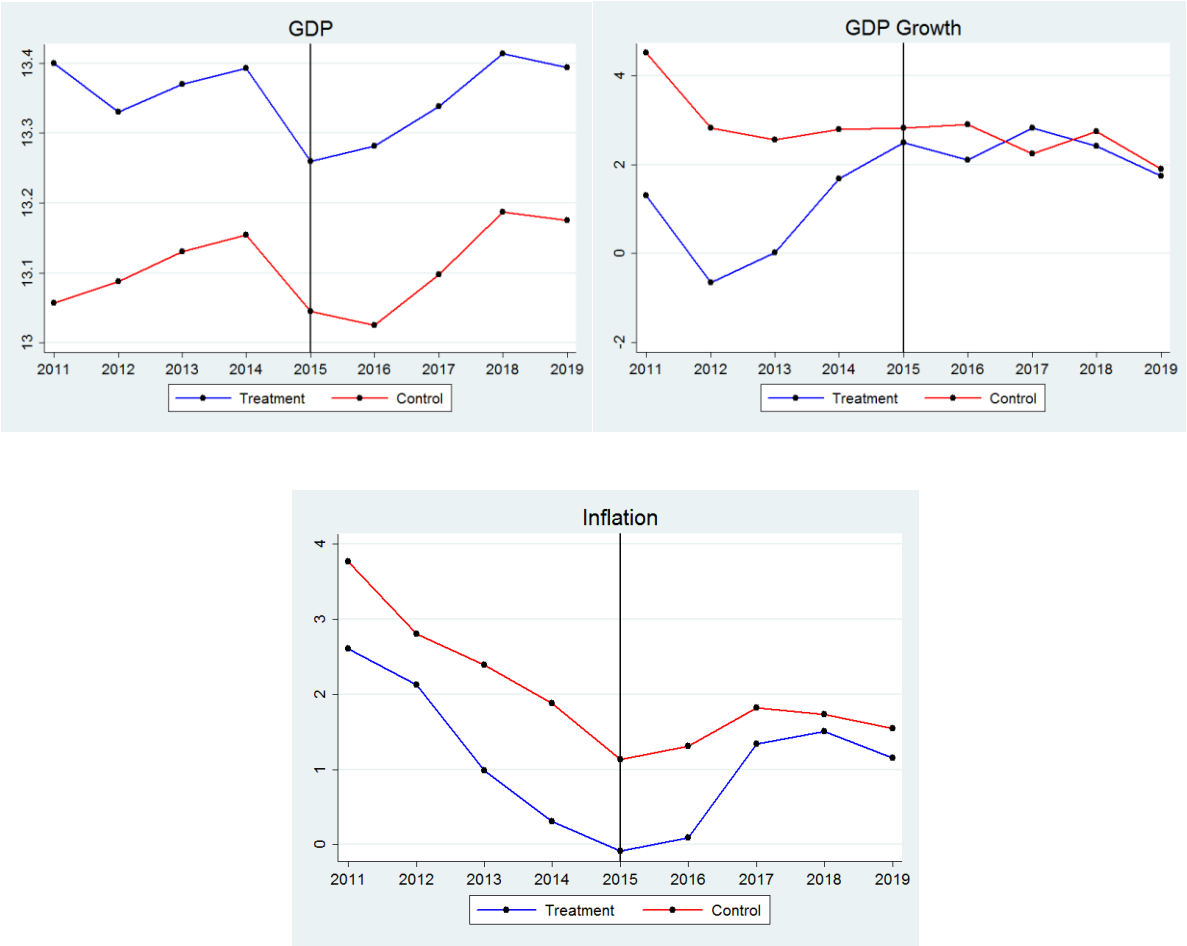
The descriptive statistic is provided in Table 4.

To utilize difference-in-difference estimation, several assumptions must be satisfied.

- The control group must be a valid counterpart comparing with the treatment group.
- The policy implementation should be exogeneous to the dependent variable. In other words, the bank profits should not influence the central bank's decision about introducing NIRP.
- "Parallel path." Simply speaking, the variation of the banks' ROA should be similar before the introduction of the policy.

One might notice that the treatment group consists of developed countries only. It is reasonable to include a control group with a similar type of country. Thus, the control group contains developed and highly developing countries from Europe and Asia. Additionally, banks from Australia are included as well. Figure 3 presents an average development of macroeconomic variables for treatment and control groups. There is a high correlation between GDP of control and treatment group, the correlation coefficient is 0.7719, which is significant at 5%. A similar conclusion applies to inflation, the correlation coefficient is 0.8472, which is also significant at 5%. However, Figure 3 does not show any observable correlation of GDP growth. But the path of control and treatment group GDP growth has a similar path until the introduction of NIRP, vertical line. All of these support the valid counterpart assumption.

Figure 3. Macroeconomic variables for control and treatment group.

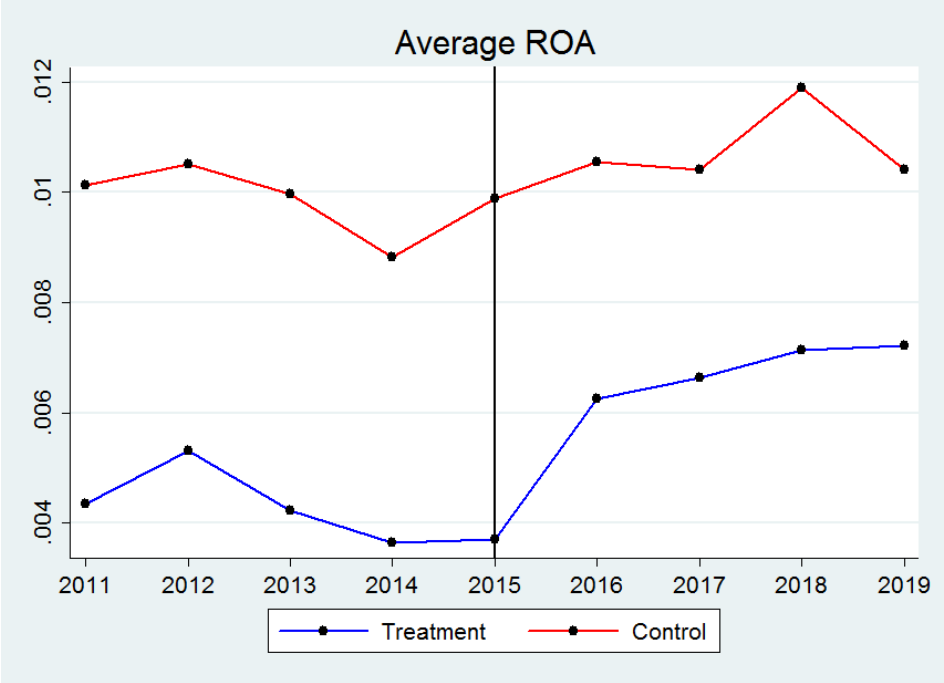


The endogeneity should not be an issue in the context of econometrical analysis. Firstly, NIRP aimed to stimulate inflation or fight an appreciation of the domestic currency. Therefore, NIRP had a side effect of affecting bank profitability. Secondly, with a certain level of confidence, the implementation of unconventional monetary policy was not dictated by the performance of banks.

"Parallel path" is a crucial assumption. "Parallel path" assumption states that the average differences between control and treatment groups should be constant before treatment policy intervention. The pre-NIRP period contains observations from 2011 to 2015. While the post-NIRP period is from 2016 to 2019. It is important to note that policy (NIRP) is still present for banks in the treatment group. In other words, the policy did not end in 2019, but still ongoing. Potentially, further research employing a longer period could present a different

result and conclusion. The vertical line represents the date of treatment introduction. Visually, the average difference between control and treatment groups is constant until the introduction of a treatment policy. However, after the treatment, there is a considerable change of ROA. The correlation prior treatment policy (NIRP) is 0.7932. The correlation after treatment policy is 0.4079.

Figure 2. "Parallel Path" assumption



5. Data

The yearly panel data has been adopted from Wharton Research Data Services (WRDS). Panel data contains income statements and balance sheet variables of commercial banks from 2011 to 2019. A nine-year span of observations allows to, potentially, capture changes in the world banking system and economies. First, it is important to discuss the timing of the introduction of NIRP since the treatment group contains European union countries, Denmark, Sweden, and Switzerland. The European Central bank and Denmark central banks introduced negative policy rates in mid-2014. While policy rate of the central

bank of Sweden entered negative rates in 2015. A small discrepancy in the dates of introduction of NIRP allows setting a date of treatment as 2015. To further support this claim, as noted by some authors, NIRP takes some preparations, and effective change in policy rates may take some time. It is reasonable to assume that the Swedish central bank could have taken experience from ECB; thus, the effective timing of NIRP could be relatively close. Finally, country-specific variables are adopted from the World Bank database.

The dataset includes 164 banks, with 89 banks are subject to treatment monetary policy. The treatment group includes commercial banks of European Union countries, Sweden, Denmark, and Switzerland. While the control group includes 15 countries mostly from Europe. Also, I have added bank-level data from Australia and Asia countries. For sake of outliers, I cut extreme percentiles, particularly 1 and 99 percentiles. Next, the robust standard errors will be used to address heteroskedasticity. Table 6 presents a correlation matrix of bank and country-specific control variables. No highly correlated regressors are observed.

6. Results and Discussion

The empirical results are provided of the regression model can be observed in Table 3. Table 3 reports the estimated impact of NIRP (*DID*) on the dependent variable, Return on Assets (ROA). Incremental addition of bank-specific and country-specific variables allows to observe the evolution of the impact of NIRP on ROA. The main attention and discussion will be dedicated to the analysis of the evolution of the coefficient of the estimated impact of NIRP (*DID*).

The first baseline regression model reports a positive and statistically insignificant average impact of NIRP. The ROA of treatment group countries increases by 0.121% on average. However, the coefficient, in addition to being insignificant, is not sizeable. This,

potentially, indicates that banks could preserve profits in the presence of unconventional monetary policy. To further analyze the impact of NIRP on bank ROA, the incremental addition of regressors is conducted.

The incremental addition of bank- and country-specific control variables through models (2) to (4) is done. Specifically, model (4) shows a small and statistically insignificant decrease of ROA, which undergo policy treatment. ROA is expected to decrease by 0.115% percent for banks in which countries NIRP was adopted. This result suggests that net income is preserved. However, a small and insignificant decrease in ROA may hide the changes in net income components.

Indeed, model (5) sheds light on the previous assumption. Once, regression model controls for non-interest income and commission/fees, then *DID* coefficient becomes negative and statistically significant. The average impact on ROA due to NIRP is negative and significant. The Return on Assets decreases by 0.412% on average for treatment group banks. The result indicated a decrease in net interest income, which further contributes to the decrease of ROA. These results suggest that interest-related income is decreased due to NIRP. And a negative sign of *DID* in model (4) suggests that banks may not able to compensate through non-interest channel.

Moving forward, **Debt to Assets** and **Reserves**, are significant for most model specifications. It is important to note that, on average, the **Debt to Assets** ratio is higher for treatment group banks. This implies that banks that undergo NIRP treatment are riskier than the control group, on average. The coefficient of **Debt to Assets** captures the previous fact due to the negative coefficient of the control variable. **Reserves** regressor also has a negative coefficient. Firstly, since lending rates are decreasing, banks would increase credit volumes and ease standards. However, it will lead to an increased amount of bad loans, which results

in credit losses. Thus, bank profits are reduced. Secondly, in line with a theoretical framework of Eggertson et al. (2007) and (2009), $\Gamma(l_t, R_t, m_t, z_t)$ The intermediation cost function increases with the number of loans. This suggests a reduction of profits, z_t.

Additionally, the regression model in Table 3 employs a proxy variable, which is lagged by a 1-period bank's ROA. However, the regular fixed effect estimation is not applicable for dynamic panel models. Thus, Arellano-Bond estimation methods were employed. Model (6) shows that previous ROA values are insignificant. The sign of *DID* did not change, but the magnitude is lower compared with the model (4). This result is most likely due to controlling for lagged ROA values. Additionally, some significant variables decreased in magnitude, specifically **Debt to Asset** and **GDP growth.** These issues are discussed by Achen (2000). Potentially, the inclusion of lagged dependent variable might diminish the explanatory effect of other regressors. The author also points out that sometimes the sign of some explanatory variable might change as well. However, it is not the case if comparing models (4) and (6). Similarly, comparing models (5) and (7) the *DID* coefficient preserved its sign, but the magnitude is lower.

Several publications have discussed the importance of macroeconomic conditions for bank profit preservation in the context of NIRP. In the context of the regression model, **GDP Growth** was a significant regressor. Specifically, in model (4), **GDP growth** had a positive and significant impact. Potentially, positive expectations of economic growth might show a positive and sizeable effect. However, the master thesis does not control for expected GDP growth and GDP.

Table 3 reports DID estimation results for additional profit measures, Net Interest Income (**NII**), Commissions and fees (**Com/fees**), and Non-Net Interest Income (**Non-NII**). Each model includes a full set of the control variable, with the main interest lying in *DID*

coefficient. All models include the full set of bank- and country-specific variables. First of all, Table 3 shows that interest-related income dropped and supports the claim from the model (5) of Table 3. All of these confirm the assumption that interest-related income dropped due to the introduction of NIRP. Next, as existing literature discussed, banks increased commissions and fees. An increase of commission/fees indicates a somewhat indirect pass-through of NIRP to households. However, once the regression model controls for commission and fees, the increase of non-interest income ceases to be significant, observe model (6). This suggests that commissions and fees contribute the most to the increase of non-interest income.

Potentially, interaction terms can provide an additional explanation of the dependent variable's development due to NIRP. Table 4 provides relevant regression estimation results with interaction terms included. The interpretation of additional bank-specific regressors is carried by an assumption of other variables being zero. For some control variables, it might not be reasonable. For example, it is not reasonable to assume that GDP is 0. The sample average is 13.2405. A similar discussion is applied to GDP growth as well. While a growth rate of 0 or close to 0 is plausible. The number of observations in which GDP growth is 0 or close to 0 is small. And the number of negative GDP growth observations is limited, less than 9% cumulatively.

As discussed before, the risk control variables **Reserves** and **Debt to Assets** have a negative additional impact on bank profits. On other hand, the macroeconomic environment can help to maintain bank stability, profit levels specifically. Table 4 presents the interaction terms in model (1) of **Reserves** and **Debt to Assets** with **GDP** and **GDP growth**, which supports the previous assumption. The marginal impact of **Reserves** and **Debt to Assets** is offset by positive values of interaction terms with macroeconomic variables. All of these provide additional support to the claim of the importance of economic well-being as stabilizing factor in the presence of unconventional monetary policy.

Next, model (2) explores the impact of NIRP on bank ROA, also controlling for non-interest income and commissions/fees with relevant interaction terms. The *DID* coefficient is negative and significant, which suggests a decrease in net interest income of treatment group banks due to policy intervention. The **Loans** variable is attributed to the interest-related income, that is credit growth is expected to rise according to the intentions of the central bank. The positive sign of **Loans** suggests an attempt of a bank to increase credit volume, to preserve income levels due to decreasing lending rates. However, the interaction term of **Loans** with dummy variable **EU** suggests that banks in the Euro Zone could increase credit volume to a lesser extent. This may suggest that banks in the EU experienced a higher reduction of net interest income. Additionally, interaction terms of dummy variable **EU** with a **Com/fees** and **Non-NII** shows that banks in the EU increased non-interest income and commission and fees by a greater amount than other banks.

The above results go somewhat in line with existing literature that discusses the effect of NIRP on bank profitability. Specifically, I want to focus on the work of Molyneux et al. (2019). Firstly, both works agree on the fact that net interest income decreased in treatment group banks due to NIRP. Molyneux et al. show that NIM (net interest margin) decreases for all banks in the treatment group. On the other hand, this thesis provides similar results by specifically focusing on the net interest income variable. Additionally, both papers show that banks in which countries NIRP was adopted increased non-interest income and commission/fees. The previous result suggests that some banks changed the operational model to a service-oriented profile. However, Molyneux et al.‘s work reports that ROA of treatment group banks declined. The ROA decreased by 3.06%, which is statistically significant. Similarly, this thesis reported a decrease in ROA, but the effect is insignificant and small. These results can be explained due to the scope of focus. Molyneux et al. focus on different banks, such as investment, commercial, savings, and others. Whereas this paper

analyzed commercial banks only. However, Molyneux et al. reported a decrease of ROA by 5.04% for a commercial banks. Unlike Molyneux et al., this thesis paper reports a pass-through mechanism of NIRP to customers, through an increase in commissions and fees.

Table 2. The DID regression results.

	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA	(6) ROA	(7) ROA
DID	.00121	.00039	.00067	-.00115	-.00412***	-.00018	-.00126***
	(.00138)	(.00119)	(.00121)	(.0012)	(.00056)	(.00139)	(.00043)
Cash Ratio		-.00006	-.00008	-.00008	.00002	.00002	0
		(.0001)	(.0001)	(.00009)	(.00005)	(.00009)	(.00004)
Reserves		-.14446**	-.15529***	-.17458***	-.00188	-.17503***	.03501**
		(.06132)	(.05376)	(.05261)	(.00935)	(.06139)	(.01528)
RACR		-.00006	0	0	-.00005	0	.00001
		(.00011)	(.00005)	(.00005)	(.00004)	(.00003)	(.00001)
Debt to Assets		-.18596***	-.17607***	-.1731***	-.06517***	-.11375**	-.01643
		(.04751)	(.03562)	(.03395)	(.01565)	(.05706)	(.0111)
Deposit-Cust.			-.00799	-.00878	-.00181	-.00645	.00464*
			(.00775)	(.00802)	(.00285)	(.0128)	(.00263)
Deposit-Banks			-.03576**	-.03265**	-.0041	-.01751	.01045*
			(.01502)	(.01438)	(.00577)	(.02216)	(.00552)
Loans			-.00111	.00213	.0156***	.01483	.00907**
			(.00607)	(.00548)	(.00366)	(.0093)	(.00358)
Eu				.00233*	-.00198***	-.00003	.0003
				(.0012)	(.00043)	(.00076)	(.00036)
Inflation				.0003	.0005***	.00055*	.00034***
				(.00032)	(.00012)	(.00031)	(.0001)
GDP Growth				.00069***	.00001	.00038**	-.00005
				(.00022)	(.00009)	(.00018)	(.00005)
GDP Var.				.00158	.00166**	.0016	.00051
				(.00144)	(.00067)	(.00119)	(.00056)
GDP				-.01001***	-.00102	-.01047***	-.00514***
				(.00344)	(.00119)	(.00395)	(.00163)
Com/fees					.28358*		.55359***
					(.15892)		(.19413)
Non-NII					.90058***		1.0041***
					(.03474)		(.02788)
Lag. Dep. Var.						-.01225	.0541**
						(.06249)	(.02518)
Constant	.00689***	.1818***	.18195***	.30533***	.08096***	.24924***	.08656***
	(.00039)	(.04314)	(.0352)	(.06444)	(.02349)	(.06063)	(.02291)
Observations	1475	1352	1268	1268	1242	958	937
R-squared	.00532	.13089	.16686	.20115	.85649		
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

Table 3. The DID estimation model on profit-specific bank variables.

	(1) NII	(2) NII	(3) Com/fees	(4) Com/fees	(5) Non-NII	(6) Non-NII
DID	-.00138**	-.00167***	.00127***	.00139***	.00296**	.0015
	(.00056)	(.00052)	(.00034)	(.00033)	(.00115)	(.00119)
Com/fees		.42505***				.5619***
		(.11129)				(.17716)
Non-NII		-.07184**		.01912*		
		(.02853)		(.00977)		
NII				.12804***		-.63598***
				(.03331)		(.22431)
Constant	.08364***	.08142***	.04381***	.02868***	.23433***	.26278***
	(.02636)	(.02269)	(.01109)	(.00963)	(.07087)	(.07773)
Observations	1268	1242	1242	1242	1268	1242
R-squared	.24892	.31879	.17211	.21968	.25329	.29229
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

Table 2. Regression estimation with interaction terms

	(1) ROA	(2) ROA
DID	-.0004	-.00402***
	(.00112)	(.00054)
Reserves	-.77248***	
	(.24149)	
Debt to Assets	-.76903***	
	(.25502)	
Loans	.00713	.02209***
	(.00513)	(.00433)
Reserves*GDP	.04285**	
	(.01768)	
Reserves*GDP growth	.0332***	
	(.00738)	
Debt to Assets*GDP	.04751**	
	(.01932)	
Debt to Assets*GDP growth	.01129**	
	(.00532)	
Com/fees		.26854
		(.17509)
Non-NII		.74318***
		(.05434)
Loans*EU		-.01497**
		(.00575)
Com/fees*EU		.60942**
		(.29215)
Non-NII*EU		.19626***
		(.05794)
Constant	.80624***	.07352***
	(.2302)	(.02194)
Observations	1268	1242
R-squared	.30564	.86831
Bank FE	Yes	Yes

Robust standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

7. Conclusion

Driving central policy rate into the negative territory was conducted with stimulatory intentions of central banks. Decreased bank lending rates and increased credit volumes would stimulate aggregate demand; thus the short-term inflation and inflation expectations will reach healthy levels. Additionally, lowered market rates and flattened yield curve would divert capital inflow; thus stopping appreciation of the domestic currency. Despite the unconventional nature of NIRP, the transmission framework and channel did not differ from policy changes in positive territory. However, the retail deposit rate stopped responding to policy rate once it went into a negative area. Existing literature argued that deposit rates are binding at 0. The stickiness of deposit rates indicates an ineffective pass-through of NIRP. Additionally, reduction of lending rates may hurt interest-related profits, if rates are already low. This may incentivize the bank to increase lending volumes and ease credit standards. However, interest-related income still can be hurt. Reduced profit levels might limit the effectiveness of NIRP. To preserve profits, a bank may become riskier, which may hurt the entire banking system. The reduction in net interest income can be achieved by an increase in non-interest income and commissions and fees.

This master thesis complements existing literature on how bank profits changed due to the introduction of NIRP. Specifically, the difference-in-difference estimation showed a small and insignificant decrease of Return on Assets (ROA) of treatment group countries, comparing with the control group. Further analysis identified two effects that contribute to the previous result. Net interest income, the profit gained through interest-related activities, decreased. The interest gap between lending and deposit rates shrank because of unconventional monetary policy. Secondly, banks increased non-interest income to preserve

profit levels. Specifically, the thesis shows that commission and fees contributed the most to the increase of non-interest income. Firstly, this result suggests an additional effect on households. That is, the losses from NIRP are transmitted to customers. Secondly, some banks moved their operational models towards a service-oriented specification.

Overall, according to the ECB and central bank of Sweden, the inflation rate was kept around 1 and 2 percent, after NIRP. On the other hand, the exchange rate of Danish krona to euro did not change significantly after unconventional monetary introduction. And, Swiss frank relation to the euro did not depreciate much.

However, it must be noted that the Negative Interest Policy was not conducted in a vacuum. Other unconventional monetary measures have been conducted in a similar period. For example, quantitative easing (QE) was conducted in March 2015 by the ECB[5]. In comparison, the forward guidance policy started in July 2013 (ECB, 2017). Hence, post-NIRP treatment period bank profit performance is affected by the aforementioned policies. Moreover, the Negative Interest Rate Policy is still ongoing, thus further research may present different results and conclusions. This thesis paper does not distinguish the marginal effect of NIRP on bank profitability. Potentially, banks might start operating internationally. Thus, a large-scale bank can, additionally, compensate for losses by operating in other countries. However, the dataset only includes consolidated bank-level observations, limiting the potential to distinguish profit changes within NIRP adopter countries.

[5] https://www.ecb.europa.eu/explainers/show-me/html/app_infographic.en.html

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Table 5. Descriptive Statistics for Treatment and Control Groups.

		Treatment				Control			
Variable	Form	Mean	Std. Der.	5th percentile	95th percentile	Mean	Std. Der.	5th percentile	95th percentile
ROA	Ratio	0.0054	0.0144	-0.0158	0.0187	0.0102	0.0099	-0.0001	0.0241
Cash Ratio	Ratio	5.8898	8.6069	0.0842	26.6726	8.9942	6.9512	1.0793	21.0344
Reserves	Ratio	0.0327	0.0429	0.0009	0.1333	0.0168	0.0194	0.0015	0.0579
RACR	Percentage	17.9683	11.959	11.28	23.6	17.5213	5.2522	12.2	25.06
Debt to Asset	Ratio	0.9203	0.0366	0.8556	0.9671	0.8981	0.0410	0.8263	0.94477
Deposits-Customer	Ratio	0.4526	0.2259	0.0554	0.8286	0.6081	0.1638	0.2901	0.8163
Deposits-Banks	Ratio	0.1444	0.1434	0.0091	0.5152	0.0760	0.0814	0.0059	0.2642
Loans	Ratio	0.5418	0.1919	0.1398	0.7786	0.6024	0.1480	0.3182	0.8349
Non-NII	Ratio	-0.0122	0.0168	-0.0405	0.0001	-0.0107	0.0095	-0.0252	-0.0005
NII	Ratio	0.0165	0.0096	0.0053	0.0321	0.0218	0.0091	0.0115	0.0399
Com/fees	Ratio	0.0079	0.0051	0.0015	0.0176	0.0069	0.0056	0.0019	0.0159
GDP	Log. Trans.	15.3533	1.4885	10.0966	15.1327	13.1066	1.2544	10.9715	14.89
GDP growth	Percentage	1.5513	2.4800	-1.8411	4.8149	2.8119	2.1844	0.4273	6.6258
GDP variance	Number	1.8088	4.7546	0.0001	11.0754	0.8965	2.793	0.0001	9.7394
Inflation	Percentage	1.1125	1.1533	-0.6925	3.0414	2.0411	1.4889	-0.5444	4.5756

Note: Return on Asset (ROA) is a ratio of net income to total assets. The variables, which form is noted as Ratio, are divided by the total assets.

Table 6. Matrix of correlations

Variables	ROA	Reserves	RACR	Cash Ratio	Debt to Asset	Dep.-Cust.	Dep-Banks	Loans	EU	Inflation	GDP growth	GDP Var.	GDP	Non-NII	Com/ fees	NII
ROA	1.000															
Reserves	-0.448	1.000														
RACR	0.073	-0.120	1.000													
Cash Ratio	0.075	-0.005	0.027	1.000												
Debt to Assets	-0.303	-0.259	0.018	-0.136	1.000											
Dep.-Cust.	0.138	0.047	-0.190	0.300	-0.149	1.000										
Dep.-Banks	-0.123	0.131	-0.036	-0.277	-0.191	-0.589	1.000									
Loans	0.024	0.111	-0.251	-0.316	-0.218	0.188	0.117	1.000								
EU	-0.257	0.235	-0.008	-0.335	0.224	-0.302	0.366	-0.040	1.000							
Inflation	0.200	-0.233	0.007	0.024	-0.080	0.064	-0.056	0.039	-0.222	1.000						
GDP growth	0.320	-0.136	0.027	0.168	-0.180	0.322	-0.242	-0.043	-0.214	0.099	1.000					
GDP var.	-0.105	0.154	-0.033	0.021	0.001	0.078	-0.067	0.003	0.135	-0.033	0.020	1.000				
GDP	-0.036	-0.297	0.003	-0.385	0.376	-0.397	0.282	0.020	0.140	-0.055	-0.181	-0.225	1.000			
Non-NII	0.734	-0.663	0.178	0.015	0.087	-0.086	-0.061	-0.167	-0.113	0.075	0.262	-0.164	0.221	1.000		
Com/fees	0.172	0.043	-0.053	0.231	-0.204	0.125	-0.038	-0.109	-0.077	-0.106	-0.004	0.051	-0.065	-0.018	1.000	
NII	0.225	0.349	-0.155	0.094	-0.582	0.358	-0.106	0.287	-0.242	0.129	0.110	0.100	-0.370	-0.452	0.259	1.000