Columbia University, School of International and Public Affairs Capstone Project

Negative Interest Rates
A comparative study of implementation and effects across four central banks

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ABSTRACT

This report investigates negative interest rate policies across four central banks. During 2014-2016, the European Central Bank, the Swedish Riksbank, the Swiss National Bank, and the Bank of Japan cut their rates below zero. For a long time this was deemed impossible but all four central banks were successful in bringing short-term interbank rates negative. Beyond that, a wide universe of asset return rates went negative, telling us that monetary transmission can work in negative territory. However, some features of monetary policy do change. We found that longer dated securities are less responsive to central bank policy rate cuts when these cuts are in negative territory. Further, we found that money market trading can suffer if market players are not technically equipped to handle negative rates. Whether central banks telegraphed the possibility of negative rates before the actual cut (ECB, SNB, Riksbank) or did not (BoJ) made a big difference in market functioning immediately after the cut below zero.

In general, however, we conclude that negative rates – not too far below zero – behave in much the same ways as positive rates close to zero.

DISCALIMER

This report does not represent the views of Columbia University or the Federal Reserve Bank of New York. The views expressed herein should be attributed to the authors and not to the FRBNY, Columbia University, or Professor Daniel J. Waldman.
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1 Introduction

Ever since the financial crisis of 2007 and 2008, central banks across the globe have been coming up with new ways to carry out their mandates. In 2009, the US Federal Reserve was the first to start a large-scale program of long-dated asset purchases. Since then, more have followed with “unconventional policies”. The UK, Japan, the Euro Area, and Sweden also introduced asset purchase programs. Central banks in Japan, the Euro Area, Switzerland, and Sweden also all cut their policy rates below zero.

Negative interest rate policies (NIRPs) are the topic of this report. Before central banks cut rates into negative territory, the wider economics profession believed in a zero lower bound for interest rates. The basic rationale for this was that if you have to pay to deposit money, you might as well hold it in cash. Nonetheless, central banks have been successful in cutting their targets for overnight rates below zero. These negative interest rates were transmitted to a broad selection of assets in these jurisdictions. At first glance, cutting rates in negative territory does not seem that different from cutting rates in positive territory. This report seeks to investigate that statement.

We look at the negative interest rate implementation in Japan, the Euro Area, Switzerland, and Sweden. These are the only central banks with floating exchange-rates that have implemented negative rates. Our analysis is divided into a basic “Before” and “After” setup. For each jurisdiction, we first look at the implementation framework for monetary policy, and if they were any special considerations for implementing negative rates. The Bank of Japan and the Swiss National Bank, for instance, used a tiering system where negative rates applied only to a portion of bank reserves held at the central bank. After explaining how each central bank pushed rates into negative territory, we look at how markets reacted to negative rates. The central question is whether cutting rates below zero yields the same impact as cutting them in positive territory. There was one clear difference across the board. At the short end of the yield curve, interest rates go negative in all jurisdictions. But for long-dated securities, the correlation between them and the central bank policy rate weakens after the rate crosses into negative territory. In other words, monetary policy transmission through credit prices is hampered once rates cross into negative territory. Beyond that, it is hard to disentangle the effects of negative interest rates from the asset purchase programs across all the jurisdictions.

This report is divided into four chapters – one for each central bank. At the end, we will provide some comparative observations and conclusions.

1.1 Negative rates: a new monetary policy tool\footnote{The section draws heavily on Coeuré (2016), which references a speech given by Benoît Coeuré, Member of the Executive Board of the ECB, at the Yale Financial Crisis Forum in July 2016.}

At the outset, it is important to note that whilst the idea of negative rates has been discussed on a theoretical basis in economic circles for decades, until 2014 the concept of “charging” a negative deposit rate to banks was uncharted territory.
Until the financial crisis, there had always been an assumed zero lower bound for interest rates. This assumption was predicated on the notion that if other assets offered negative yields, individuals and businesses would prefer to hold cash (which offers a zero nominal return). However, this doesn’t take into account the implicit costs of holding large amounts of cash – these include storage costs, security costs, and the general inconveniences of paying with cash. Therefore, the opportunity cost of holding cash creates a “physical lower bound” (see Figure 1).

Economists have also explored the concept of an “economic lower bound” or a “reversal rate”, which is the point at which decreasing the policy rate has a contractionary (rather than expansionary) impact on lending. At this juncture, the costs of negative rates would outweigh the benefits.

Within this context, our report seeks to use empirical evidence to comment on the approach and impact of negative rates across the four regions whose central banks have implemented NIRP. However, since the central banks (and regions) we are studying have had only limited experience with their respective negative interest rate policies, it is too early to tell with precision where exactly the economic lower bound lies.

2 Brunnermeier and Koby (2016)
1.2 References for the introduction


https://scholar.princeton.edu/sites/default/files/markus/files/08f_reversalrate.pdf
2 The Euro Area

We begin with the Euro Area – the largest economic region in our sample and the first to cut to negative rates.

Figure 2 GDP in 2014

On June 5, 2014, the European Central Bank (ECB) announced a negative rate on its deposit facility, crossing the so-called zero lower bound for the first time. Since then, the ECB has made three further rate cuts, and the deposit rate currently stands at -40 basis points (bps). Figure 3 delineates a timeline of key monetary policy events leading up to and after the negative rates were initiated. In addition to interest rates, the ECB has been utilizing a wide range of policy actions (such as targeted long-term refinancing operations [TLTROs] as well its quantitative easing program).

Figure 3 Timeline of events in the Eurozone
It must be pointed out that while the focus of our research has been on NIRP, it is difficult to disentangle the impacts of this policy action from the wider policy toolkit the ECB has been utilizing to combat the economic deterioration of the Euro Area.

2.1 Approach and Implementation

In this section, we will explore the ECB’s approach towards negative rates and examine how they were implemented. For context, we will also look at the macroeconomic environment in the Euro Area prior to the implementation of negative rates, and describe how the Euro Area financial system is structured.

2.1.1 Euro Area money market setup

The Euro Area financial system is largely intermediated by monetary financial institutions (i.e. the banking sector). The total size of the Euro Area financial sector stands at around 68.6 trillion euros (for context, the GDP of the Euro Area in 2015 was around 10 trillion euros). Of this, credit institutions hold 46% of the assets. While the banking sector continues to represent the largest share of the financial sector, the share of the non-bank financial sector (insurance companies, pension funds, and other financial intermediaries) has been rising since the financial crisis. Money market funds, however, only account for 1.5% of total financial assets. Therefore, for the purposes of monetary policy transmission, the banking sector is the most significant.

*Figure 4 Total Assets of the Euro Area Financial Sector (EUR trillions)*

![Graph showing total assets of the Euro Area financial sector](image)

Source: ECB

Looking closer, the banking sector in the Euro Area is heavily dependent on deposits for funding; deposit liabilities make up more than 50% of the balance sheet of Euro Area financial institutions.

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3 All data in this section is referenced from the ECB’s 2016 “Report on Financial Structures”, and is valid as of the end of 2015 (unless otherwise specified)
Since negative rates are not passed on to retail customers, when rates go below zero, this dynamic can adversely impact banks’ profitability (which we will explore in Section 2.2 and Section 6.3).

**Figure 5 Aggregate Liabilities of Euro Area Monetary Financial Institutions**

There are also some heterogeneous dynamics across Euro Area member states in terms of the makeup of the financial system. MFI’s account for the greatest share of the financial system in most Euro Area countries except Luxembourg, Cyprus, Malta, and the Netherlands. In terms of non-bank financial institutions, the insurance sector accounts for between 1% and 19% of the total assets of the Euro Area financial system, and is especially developed in core countries like Germany and France.

### 2.1.2 Macroeconomic Context

In the wake of the financial crisis, the ECB developed a comprehensive package of financial reform to respond to the deterioration in financial, monetary, and economic conditions of the Euro Area. Through *unconventional* monetary policies and historically low interest rates, the ECB aimed at “safeguarding the transmission of monetary policy at times of impairment and fragmentation in financial markets, thereby helping to sustain financial intermediation and the availability of credit to the real economy.”5 Between October 2008 and June 2009, the central bank lowered its key interest rate by 325 basis points, and by the end of 2013 the rate on the deposit facility reached 0 bps, the “zero lower bound”. However, while the Euro Area exited recession in mid-2013, the financial crisis

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4 All data in this section has been referenced from the ECB’s Statistical Data Warehouse.
5 European Central Bank, 2013.
exposed profound structural flaws in the “plumbing” of the Eurosystem, and the enduring implications of the crisis continued to pose significant challenges.

By 2014, real GDP growth in the Euro Area had barely recovered to pre-crisis levels. In the ECB staff’s June 2014 Macroeconomic Projection (the latest projection prior to implementation of the negative interest rate policy), real GDP growth projections for 2014 had been revised down from 1.2% to 1.0%.

Importantly, the inflation situation was still extremely challenging. The primary mandate of the ECB is to maintain price stability. However, headline inflation had been on a downward trend since 2012, reaching 0.5% in May 2014. While the trends in headline inflation were largely driven by energy and food price volatility, the annual rate of change in core inflation was also consistently much lower than what the ECB sought, indicating a fundamental weakness in demand.

![Figure 6 Euro Area Headline and Core Inflation](image)

Source: ECB

In terms of using interest rates as a policy tool, the first response of the European Central Bank (ECB) was to increase its benchmark rate (in July 2008), followed by a gradual movement towards the zero lower-bound in 2013 (interrupted by two more policy rate rises). However, with core inflation sitting at or below 1 percent for about a year prior to June 2014 and interest rates already at the zero lower-bound, the ECB had limited policy options remaining in its toolkit. In announcing the ECB’s negative interest rate policy on June 5, 2014, Mario Draghi, President of the ECB, articulated the thinking behind the bank’s actions when he made the following statement:6

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6 Draghi, 2016
2.1.3 Monetary Policy Implementation Strategy

The primary mandate of the ECB is price stability, defined as a “year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%.” In June 2014, to combat the low-inflation trend plaguing the Euro Area, the European Central Bank initiated a negative interest rate policy mechanism, when it decided to move one of its key interest rates (the deposit facility rate) into negative territory, at -0.10 bps.

The June 2014 monetary policy decision was followed by three additional rate cuts (to -0.20 bps in September 2014, -0.30 bps in December 2015, and -0.40 bps in March 2016). In addition, the negative interest rate policy was complemented by other “unconventional” policy actions taken by the ECB, including the asset purchase program (QE) initiated in March 2015 and targeted longer-term refinancing operations (TLTROs).8

Figure 7 Crossing the ZLB: Evolution of the ECB’s Deposit Rate

2.1.3.1 Technical Implementation of Monetary Policy by the ECB

The ECB implements its monetary policy strategy using an interest rate corridor framework. The Governing Council of the ECB meets eight times a year to determine its monetary policy action and articulate its target rates.9 The three official interest rates set by the ECB are:

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7 While the Treaty on the Functioning of the European Union (which established the European Community) mandates price stability as the primary objective of the ECB, the Governing Council only announced a precise quantitative definition for what that would entail at its meeting on 13 October 1998.

8 Description of QE programs included in appendix.

9 Prior to January 2015, the Governing Council met on a monthly basis.
• main refinancing operations (MRO) rate: the rate at which banks can borrow from the ECB for a period of one week
• deposit facility rate: the rate offered to banks for overnight deposits within the Eurosystem
• marginal lending rate: the rate charged to banks for overnight credit within the Eurosystem

The ECB uses its two overnight standing facilities (the marginal lending facility and the deposit facility) to determine the “corridor” around the target MRO rate. These standing facilities “aim to provide and absorb overnight liquidity, signal the general monetary policy stance and bound overnight market interest rate”. The corridor is currently uneven, with the marginal lending rate sent 25 bps higher than the target rate and the deposit facility rate set 40 bps below the target rate.

Counterparties eligible to access these standing facilities must be subject to the ECB’s minimum reserve system as per Article 19.1 of the Statute of the ESCB. Access to these standing facilities is provided through the National Central Bank (NCB) of the member state in which the counterparty is incorporated. Counterparties can access liquidity only upon the provision of “adequate” collateral, in line with the Statute of the ESCB. The ECB prescribes a list of eligible assets that may be used as collateral, and the NCB’s assess their admissibility according to this criteria.

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11 The width of the corridor has changed over time. Prior to April 1999, the corridor was uneven. From 1999 through 2008, the corridor was 200 bps. During the financial crisis, the corridor was narrowed to 100 bps (in October 2008) for a short period of time, before being restored to 200 bps in early 2009. The corridor was narrowed again, to 150 bps, since the Governing Council meeting of May 7 2009.
12 The criteria are laid out in the “Eurosystem legal framework for monetary policy instruments”
The ECB seeks to use the corridor framework to influence the Euro Overnight Index Average (EONIA), which is the effective interest rate in the interbank overnight market. Prior to the financial crisis, the EONIA rate generally settled around the main refinancing rate, since the ECB managed liquidity supply by regulating the quantity provided at their weekly operations in such a way as to ensure this (given banks’ liquidity needs). However, post-crisis the ECB moved to a fixed-rate full allotment policy for all refinancing operations.\textsuperscript{13} The resultant excess liquidity pushed EONIA rates close to the floor of the policy corridor.

By and large, the implementation of negative interest rates took place within existing operational frameworks. At the same time, the ECB also decided to change its remuneration policy: all current account balances in excess of the minimum reserve requirements now “earned” the deposit rate (as opposed to 0 bps as was the case previously).

The negative rate applies directly to the interest rate on the deposit facility. In addition, the negative rate is applicable to the following:

- banks’ average reserve holdings in excess of the minimum reserve requirements (required reserves earn the MRO rate)

\textsuperscript{13} Under fixed rate full allotment counterparties have their bids fully satisfied, against adequate collateral, and on the condition of financial soundness.
• government deposits held with the Eurosystem that exceed certain thresholds
• Eurosystem reserve management services accounts
• participants’ account balances in TARGET2
• non-Eurosystem NCB balances (overnight deposits) held in TARGET2
• other accounts held by third parties with Eurosystem central banks

2.1.3.2 Implementation Considerations and Challenges
Since the ECB has a mandate to maintain price stability for the Euro Area as a whole, in normal times, the central bank does not seek to influence country-specific developments. However, due to the size and complexity of the Euro Area, it faces some very specific distributional considerations related to the implementation of monetary policy actions compared to other central banks. The member state financial heterogeneity impedes the smooth transmission of monetary policies by the ECB. Since the ECB institutes the negative interest rate on excess reserves, the “charge” is greater in countries whose banks hold large excess liquidity. Typically, these are countries with larger current account surpluses.

In addition, the real economies of the Euro Area have a heavy dependence on bank financing: two-thirds of the external financing of Euro Area firms is intermediated by banks. In particular, small and medium-sized enterprises (SMEs) are typically more dependent on bank lending than larger firms. Since SMEs constitute 99% of all Euro Area firms, they play a significant role in the economy of the Euro Area. Therefore, financial stability concerns related to the impact of negative rates on bank profitability are especially relevant for the ECB (since negative rates are not passed on to retail customers, a low/negative rate environment will compress banks’ net interest margins and thus their profitability).

The ECB also had to prepare for potential operational and technological challenges associated with negative rates. While the implementation of negative interest rates took place by and large within existing operational structures, the ECB had to conduct a thorough review of their IT, documentation, and accounting systems to ensure these systems could handle a rate below zero. With regard to preparing their stakeholders, while there is no formal declaration of its policy forecast prior to the June Governing Council meeting, the ECB informed its counterparties that is might introduce a negative rate almost a year in advance of its public decision. The move was also heavily signaled to the markets through press conferences and speeches made by senior ECB officials.

2.1.3.3 Direct Costs of NIRP
As of 2016, Euro Area banks’ overnight deposits (€297 billion) and current account balances (€613 billion) amounted to about €910 billion. The minimum reserve requirement is remunerated at the MRO rate of 0 bps. Minimum reserves comprised €116 billion; hence the excess reserves of €794 billion were subject to the negative deposit rate of -40 bps. Therefore, the direct annual cost of the negative interest rate was about €3.2 billion for all Euro Area banks in aggregate.

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14 It should be noted that the ECB’s use of its interest rate policy to influence inflation differentials within countries in the Euro Area would not work unless combined with other policy mechanisms. Using only one policy instrument – the interest rate – the ECB can only influence one target – the average inflation rate across the Euro Area. Therefore, any discussion of interest rate policy as it relates to specific member states must take into consideration other policy tools.

15 Data in this section has been derived from the IMF, and is as of the end of 2015.
Using this as a framework, we could conclude that a 10 bps reduction in the deposit rate would result in a direct cost of about €800 million per year.\textsuperscript{16}

2.2 Experience with negative rates

We now turn to the impacts of negative rates across various markets and economic indicators.

2.2.1 Financial Market Impact

We start with looking at the immediate impacts to financial markets.

2.2.1.1 Money Markets

\textbf{Extraordinary excess liquidity makes a corridor regime de facto floor-only}. Short-term financing markets are a key arena where the proximate impacts of NIRP can be readily observed. The first highlight to notice from the figures below is that the historical 30-50 basis point spread between 3 Month EURIBOR and EONIA in the pre-crisis period has collapsed to almost zero in early 2017, and they both now closely hug the floor of the policy corridor (because true market-clearing levels are well below -40 basis points). This reflects the extraordinary liquidity surplus currently in the Eurosystem, due to LTROs, asset purchases and a host of other complementary measures. Also worth noting is the significant drop-off in EONIA volumes since 2015 (from an average of €30bn to €10bn per day), due to the ECB’s greatly expanded role as dominant counterparty to the banking system.

\textit{Figure 10 Euro Area Money Markets (View I)}

\textsuperscript{16} Jobst and Liu, 2016.
A related view in the figure below conveys the evolution of spot vs. forward EONIA pricing over the post-crisis period. By focusing on mid-2014, it can be seen that forward expectations one year ahead closely tracked actual EONIA levels at the time that the deposit rate went negative, suggesting that markets did not initially believe that the ECB would be as quick to breach the “Zero Lower Bound” as they in fact were. Moving ahead to 2016, however, the dip in 1yr1yr forward levels to -50 basis points in early 2016 reflects that money markets were farther ahead of the ECB’s actions this time and indeed were positioned for the deposit rate to go even more deeply negative than -40 basis points. At the time of writing in early 2017, growth and headline inflation in the Euro Area have begun a marked improvement and so EONIA expectations have recovered above spot levels in anticipation of the ECB potentially initiating a mild hiking cycle back toward 0% if conditions hold and political risks for the balance of 2017 do not run out of control.

Figure 11 Euro Area Money Markets (View II)

Figure 12 Euro Area Money Markets (View III)
2.2.1.2 Sovereign Debt

**Periphery-core compression since 2012, followed by stabilization under NIRP.** The story most germane to NIRP arising from sovereign debt markets is that while the first round of 2012 policy rate cuts and LTROs clearly resulted in dramatic periphery-core spread compression (500 to 200 basis points over approximately 3 years), the deposit rate’s breach of the Zero Lower Bound in mid-2014 does not appear to have had the same incremental impact. Not only have spreads have remained broadly stable at approximately 100 basis points since the onset of APP in 2015, but the outright 10 year yields of indicative Member States like Germany and Italy have also not moved meaningfully over this period. This fact pattern suggests that, much like successive rounds of quantitative easing efforts observed in Advanced Economies since the Global Financial Crisis, NIRP in the Euro Area faces a “law of diminishing returns” whereby cuts in the deposit rate from 0.0% to -0.4% in 2016 have not delivered the same relief in funding cost as prior easing action in 2012 of comparable magnitude in positive territory. Or an alternative explanation could be that further compression since 2016 has been stymied because German 10yr yields themselves are now nearing the Zero Lower Bound, and are subject to similar behavioral resistance to going negative that can be observed in retail bank deposits.

*Figure 13 Euro Area Sovereign Debt Markets*
2.2.1.3 Securitization Markets

**Lock-step compression in parallel with the policy rate.** In comparison to the sovereign debt market story, Euro Area securitization markets in some ways follow a similar arc and in others they diverge. In terms of commonalities, both ABS and MBS indices enjoyed significant yield compression throughout the 2012-2015 period, from a peak of 4% p.a. to approximately 0.5%. Like sovereigns, these levels then broadly stabilized from 2015 onward and have remained somewhat range-bound since (despite a further round of deposit rate cuts in 2016 and continuing QE-related purchases of ABS and Covered Bond supply by the ECB). This echoes the sovereign narrative of limited incremental impact mentioned above. However, these two related asset classes have moved largely in tandem throughout the observation period (unlike the compression in Italy vs. Germany 10yr spreads), and have even moved modestly farther apart since 2016. Broadly speaking, NIRP since 2014 appears to maintained downward pressure on yields in securitized markets, but has failed to deliver incremental tightening.

*Figure 14 Euro Area Securitization Markets*
2.2.1.4 Corporate Credit Markets

Significant post-crisis compression, then decelerating improvement since NIRP. The corporate credit story is broadly similar to that of sovereign debt, in that yields for both high and low-risk components of the asset space experienced dramatic tightening in the 2012 – 2015 period, but appear to have “run out of steam” from 2016 onward in the face of further deposit rate cuts. The one distinguishing aspect of corporate bond reaction to note is that a flare-up in High Yield risk aversion in early 2016 appears to have been quickly contained and brought back in line with its previous levels of approximately 4% p.a. by the middle of the year. Interestingly, the Investment Grade part of the market did not feel the same sell-off pressure that the lower-rated names did during this period. So one could tentatively conclude from this fact pattern that NIRP appears to have contributed to a containment of investor flight from the High Yield Corporate Bond universe in 2016, while Investment Grade seems to have had little to no reaction to the second round of NIRP cuts to -0.40%.

Figure 15 Euro Area Corporate Credit Markets
2.2.1.5 Equity Markets

Broad equities back to where they started in 2010, banks down by 50%. While the fortunes of Euro Area equity markets have waxed and waned throughout the post-crisis period, it is striking to note from a high-level perspective that the overall index has made essentially no net gains over a 7yr horizon. It is also instructive to highlight that the subset of banking names within the EURO STOXX 50 has given up approximately half their market value since 2010 (as of Q1 2017). This fact corroborates the concerns elucidated in more detail later in this chapter as to the gloomy outlook for financial institution profitability and stability. As to the interpretation of NIRP’s impact on these markets, we can broadly see that the 0% deposit rate appears to have boosted the recovery momentum that was instigated from the depths of the sell-off in mid-2012 and that the first round of cuts to -0.20% seem to have further encouraged the rally to its height in mid-2015. However, when the markets began to reverse course later in the year and into 2016, it could be argued that rather than returning the indices to an upward trajectory, the second round of cuts to -0.40% in early 2016 seem to have merely “stopped the bleeding” and did not deliver the same incremental impact that the earlier round had. This dynamic generally aligns with the themes of NIRP’s “diminishing marginal returns” seen in other Euro Area asset markets like sovereign debt and corporate credit.

Figure 16 Euro Area Equity Markets
2.2.2 Banking System Health

We next look at the banking sector and how negative interest rates affected the eurozone banks. As noted above, the banking sector is the dominant financial intermediary in Europe.

2.2.2.1 Lending Margins

Steady downward march in large Member States since 2015. Because the real economies of the Euro Area are highly reliant on traditional depository financial institutions for financing, the Net Interest Margins (“NIMs”) of banks are crucial to understanding how NIRP is transmitted to private sector activity. Non-financial corporates source 66% of their financing from banks, and those lenders in turn depend on NIMs for 60% of their gross profits (Jobst and Lin, 2016a). By analyzing the figure below, one can see that average lending margins on new loans have suffered for banks in periphery Member States since late 2014, but core institutions have largely kept spreads stable at approximately 1.5%. While caution should be taken in extrapolating Italy’s experience since it has weathered idiosyncratic stress in its banking system over the last several years, both Spain and Germany have also lost 50 basis points of margin over the same period (following its comprehensive bank recapitalization program in 2012). This broad degradation in profit outlook for Euro Area banks presages a possible impairment of the credit channel through which NIRP is designed to flow, because lenders will become less and less amenable to compressing their long-end lending rates as deposit rates venture deeper into negative territory.

*Figure 17 Euro Area Bank Lending Margins*
2.2.2.2 Lending Exposures

Short-term lending flat since 2015, long-term behavior splits along core-periphery dimension. As has proven true in a variety of other dimensions when examining the after-effects of the European debt crisis, the decomposition of bank lending behaviour by tenor in the exhibits below can be framed as a story of divergence between core and periphery Member States. For short-term lending (less than one year), French and German banks have largely maintained their exposures at levels comparable to what they were in 2010, while Spain and Italy are down by approximately 20-30%. In the medium-term category (1-5yr maturities), the three major jurisdictions aside from Spain moderated their activity slightly in the 2010-2014 period, but as NIRP and QE took hold in the 2014-2015 period their risk appetite seems to have experienced a reasonable rebound of 20-40%. This could conceivably be due to an incremental rotation in to longer duration assets in hopes of achieving greater yields, or simply could simply be a reflection of the strengthening fundamental growth picture and loan demand from borrowers. Spain’s performance in this tenor range should be considered an outlier, as the dramatic fall-off in exposure from its peak in 2010 is likely attributable to the ESM-assisted recapitalisation and clean-up of its banking system rather than to endogenous risk decisions taken by the banks themselves. The long-term lending category (5 years and longer) is where the “parting of the ways” between core and periphery countries is most pronounced. French and German banks show a persistent upward march in long-term lending exposures, reaching increases of approximately 10-30% over the 2010-2017 period. In rather stark contrast, Italy’s lending decreased by roughly 10% over that same horizon (again setting Spain aside because of idiosyncratic circumstances). One could easily argue that Italy’s banking system, saddled with exceptionally high Non-Performing Loans (“NPLs”), is the culprit of this retrenchment at the long end of the curve as institutions have attempted to protect their solvency by not over-extended on new credit. The case of the core countries, however, appears to be a more straightforward
confirmation of the “reach for yield” (or more formally “portfolio rebalancing”) phenomenon that NIRP and QE have been associated with. Against the backdrop of yields on German sovereign debt as long as 10 years in maturity approaching the Zero Lower Bound in recent years, this data illustrates the growing duration that core European banks are willing to tolerate to achieve even marginal positive returns.

*Figure 18 Euro Area Bank Lending Exposures of Selected Member States (<1yr)*

*Figure 19 Euro Area Bank Lending Exposures of Selected Member States (1-5yrs)*
2.2.2.3 Profitability Drivers

One-time QE effects have delayed real pain, but NIRP will begin to hurt from 2018. Despite some of the concerns aired in recent years about threats to bank profitability, at the aggregate Euro Area level (and indeed in the largest Member States) the ECB has concluded that the net effect of its
unconventional measures up to 2017 has been approximately neutral. Up to this point, banks have largely been able to circumvent the modest incremental cost applied to their excess reserve holdings by increasing lending volumes, shifting some of their funding to cheaper wholesale sources (away from retail deposits which are de facto floored at 0%) and recognizing mark-to-market gains on their securities holdings. However, the IMF predicts that from 2018 onward the ongoing costs imposed by NIRP will begin to outweigh the benefits as the gains from these one-time adjustments and maneuvers start to fade (Jobst and Lin, 2016a). The compression in NIMs will erode equity buffers over the medium term, so not only will some banks become more vulnerable at the microprudential level, but also will potentially become a more threatening propagation mechanism for systemic shocks unless they de-lever by raising capital (which recent history has proven they are loath to do unless in dire straits) or by shedding assets (which would slow real economic activity). This danger of impairment to the transmission of monetary policy lies not only in the management of leverage, but also in the credit channel because as rates potentially sink into more deeply negative territory, banks may slow their pace of tightening in the long-end rates they charge to clients in the interest of protecting their margins. In terms of the direct, tangible costs of NIRP currently facing Euro Area financial institutions, a -0.40% deposit rate means that the excess reserve pool of €800bn held with the Eurosystem currently attracts €3.2bn p.a. in negative interest, and the IMF estimates that a further 10 basis point rate cut would incur €9bn in additional costs (Jobst and Lin, 2016a). They further forecast a more aggressive easing of 50 basis points would compress NIMs by approximately 0.07% in aggregate.

*Figure 21 Estimated Effect of Monetary Policy on Bank Profitability*

(percentage point contribution to return on assets)
2.2.2.4 Income Composition

Fee share of total income sees modest pickup post-NIRP. In addition to the compensatory measures mentioned above that Euro Area banks are taking in response to NIRP, at the aggregate level is appears that the banking system is making modest moves toward more fee and commission-based product offerings as their lending margins shrink. Although data for 2016 was not available from the ECB at time of writing, the general directional trend since the onset of NIRP in 2014 indeed seems to confirm that fees are gradually becoming a more important feature in the revenue picture for banks. It should be noted, however, that the scale in the exhibit below has been intentionally magnified to make detailed movements in the series discernible, and that fees have only increased by 2 percentage points to roughly 27% of total income. One interesting aspect to note is that the income share for fees appears to have stabilized in the 2012-2014 period as policy rates hovered around zero, but dipped again as the deposit rate sank to -0.20%. This could potentially imply that the banking system initially “doubled down” on interest income with the assumption that NIRP would quickly feed through to improved real activity and loan demand from borrowers, but from 2015 onward the upward climb of the fee share indicates that lenders have become more skeptical that NIRP will immediately stimulate a recovery. They therefore are now more seriously focusing on other non-interest areas to offset thinner NIMs.

*Figure 22 Euro Area Bank Income Share – Fees*
2.2.3 Financial Stability

2.2.3.1 Credit-to-GDP Gap

Credit bubble threat is far in the distance for the Euro Area. In similar fashion to the output gap commentary mentioned above, the Credit-to-GDP gap has been deeply negative since the onset of the crisis and has yet to recover. The initial accommodative initiatives put forth by the ECB in 2012-2013 (0% deposit rates and LTROs) appear to have done little to arrest the collapse in credit creation vs. its trend, although it could be argued that these steps transformed what would have been a precipitous crash into a prolonged slide toward -10% by early 2014. While taking care to avoid causal statements about what share of the credit asset purchases, TLTROs and deposit rate cuts to -0.20% had claim for the brief pickup in credit in early 2015, as a combined package they appear to have had a modest impact. Interestingly, from mid-2015 the credit gap has essentially relinquished all of its post-crisis gains, aligning with the possibility that the initial effects of both NIRP and asset purchases tend to “fade” over time and enjoy diminishing marginal returns in terms of real activity. From a systemic perspective, the behavior of this series suggests that while stability risks may be accumulating in places like over-stretched asset market valuations, it appears that over-leveraging should not be a primary near-term concern for the Euro Area.

Figure 23 Euro Area Credit-to-GDP Gap

2.2.3.2 Bank Credit to Sovereigns

“Doom loop” dangers have remained elevated during the NIRP period. While the “doom loop” fragility concerns associated with the Eurocrisis are often raised in the context of lenient risk weighting regimes, it can also be considered through the lens of NIRP because it could be defensibly argued that Euro Area banks have taken on longer-duration debt issued by their own governments
due to the “reach for yield” pressure exacerbated by low policy rates. Data as to the tenor composition of these holdings is unfortunately not available, but we can see in the exhibit below that Italian banks almost doubled their total nominal exposure over the 2010-2017 period, while Spain and Germany increased theirs by approximately 30%. In Italy in particular, we could hypothesize that banks have perhaps taken up more long-dated government debt because of a dearth of other domestic assets with reasonable returns and decent creditworthiness backstopping them. These instruments are also key in allowing Italian banks to source liquidity from the ECB at a time when private sector lenders have often been less receptive to funding them. Taken as a group, the broad takeaway from these data is that sovereign debt holdings by banks have increased since the onset of the crisis and have remained elevated since. This suggests that NIRP may have played a contributing role in adding to the systemic vulnerability of the Euro Area.

Figure 24 Euro Area Bank Credit Extension to Domestic Sovereigns

2.2.4 Real Economy Impact

2.2.4.1 Inflation

Spot remains stuck, expectations picking up. As one of the macroeconomic indicators most central to the reinvigoration of sluggish Euro Area aggregate demand (not to mention legally enshrined in the ECB’s mandate), inflation performance is key to understanding the impacts of Negative Interest Rate Policy (“NIRP”). The key takeaway to glean from the exhibit below is that 5yr swap rates have recently gained ground toward 2% since late 2016, realized core HICP has remained stalled below 1% since mid-2013. Interesting to note is the relative stability of the 5yr forward market prediction of inflation between the first round of deposit rate cuts (and LTROs) in 2012 and the onset of TLTROs in mid-2014, while actual core HICP marched steadily downward by
approximately 100 basis points during this same period. This potentially suggests that markets viewed the current policy stance of the ECB as insufficient, but were still convinced that more aggressive steps lay in store that would pull inflation back toward its 2% target in the medium-term. As the ECB buttressed its initial efforts with the rollout of asset purchases and pushing deposit rates into mildly negative territory, however, the non-reaction of actual core inflation and degradation in the medium-term outlook to 1.5% by mid-2016 perhaps reflects that market actors gradually lost confidence that the ECB had the necessary tools to effectively combat deflationary pressures after all. While an argument could be made that the recent recovery in 5yr5yr forward inflation reflects the virtuous impacts of NIRP finally feeding through real activity with an unusually long lag (generally output reacts to monetary policy in 6-18 months), the overall impression from this first set of indicators is that NIRP appears to have had de minimis incremental effect on improving inflation performance (or outlook) throughout most of the 2014-2017 period.

*Figure 25 Euro Area Inflation*

### 2.2.4.2 Credit Creation

**Back to neutral after a deep contraction.** The next important dimension to consider regarding the real economy impact of the ECB’s NIRP efforts is credit provisioning to firms and households by the banking system. From this perspective, negative rates seem to have a more heartening story to tell than through the inflation lens. While of course we must be careful in not assigning causality to NIRP alone (given the variety of other policy measures like LTROs and APP in the Euro Area landscape), negative rates do seem to have coincided with a meaningful reversal in credit contraction vis-à-vis the real economy during the 2012-2014 period, and in fact we have seen modest new expansion in credit through the end of 2016. In contrast the inflation view above, NIRP appears to
be “doing its job” in the credit dimension (in conjunction with the suite of other unconventional measures that the ECB has deployed since 2012).

**Figure 26 Euro Area Credit Creation**

![Euro Area Credit Creation Graph](image)

2.2.4.3 Financial Conditions

**consistent improvement since 2012.** Borrowing costs faced by the Euro Area private sector have unambiguously improved across the board since the onset of the crisis, decreasing from an average of 3%+ p.a. in 2012 to below 2% in late 2016. The series noted below admittedly contain a variety of heterogenous components (varying tenors, types of spending, etc), but the overall “direction of movement” is nonetheless instructive. While these constructive developments cannot of course be claimed by negative policy rates alone, they certainly can be assumed to be part of the holistic “toolkit” that has almost monotonically compressed financing costs for firms and households over the last five years.

**Figure 27 Private Sector Financing Costs**
2.2.4.4 Growth and Output Gaps

**Encouraging momentum since 2014, but work remains to be done.** In comparison to the somewhat more lackluster outcomes so far observed in financial market dimensions like sovereign or corporate funding costs, the “second wave” of policy measures deployed by the ECB in 2014-2016 (in which NIRP was an important player) appears to be feeding through to constructive (albeit lagged and gradual) improvements in growth and output gaps. The sequential deposit facility cuts from 0% to -0.40%, in combination with asset purchases and TLTROs, have witnessed an unambiguous and consistent recovery in real growth since the nadir of 2013, and if the trend continues into 2016 the Euro Area could possible regain its footing in the pre-crisis advanced economy comfort zone of approximately 3% year-on-year. A quite similar story can be told of the evolution of output gap estimates since the depths of the 2012 crisis, but with the obvious concern of outright levels still being substantially underwater in 2016. By way of context, GDP was last judged as above potential in 2008 and the IMF projects that it will not recover to positive territory again (and even then just barely) until 2020 (Jobst and Lin, 2016a).
2.2.4.5 Exchange Rate

Significant weakening in advance of QE, NIRP helps with limiting retracement

Although exchange rate performance isn’t as indispensible to the success of unconventional monetary policy for a large, somewhat close economy like the Euro Area as it is for its smaller
compatriots like Switzerland, it is still a key metric to observe in understanding the extent to which NIRP and other initiatives are being transmitted into the global financial markets and fundamental competitiveness improvements. One can clearly see that vis-à-vis the US Dollar, the Euro followed the ascent and descent of the deposit rate in fairly close lockstep during the 2010-2012 period as would be expected from the traditional “interest rate differential” mechanism (more formally explained by “Covered Interest Parity”). The next major development was a meaningful depreciation of approximately 30 basis points in early 2015 as the details of the planned “Asset Purchase Programme” were communicated by the ECB. However, since the Euro found a floor of approximately 1.10 vs. the USD in the first half of 2015, it has remained somewhat stable around that level and further deposit rate cuts in early 2016 do not appear to have resulted in further weakening. If anything, the mid-2016 appreciation moves witnessed in parallel with the deposit rate cuts from -20 to -40 basis points can be seen as counter-productive to the ECB’s aspirations for the exchange rate channel. This could suggest, in contrast to the inflation channel where the ECB’s credibility in kick-starting a recovery has remained strained from 2014 until time of writing in 2017, that the foreign exchange community may have started giving credence to a possible Euro Area growth recovery starting in early 2015. Were this not the case, the Euro may have conceivably continued to follow the deposit rate downward toward parity with the U.S. Dollar in early 2016.

2.2.4.6 Current Account Balance

In concert with QE, NIRP helping to improve EA’s external positioning. The Euro Area’s Balance of Payments stance vis-à-vis the rest of the world has steadily improved from neutral to 3-4% of GDP over the course of the post-crisis period. Viewed in concert with the exchange rate story above, we can comfortably claim that NIRP has likely contributed (alongside QE of course) to
a meaningful improvement in the Euro Area’s international competitiveness, and thus to overall GDP growth.

Figure 31 Euro Area Current Account Balance

2.3 Concluding Remarks on the Eurozone

To conclude, one of the most prominent themes to emerge from these data is that NIRP appears to deliver “diminishing marginal returns” for the Euro Area as the deposit rate has compressed deeper into negative territory. However, improvements in real activity do seem to be finally feeding through with a lag of 2 years or more. This is admittedly longer than usual year or so that “peacetime” monetary policy changes take to filter into the real economy, but this could be a reflection of the deep, structural damage wrought by the 2008 Global Financial Crisis and the secular stagnation concerns that have followed in its wake.

Macro indicators like credit creation and medium-term inflation expectations have begun to recover in 2017, bolstered by sustained accommodation in financial markets across many asset classes since 2012 (sovereign debt, mortgage rates, corporate yields, etc). The cost of NIRP, however, is beginning to take a toll on Euro Area banks via consistent, gradual tightening in Net Interest Margins because of limited further flattening of yield curve and the effective 0% lower bound that retail depositors enjoy. The extraordinarily loose monetary environment has also driven banks in core Member States to “reach for yield” by increasing exposures in long-term lending, while the large periphery countries like Spain and Italy have been unwinding their 5yr+ exposures to firms and households. This dynamic has also been transmitted via the “doom loop” channel, whereby banks in most large Member States increased lending to their home sovereign in the aftermath of 2012 and
these exposures have remained elevated throughout the NIRP period (rather than contracting post-crisis as we might have expected).

The significant credit contraction in the wake of the 2012 Eurocrisis is still being digested by the banking system, and has manifested itself in a deeply suppressed Credit-to-GDP Gap of approximately -10% in late 2016. Although NIRP has clearly assisted in re-starting the credit creation process, the threat of a lending bubble is far down the list of near-term concerns for the ECB and other policymakers.

The most prominent NIRP-related topics that we have chosen not to investigate in this report include…

1. Interaction with asset purchases
2. International spillovers
3. Shadow sector (pension funds, money market funds, insurance companies, hedge funds) because of the dominance of depository institutions in the financing of the Euro Area private sector
4. New product offerings by banks (to obviate the profitability drag from NIRP)
5. Exit implications

While these issues are undoubtedly interesting and worthwhile, they are beyond this report’s scope in examining the direct, immediate implications of NIRP in the Euro Area.
2.4 References for this section


Coeuré, B., 2015. How binding is the zero lower bound?


3 Japan

We next turn to Japan that had their policy rate at the zero-lower-bound for more than 10 years before they cut into negative territory in 2016. Japan is also the second largest of the economies in our sample.

*Figure 32 GDPs of economies in 2014*

![Graph of 2014 GDP in USD](image)

On January 29, 2016, the Bank of Japan (BOJ) surprised the market with the introduction of “QQE with a negative interest rate” on marginal excess reserves. This policy is effective on February 16, 2016. The main motivation for the implementation of NIRP by the BOJ was the need to stabilize inflation expectations and support growth. For central banks like BOJ implementing quantitative easing (QE) policies, two additional considerations were the narrowing pool of assets eligible for their purchase programs and the possibility of diminishing returns from QE.

*Figure 33 Timeline for BOJ Policy*

![Timeline for BOJ Policy](image)

Source: BOJ
Since the start of QQE in 2013, BOJ purchased large amounts of JGBs and expanded its balance sheet significantly, focusing in particular on those with maturities of up to three years. At the end of April 10, 2017, the Bank of Japan held a total of 489.6 trillion yen in assets, of which Japanese government securities accounted for 417.1 trillion yen. However, the core inflation and inflation expectations were still stagnant. Although Japanese firms' behavior has become increasingly proactive based on the prospects of a post-deflationary economy, they have nevertheless remained somewhat cautious despite their high levels of profits, probably reflecting that the prolonged period of deflation is still fresh in their memories.

**Figure 34 BOJ Balance Sheet**

Under QQE, impact of a given amount of JGB purchases on long-term interest rates during 2013 to the summer of 2014 was substantial. However, following this period, the impact of JGB purchases declined, perhaps because the Bank's remuneration rate on excess reserves, which was 0.1 percent at that time, worked as a floor for nominal short-term interest rates, discouraging long-term interest rates from falling below a certain level. It became increasingly clear that more powerful monetary easing was needed and negative interest rate offered the opportunity to further decrease the floor for short-term interest rates. In combination with large-scale purchases of JGBs, the Bank can exert even stronger downward pressure on interest rates across the entire yield curve, resulting in lower real interest rates. Some argue that the negative interest rate policy has shifted the Bank's policy focus from the quantitative to the interest rate aspect. This is not the case. Rather, "QQE with a
Negative Interest Rate further boosts the effects of existing policy measures by directly pushing down the short-end of the yield curve.

It is worth emphasizing that the global environment has also played a role in the decision of going negative. Since the turn of 2015, global financial markets have been unstable against the backdrop of the further decline in crude oil prices and uncertainty over future developments in emerging and commodity-exporting economies. The risk that market volatility could lead to a deterioration in firms' sentiment and bring about a setback in the conversion of people's deflationary mindset should not be underestimated. It was in order to preempt the manifestation of such risk and to maintain the momentum toward achieving the price stability target that the Bank decided on further monetary easing through "QQE with a Negative Interest Rate."

Since the introduction of a negative interest rate in January 2016, the impact of the Bank's JGB purchases on long-term interest rates has strengthened again as the floor for short-term interest rates declined, since they could go into negative territory. BOJ identified a causal relationship between NIRP and long term interest rates. Regression analysis using a dummy variable representing the negative interest rate policy indicated that this policy pushed down long-term JGB yields by 23 bps.

The Bank also decided to adopt a three-tier system in which a positive interest rate or a zero interest rate will be applied to current account balances up to certain thresholds in order to make sure that financial institutions' functions as financial intermediaries would not be impaired due to undue decreases in financial institutions' earnings. The ECB equally applies a negative interest rate on all excess reserves, whereas the Bank of Japan applies a negative interest rate on part of the excess reserves. In this sense, the two have different frameworks.

3.1 Approach and implementation

3.1.1 Three-Tier System

Though not the first to go negative or the first to tier rates, the BOJ is the first central bank to use a three-tier structure, applying different interest rates to different portions of each financial institution's outstanding balance.

This system was adopted based on the idea that the short end of the yield curve would be lowered if a negative interest rate is applied to the marginal increase in the current account balance, considering its influence on financial institutions' function as financial intermediaries through decreases in the financial institutions' earnings.

Transaction prices in financial markets (e.g. interest rates, stock prices, and exchange rates) are determined by marginal losses or gains made in a new transaction. Although a negative interest rate is not applied to the total outstanding balances of current accounts, costs incurred with an increase in the current account balance brought by a new transaction will be minus 0.1 percent if it is applied to a marginal increase in the current account balance. Interest rates and asset prices will be determined in financial markets based on that premise.17

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The BOJ divides up current accounts as follows:

1. Basic balance (rate: +0.1%, amount: approx. ¥210 trillion): The average outstanding balance on each financial institution held during benchmark reserve maintenance periods from January 2015 to December 2015.

2. Macro add-on balance (rate: 0.0%, amount: ¥40 trillion): The balance is made up of reserves financial institutions deposit with the BOJ to satisfy reserve requirements, reserves associated with the BOJ's lending support programs, and others. The outstanding amount of this tier is the product of a multiplier applied to the basic balance. The multiplier is currently zero, but the BOJ plans to adjust it from time to time to control the size of the macro add-on balance and thus the portion of the current account subject to a negative interest rate. Moreover, to prevent financial institutions from increasing cash holding significantly, any increase in cash holding are deducted from the zero interest rate tiers of current account balance.

3. Policy rate balance (rate: -0.1%, amount: ¥10-30 trillion): Any deposits a financial institution stores at the BOJ in excess of the first two tiers. Put more simply, financial institutions that have excess reserves at the BOJ, which is the part greater than the basic balance and macro add-on balance, will pay a premium to continue storing these funds.

Source: BOJ
3.1.2 Current Account Balances by Financial Institution

Financial institutions have been under the following three different situations depending on their current account balances and the use of lending programs by the Bank such as the loan support program: (1) those that fall under the application of a positive rate exclusively (excluding the required reserve); (2) those that fall under the application of both a positive and zero rate; (3) those that fall under the application of a positive rate, zero rate, and negative rate.

If financial institutions with a policy-rate balance lend cash in the money market to those with unused allowances in their basic balance and macro add-on balance, market interest rates will be formed between minus 0.1 percent and 0.1 percent. In other words, if the interest rate is above minus 0.1 percent, financial institutions with a policy-rate balance have the incentive to lend cash for reducing their current account balances to which a negative rate is applied. In contrast, financial institutions with unused allowances in their macro add-on balance can increase their current accounts at an interest rate of 0 percent up to the unused allowance, giving them an incentive to borrow cash in the money market if the rate is less than 0 percent. As such, the three-tier system applied to the Bank's current accounts and the fragmentation of balances among financial institutions (the coexistence of financial institutions with a policy-rate balance and those with unused allowances in their macro add-on balance) create demand for arbitrage trading in the money market.

BOJ estimated the changes before and after the negative interest rate became effective by hypothetically applying the three-tier system to the current account balances during the January 2016 reserve maintenance period (January 16 to February 15).

*Figure 36 Three-tier System of the Current Accounts by Sector*
First, the policy-rate balance of trust banks increased significantly from the January reserve maintenance period to the February reserve maintenance period. This is because amid a large decrease in the number of financial institutions that borrow cash at a rate of 0 percent or above, investment trusts and pension funds -- which refrained from investing at negative rates -- transferred their idle money from investment in the money market to "lending to the banking accounts" of trust banks. On the other hand, in concern of an inflow of deposits in the future, city banks actively purchased JGBs to avoid an increase in their current accounts and largely reduced their borrowings in the money market immediately after the Bank's decision to introduce a negative interest rate. This has caused the unused allowances of city banks' macro add-on balances to increase at an early stage. For regional banks I and II, while some lent cash to avoid generating the policy-rate balance, those with unused allowances in their basic balance and the macro add-on balance borrowed cash in the money market. For other institutions subject to the reserve requirement, the policy-rate balance declined marginally in February compared with the January reserve maintenance period as some entities began to lend cash at negative rates. However, as a whole, such movements were limited within the sector.

Next, when comparing the February and March 2016 reserve maintenance periods, the policy-rate balance increased partly due to large redemptions of JGBs and treasury fund payments at the fiscal
year-end. These caused transactions at negative rates to increase in the money market. Specifically, regional banks I and II, trust banks, and central organizations engaged in arbitrage trading in the call market and in the GC repo market; those with a policy-rate balance reduced a part of their increased policy-rate balance, and those with unused allowances in their macro add-on balance had their unused allowances decrease.

### 3.2 Impacts

A cut to official interest rates feeds through into money markets. In addition to moving the exchange rate, that affects asset prices and wholesale borrowing rates. Commercial banks generally react by lowering the rate they charge borrowers. Banks would normally pass that reduction on to their depositors but, as depositors by and large refuse to pay for their accounts, they find it difficult to push their deposit rates below zero.

#### 3.2.1 Impact on Markets

The reaction of the market is one of the key concerns when focusing on the impact of the negative interest rate policy. In the following paragraphs, we will analyze the impact of Japan’s QQE with negative interest rate on Call Market, Repo Market, Treasury Bill Market, JGB Market, Commercial Paper and Corporate Bond Market, Credit and Stock Market, and Foreign Exchange Market.

#### 3.2.1.1 Impact on Call Markets

The NIRP has a direct and immediate impact on Japan’s money market, which comprises of call market, Treasury bill market, repo market, JGB market, credit and stock market, etc., through the interest rate channel. We will analyze its impact on call market and repo market first.

#### 3.2.1.1.1 Interest rate

Since the announcement of QQE with a negative interest rate on January 29, 2016 and the implementation of the policy on February 16, 2016, the overnight rate has declined sharply first and remained steady within the negative territory with some fluctuations. As shown in the following chart, the uncollateralized negative call rate has decreased to zero after the implementation of the policy and plunged into the negative territory after the April reserve maintenance period, which means financial institutions were exposed further to the negative interest rate policy by central banks. This rate has been around minus 0.05 percent after April 2016. At the same time, the Tokyo Repo Overnight rate has declined gradually and has remained at around minus 0.1 percent with some fluctuations caused by the T-bill auctions since April considering the moving average of 15 days out of the volatility concern.

*Figure 37 Overnight Rates*
3.2.1.1.2 Amount Outstanding

The impact of the negative interest rate on the call market seems to be more dramatic. As shown in the charts below, the outstanding amount of the uncollateralized call market has dropped hugely after the policy and has recovered gradually after February 2016, which is mainly reflected in overnight transactions. In the collateralized call market, the outstanding amount has decreased more dramatically and remained in the low level. Compared with the uncollateralized call market, the collateralized call market is more sensitive to the negative interest rate policy since the policy also works through the broad credit channel, in which the change in the asset price levels affects the value of the collateral, amplifying the impact of the policy.

In the uncollateralized call market before the negative interest rate became effective, financial institutions eligible for remuneration under the complementary deposit facility (hereinafter "institutions eligible for remuneration"), such as city banks and regional banks, borrowed cash from institutions that were not eligible for remuneration under the complementary deposit facility (hereinafter "institutions not eligible for remuneration"), such as investment trusts, at a rate below the 0.1 percent interest rate on excess reserves. The institutions eligible for remuneration engaged in arbitrage trading by depositing the borrowed cash into their current accounts.

The amounts outstanding of uncollateralized call transactions declined significantly after the negative interest rate became effective. Of the institutions eligible for remuneration, city banks, in particular, reduced the amount of cash they borrowed. This was because in concern of an inflow of deposits in the future, they held down cash borrowing through the money market to avoid holding a policy-rate

Source: Bloomberg
balance (applicable to a negative interest rate of minus 0.1 percent). On the other hand, cash borrowing by regional banks increased. This is because amid limited inflow of deposits compared to city banks, those with unused allowances increased cash borrowing from the money market. On the cash-lending side, investment trusts that do not lend cash at negative rates reduced their cash lending in the call market by a large amount. Such idle money piled up in current accounts of trusts banks through "lending to banking accounts" of trust banks. Trust banks which consequently ended up holding a policy-rate balance invested at negative rates marginally higher than minus 0.1 percent to reduce this balance. In addition to trust banks, regional banks with a policy-rate balance also lent cash at negative rates.

The outstanding amount of transactions in the uncollateralized call market picked up slightly from the beginning of May 2016. However, trade sizes did not recover smoothly as some entities had constraints on trading at negative rates due to reasons such as unsupported IT systems and the cash-lending side had maximum loan balances, also known as credit lines, set to each cash borrower. The outstanding amount of transactions was 3.7 trillion yen as of March 2016 (monthly average balance), which is slightly less than half the amount of the same period in the previous year (7.9 trillion yen).

In the collateralized call market, city banks reduced the amount of cash they borrowed as observed in the uncollateralized call market, and Tanshi companies largely reduced their cash borrowing. Before the negative interest rate became effective, Tanshi companies acted as intermediaries between the GC repo market and collateralized call market using securities such as JGBs -- which they had borrowed by lending cash in the GC repo market -- as collateral when borrowing cash in the collateralized call market. However, because the GC repo rate fell into negative territory after the negative interest rate became effective, it became difficult for Tanshi companies to borrow securities to be used as collateral from the GC repo market at a rate that corresponds to the required positive returns of the cash-lending side. Therefore, Tanshi companies reduced their cash borrowing in the collateralized call market; consequently, investment trusts and trust banks also largely reduced their lending of cash in the collateralized call market.

Figure 38 Uncollateralized Call Market Outstanding Amount

![Uncollateralized Call Market](image-url)
Source: BOJ, JSDA

**Figure 39 Collateralized Call Market Outstanding Amount**

![Collateralized Call Market Outstanding Amount](image)

Source: BOJ

**Figure 40 Uncollateralized Call Market Outstanding Amount by Sector**

![Uncollateralized Call Market Outstanding Amount by Sector](image)

Notes: 1. Transactions intermediated by trust companies (monthly average balance).
2. "City banks" includes city banks, Shikoku Bank, and Toa Bank.
3. "Securities company" refers to financial instruments firms that conduct type I financial instruments business (limited to those providing securities-related business) and securities finance companies as stipulated in the Financial Instruments and Exchange Act.

Source: BOJ

**Figure 41 Collateralized Call Market Outstanding Amount by Sector**
One reason for the decrease in the amount outstanding of call market transactions was the constraint to trade at negative rates imposed by the financial institutions' IT systems. Results of a survey on the adjustment status of IT systems to negative interest rates show that only about 30 percent of the respondents had adapted their IT systems before the introduction of the negative interest rate policy. However, another 30 percent of respondents subsequently adapted their IT systems, which suggests that approximately 60 percent of the respondents had prepared for negative interest rates by the time this survey was conducted at the end of July 2016. As for the rest of the respondents, nearly 10 percent answered that they were working on their IT systems at the time the survey was taken.
3.2.1.2 Impact on Repo Market

The GC repo rate (T/N) remained generally below the 0.1 percent interest rate on excess reserves, albeit with fluctuations, until the negative interest rate was applied to part of the outstanding balance of each financial institution's current account at the Bank on February 16, 2016. However, at the quarter-ends, the GC repo rate fell substantially and turned negative as some financial institutions became less active in borrowing cash from the repo market. After the negative interest rate became effective, the GC repo rate fell substantially and hovered between minus 0.1 percent and 0.0 percent.

*Figure 44 Repo Rate (T/N)*
However, from the transaction volume it can be found that repo market is not that sensitive to the negative interest rate policy. The outstanding amount of the repo securities declined slightly after the policy implementation but quickly recovered to the previous level before the policy.

Source: BOJ

Figure 45 Outstanding Amount in Repo Market
3.2.1.3 Impact on Treasury Bill Market

After implementation of NIRP, T-bill yields have plunged further into negative territory with some fluctuations by the T-bill auctions as those rates have become negative rate since July 2015. And T-bills with longer mature period reacts more violent to the NIRP. At the same time, FX Swap-Implied Yen Rate increased after NIRP implemented and then decreased and remained at around negative 0.4 percent with some fluctuations. The steady rate of the FX Swap-Implied shows robust demand for Japanese T-Bill in the international market. On one hand, the large demand is mainly from the large international financial institutions such as the central bank. Japanese Treasury Bill are held as a necessary part of foreign reserve. On the other hand, some individual investors also have a steady demand for Japanese-Yen dominated asset since Yen is treated as a safe haven to some extent due to the events like the U.K. referendum.

*Figure 46 Yields on T-bills*

![Yields on T-bills](image)

Source: Bloomberg

3.2.1.4 Impact on JGB Market

3.2.1.4.1 JGB Yields

The long-term JGN yields have plunged into the negative territory after the implementation of the negative interest rate policy. As shown in the following chart, the rate has recovered within the negative territory since June 2017, although there is a reverse in June due to the U.K. referendum. After November 2016, the yields have returned to positive and have increased further with some volatility.

*Figure 47 Long-term JGB Yields (10 year)*
Regarding the yield curve for JGBs, the decline in the longer end of the curve is relatively large and the curve has flattened after policy implementation. These trends continued until BOJ introduced the Yield Curve Control in September 2016. The long-term JGB yield curve recovered gradually since then, but is still more flat than the curve in January 2016 before the introduction of the negative interest rate policy.

Figure 48 JGB Yield Curve

Source: Investing.com

Source: Japan Macro Advisors
3.2.1.4.2 Liquidity of JGB Markets

Many indicators suggest that the liquidity in the JGB markets remains deteriorated after the negative interest rate policy. Using long-term JGB futures as indicators, it can be found from the chart that the transaction volume for the long-term JGB markets has increased temporarily after the introduction of the NIRP, but then returned gradually. It seems that the stimulation effect of the policy on transaction volume is only temporary. Moreover, the bid-ask spreads have remained wide for the Long-term JGB futures. Considering market liquidity, if we use the number of best-ask orders, which shows the number of the potential next orders, to measure market depth and resiliency, the condition is not positive since the indicator remains at a relative low level. Price impact, which is another indicator to measure the market depth of the JGB markets, remains high and volatile, showing that the liquidity of JGB markets is deteriorated.

*Figure 49 Transaction Volume and Market Depth (4 charts)*
3.2.1.5 Impact on Credit and Stock Market
Commercial Paper Considering the credit market, the corporate bond yields follow similar changing pattern as the JGB yields. The corporate bond yields have declined sharply after the NIRP but are still within the positive territory. The yields have recovered since June 2016 in spite of the U.K. referendum. The yield spread of the corporate bonds and JGBS has increased since January 16 and has narrowed after August.

Figure 50 Yields

![Graph showing yields over time]

Source: BOJ and Author's Calculation

Figure 51 Yield Spread between Corporate Bonds and JGBs
In contrast to the credit market, the NIRP does not have an obvious impact on the stock market. Stock price remains more or less unchanged after the NIRP. Moreover, no investment type has become to a pure buyer or seller after the policy was introduced.

*Figure 52 Stock Price (TOPIX)*

Source: Bloomberg

*Figure 53 Stock Investment by Investor Type*
3.2.1.6 Impact on Foreign Exchange Market
One of the important channels for the negative interest rate policy to stimulate the economy is the foreign exchange channel. The negative interest rate will make the home currency become less attractive, and the depreciation of the home currency will make home products more competitive in the international market. However, in Japan, the foreign exchange market seems to go to an opposite direction due to the impact of the international market. The Yen appreciated against both the U.S. dollar and the Euro especially after the U.K. referendum. The increasing demand for Yen is a result of strengthened market expectation to treat yen as a safe haven.

Figure 54 Exchange Rate

Source: Bloomberg
3.2.2 Impact on Banks

Banks, as important components of the non-financial sector credit creation entities, play an essential role in this increase. In the following parts, we will analyze its impact on banks in details.

3.2.2.1 Loans and Deposits

Lending rate and deposit rate have decreased a little bit after NIRP implemented. Currently, the long-term prime lending rate is around 0.9 percent and the long-term prime repo rate is slight above zero.

Bank loans continue to grow after the NIRP, roughly at 2 percent every year. After NIRP implemented, bank lending to households has increased in an increasing velocity while the bank lending to corporates has increased in a decreasing speed.

*Figure 55 Bank Lending*

![Bank Lending](image)

Source: Japan Macro Advisors

The NIRP has worked through the narrow credit channel to stimulate loan supply to further increase aggregate demand. Normally banks have two ways to make up the losses of putting their reserves in the central bank due to the NIRP. One way is to decrease the interest rate of loans to attract more borrowers, hoping to increase profits by expanding the outstanding amount of loans. Another way is to increase the interest rate for loans to make up the losses by a higher profit margin. From the chart below, we can find that the Japanese banks have preferred the first way. The outstanding amount of the low interest rate loans has increase rapidly since January 2016. While at the same time, the outstanding amount of the high interest rate loans has decreased gradually after the NIRP.

*Figure 56 Bank Loan Outstanding by Interest Rate*
Loans and Discount Outstanding by Interest Rate

Source: BOJ

Figure 57 Bank Loan Outstanding by Borrower Type

Source: BOJ
When analyzing those growing loans by types of borrowers, it can be found that loans to firms have grown more quickly, the growth of loans to individuals has picked up slightly, while the loans to local governments have remained unchanged.

3.2.2.2 Banks’ Balance Sheet
A breakdown shows that on the asset side, cash and deposits (mainly current account deposits at the BOJ) witnessed the most significant rise. In terms of the other asset classes, loans and bills discounted, securities investment excluding JGBs increased, while JGB holdings decreased. The data suggest that portfolio rebalancing from JGBs (entailing yen interest rate risk) to other risky assets (entailing credit, equity-related, overseas interest rate risks, etc.) has continued to take place.

Figure 58 Asset of Domestically Licensed Banks

![Graph](image)

Source: BOJ

The flattening of the yield curve has been putting pressure on bank net interest margins and profitability, especially for regional banks which rely more on domestic activity.

The effect of negative interest rates on Japanese banks' profit margins tended to be larger compared to European banks. Because low or zero interest rates had persisted for a longer time in Japan than in Europe, Japanese banks' deposit rates were already low when the negative interest rate policy was introduced. Furthermore, the share of deposits in total funding was high in Japan, with customer deposits accounting for over 70 percent of banks’ liabilities.

Figure 59 Land of Falling Margins
In addition, the different competitive landscapes facing financial institutions could also have a large effect on bank profit margins. For example, Sweden, which has a banking sector with a significant
degree of market concentration (degree of oligopoly in the market), has kept profit margins from contracting due to a decline in lending rates. In contrast, market concentration is lower in Japan, and thus a reduction in lending rates through competition among financial institutions may be more likely.

3.2.3 Impact on Institutional Investors

Since the introduction of QQE with a Negative Interest Rate, institutional investors -- such as life insurance companies and public pension funds -- and depository institutions with a focus on market investment -- such as Japan Post Bank and central organizations of financial cooperatives -- have further increased their propensity to accumulate foreign bonds and other risky assets in their investment portfolio.

![Japanese Life Insurers’ Holdings of Marketable Securities](image)

Source: Life Insurance Association of Japan

As domestic interest rates have declined further, life insurance companies have focused on securing investment income by, for instance, accumulating overseas assets such as currency-hedged foreign bonds, and investing in areas in which relatively higher growth is expected (including fund investment). In particular, since the introduction of QQE with a Negative Interest Rate, the trend of accumulating overseas assets has intensified further.

Looking at developments in pension funds, the Government Pension Investment Fund (GPIF) appears to have nearly completed rebalancing, which was aimed at attaining its basic portfolio. Other public pension funds, however, continue to increase the share of domestic and overseas stocks in
their portfolios, while reducing the share of domestic bonds. As the shortfall in their provisions for future benefit payments has grown, corporate pension funds have continued to adjust their portfolios to reduce the share of domestic bonds and increase their holdings of alternative assets, such as fund investment, with the aim of securing investment income, while they maintain a cautious investment policy on the whole.

Depository institutions with a focus on market investment, such as Japan Post Bank and the central organizations of financial cooperatives, have continued to reallocate investments away from domestic bonds toward foreign bonds and other risky assets in response to the further decline in interest rates.

As long-term and short-term interest rates have turned negative following the introduction of QQE with a Negative Interest Rate, the activities of investment trusts have also been affected. Particularly early redemptions at money management funds (MMFs), which invest primarily in short-term money markets, have been widely observed. Their assets under management in the second half of 2016 have plunged to nearly 25% of the level at the end of 2015. Although the negative rate is applicable only to a part of current accounts that financial institutions hold at the Bank of Japan, yields are falling in the domestic short-term market, which is the main investment of the funds. Money that would have been invested in MMFs would probably flow into deposits.

At money reserve funds (MRFs), more than 90 percent of assets under management are now transferred to trust banks in the form of money trusts, as it has become difficult to earn positive yields from investing in the securities and call money markets.

3.2.4 Impact on Households

Figure 62 Loans to Households

![Loans to Households](image)

Source: BOJ
From the loan supply side, we can find that the NIRP seems to have no obvious impact on households’ new funding sources. Housing loans to households seems steadily growing at 0.04 percent annually with some volatility and the consumer loans have a sharp increase at 0.15 percent after NIRP and then quickly return to the previous growth rate of around 0.04 percent in the third quarter last year. However, considering the spending side, NIRP seems to have ambiguous impact on household spending in Japan. Household spending keeps decreasing at around minus 2 percent.

3.2.5 Impact on Real Economy

3.2.5.1 Inflation

![Inflation Chart](image)

Source: Japan Macro Advisors

Inflation picked up in Japan in 2017, as a result of higher energy prices. Headline inflation is rising but still far below the 2% target, while core inflation (excluding food and energy) has been stagnant.

There are several factors holding down core inflation. Firstly, firms have refrained from revising prices upwards given weak consumption growth. Consumer spending has declined for twelfth consecutive months. Japan’s demographics are a key factor working against consumption. Nearly 30 percent of the population will be aged 65 or above in 2020, according to a government estimate. Living off pensions, elderly households are unaffected by any wage hikes and tend to withhold spending. Secondly, wage growth remains subdued. Real wages have been largely flat despite job losses hitting a 22-year low.
Considering inflation expectation, the condition is not positive. The inflation expectation increases slightly with some fluctuations and remains stable at around 0.6 percent, which is still far below the 2 percent target.

3.2.5.2 Credit Creation
In Japan, the total non-financial sector credit creation has a slight increase after NIRP. The Credit to GDP gap, which is the difference between the credit-to-GDP ratio and its long-run trend, has increased from around 1.8 percent to 3.5 percent after NIRP.

*Figure 65 Bank Lending to Non-financial Sector*
3.2.5.3 Output Gap

Most recently, the potential growth rate is estimate to be close to zero within the negative territory, which indicates a deflationary pressure within the economy.

Source: BIS

Figure 66 Output Gap

Source: Japan Macro Advisors
3.3 Concluding remarks on Japan

3.3.1 Effectiveness of the Policy

It is possible that the interest rate in Japan will remain at negative levels for an extended period. However, his policy has encountered some challenges both for now and for future. However, the effectiveness of this policy is still in doubt. Although there are some obvious policy effects on interest rates, namely a quick response of the money market, a substantial decline in JGB bonds and a change in behavior of banking system, this policy seems not to be effective considering its impact on the real economy. Core inflation and inflation expectation have not raised to the 2 percent price stability target as expected in the policy design process although there seems to be a steadily effect spread to the price front. NIRP's effect on credit and stock market as well as foreign exchange market still wait to be seen.

3.3.2 How far into negative territory can the interest rate be moved?

With regard to potential problems associated with negative interest rates, the following can be mentioned: (1) if the decrease in financial institutions' earnings due to negative interest rates become sizable, it could impair their functions as financial intermediaries; and (2) if financial institutions reduce their outstanding balances of the central bank's current accounts with which a negative interest rate is charged and significantly increase their cash holdings which yield zero interest, the effects of negative interest rates will be lessened. The Bank of Japan's framework is designed to address these potential problems.

With regard to (1), the Bank has adopted a three-tier system in order to mitigate a concern over undue impact on financial institutions' earnings. With regard to (2), if a financial institution increases its cash holdings significantly, the Bank will deduct an increase in its cash holdings from the zero interest-rate tiers of current account balance. Thus, a negative interest rate will be charged on the increase in its cash holdings. Similar multiple-tier systems are adopted in countries where the size of negative interest rates is relatively large, including Switzerland (minus 0.75 percent as of January 29, 2016), Sweden (minus 1.1 percent as of January 29, 2016), and Denmark (minus 0.65 percent as of January 29, 2016).

3.4 References for this section

Bank of Japan (2016). Comprehensive Assessment: Developments in Economic Activity and Prices as well as Policy Effects since the Introduction of QQE.
4 Sweden

In this chapter, we will look at The Riksbank of Sweden and how it from a hiking cycle after the crisis, to a cutting cycle from late 2011, to negative rates and QE in early 2015. We’ll describe how negative rates and QE were implemented as the final cure against falling inflation expectations. We will describe how the Swedish monetary system reacted to negative rates, how the monetary transmission suffers at rates below zero and how the Riksbank was successful in their quest for upward trending inflation expectations. In Figure 67 we sketched the major events and superimposed the policy rate path.

*Figure 67 Timeline of events in Sweden*

![Timeline of events](image)

The chapter’s first section is on the Riksbank’s approach and implementation. It will begin with some introductory notes on the Swedish economy and financial system. We will move on to an overview of recent Swedish monetary policy to understand the reasoning for NIRP in Sweden. We will then walk through how monetary policy is implemented in Sweden and how the Riksbank went about implementing negative rates.

Section two will go through various market impacts from NIRP. We focus mainly on money markets and mortgage debt. Section three looks at wider macroeconomic impacts of NIRP.

A key point to mention up front, is that Sweden implemented a QE program alongside NIRP. Any trend or change ascribed to NIRP could most likely also be ascribed to QE.
4.1 Approach and implementation

Sweden went to NIRP and started QE on February 12th, 2015. At the time, its GDP was $574 billion making it the smallest economy in our analysis. For comparison, the combined eurozone economies are 23 times bigger.

*Figure 68 GDP of NIRP countries in 2014*

Sweden – like Switzerland – is a textbook example of a small open economy. Since 2000, exports and imports have been hovering around 45 and 40 percent of GDP respectively. Around 40 percent of trade is done with eurozone partners. That links Swedish monetary policy quite closely to ECB decisions. In fact, Swedish QE and NIRP was announced by the Riksbank just two weeks after the ECB rolled out their QE program in January 2015. Below, we will see that inflation expectation trends also played a large part in the Riksbank’s decision to go negative. But the timing of NIRP and QE in Sweden ECB QE program timing is striking nonetheless.

4.1.1 Swedish financial market setup and funding of main monetary institutions

Sweden has a bank-heavy financial system. For instance, non-financial corporates have 1,006bn SEK ($118bn) outstanding in corporate bonds while credit institution (Monetary Financial Institutions, MFIs) lending to non-financial corporates is almost double that at 1,983 SEK ($233bn). As seen in Figure 69, credit institutions hold assets of almost three times the size of Swedish GDP.

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18 Data for this section comes from Statistics Sweden and is all end-of-year 2015.
There is no money market fund sector to speak of in Sweden. Total money market fund assets are SEK 24bn which is dwarfed by other cash instruments. The Riksbank has SEK 73bn currency outstanding and MFIs SEK 5,440bn transferable deposits outstanding.

Monetary policy thus flows through MFIs and banks and Mortgage Credit Institutions are by far the biggest MFIs. Below we present aggregate stylized balance sheet for the two groups.

For the banks, it is important to notice that around 50% of their funding comes from depositors 34% of these (18% of total funding) comes from retail depositors. When rates go negative, these deposits cannot adjust down below zero because banks do not pass negative rates on to retail customers.
Mortgage Institutions are mainly financed by covered bonds (listed under long-term debt securities in Figure 71) which did adjust down in sync with the policy rate as it went negative.

We will return to the banks and mortgage institutions when we go through the hierarchy of monetary institutions in Section 4.1.3 where we describe monetary implementation. For now, we will turn to the question of why Sweden even dropped rates below zero in the first place.

4.1.2 Goals for negative rates and macroeconomic backdrop\(^{19}\)

The Riksbank is an inflation targeting central bank and has been ever since 1993. It targets the CPIF, which is the CPI with a fixed interest rate.\(^{20}\) The Riksbank sets a target O/N interest rate 6 – 8 times a year. The rate is set by a six-member executive board that votes and decides with simple majority. In the event of a tie, the chairman of the board (the Riksbank governor) can break the tie. The Riksbank publishes a longer Monetary Policy Report (MPR) or a shorter Monetary Policy Update (MPU) along with each rate decision. The publish detailed minutes one month after the rate decision.\(^{21}\)

Since before the crisis, the Riksbank has had institutionalized forward guidance in that it publishes a forecast of the policy rate three years out. When reading the Riksbank minutes, it emerges that the governors discuss the published forecast path just as much as they discuss the actual target rate fixing.

The evolution of Swedish monetary policy from 2008 to negative rates in 2015 is much similar to that of the ECB. After intensive cuts in the wake of Lehman’s collapse, the Riksbank started hiking regularly in 2010. The executive board reversed course in 2011 and slowly moved towards the negative rates (see Figure 72).

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\(^{19}\) The section draws heavily on King and Goodfriend (2016) which is the 2010-2015 edition of a regular 5-year independent review of the Riksbank that the Swedish parliament’s Committee on Finance commissions.

\(^{20}\) The CPIF is thus not directly affected by a change in mortgage rates.

\(^{21}\) Both minutes and monetary policy reports/updates can be found in English editions on the Riksbank’s website.
King and Goodfriend (2016:25f) provide some helpful headlines to the Riksbank’s policy actions since 2010 in their five-year review of Riksbank policy. They provide a useful overview and reads as follows:

Table 1 Headlines for Swedish monetary policy leading up to NIRP

<table>
<thead>
<tr>
<th>Headline</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pause for thought</td>
<td>September 2011-October 2011.</td>
</tr>
<tr>
<td>Disappointment and easing</td>
<td>December 2011-December 2012.</td>
</tr>
<tr>
<td>Another pause for thought</td>
<td>February 2013-October 2013.</td>
</tr>
<tr>
<td>Going to zero</td>
<td>December 2013-December 2014.</td>
</tr>
<tr>
<td>Going negative [plus QE]</td>
<td>February 2015-now</td>
</tr>
</tbody>
</table>

The hiking cycle from February 2010 to July 2011 started after a year of high growth, expectations of medium-term inflation around target (see
Figure 73) and increasing house prices and household indebtedness.
Recent inflation was higher than the modelled forecast when the Riksbank began its hiking cycle. Most board members wanted to balance the expansionary effects of low rates with the risks of excessive indebtedness among households, abnormally high house prices and financial fragility in the future. In minutes, Governor Ingves and the majority of the board repeatedly express their worries about household indebtedness and house price increases. They wished to use the interest rate to “lean against the wind” of increasing household leverage.

The first hike in July 2010 was done with these comments:

“Inflationary pressures are currently low, but are expected to increase as economic activity strengthens. […] The Executive Board of the Riksbank has therefore decided to raise the repo rate by 0.25 of a percentage point to 0.5 per cent. Another factor is that household indebtedness has increased significantly in recent years.” (MPR, July 2010)

This sums up the executive board majority’s reasoning all the way through 2011. Importantly, two board members (deputy governors Ekholm and Svensson) dissented against the majority view for most of the hiking cycle. The repeatedly argued that the central bank should focus on its goal of price stability and not worry about housing prices and household debt. They emphasize that market expectation of the future target rate is widely different from the Riksbank own forward guidance. If the markets were to adjust their expectations into sync with the Riksbank’s forecast, monetary policy would become increasingly contractionary. Figure 74 shows divergences in expectations for the beginning, the middle and the end of the hiking cycle.
In a way, the minority was vindicated a year later in the summer of 2011. As the Riksbank moved through the hiking cycle, market expectations of future interest rate decisions moved closer and closer to the Riksbank’s published forecast. The highest level of agreement is reached in April 2011. After that the market expectation path begins to fall again. And in December 2011 the Riksbank starts cutting again.

Another way to visualize this reversal in expectations, is to look at swap rates which are basically a weighted average of FRAs over a given time period. In Figure 75 we have plotted the five-year swap rate (where the 3M Stibor fixing is the floating leg) on top of the Riksbank’s repo rate. The five-year swap rate falls sharply from around April 2011 signifying a marked drop in expectations for future interest rates. Importantly this is not because the Riksbank started cutting (that happened in December) or because it changed its forecast of policy rates (cf. red line in left-hand panel in Figure 74). Market participants were updating their expectations independently of Riksbank announcements.
There can of course be many reasons for forward rates to fall independently of central bank action, but in the years the Riksbank and market participants have coalesced around one particular explanation: market players were beginning to lose faith in the Riksbank’s inflation targeting.\footnote{\cite{Ingves2015}}

As seen in Figure 76, inflation expectations start to decline in July 2011. Three months after the interest rate expectations start to drop.
In December 2011, the Riksbank starts cutting. But inflation expectations kept dropping until rates went negative and QE was begun in February 2015.

We believe this the drop in inflation expectations is decisive for understanding the negative rates and QE decision. As mentioned, the typical explanation is that markets participants began to lose faith in the Riksbank’s price stability goal. The Riksbank was hiking and was using worries about a debt fueled asset bubble in housing markets as a justification. We believe that the above data can be fairly interpreted to mean that markets started to worry about the inflation target’s role as an anchor.

In the minutes of the February 2013 executive board meeting, Ingves acknowledges this point for the first time\(^\text{23}\) and it seems to become more and more prevalent in executive board decision making going forward. As a proxy for this development, we have plotted how many times the word “anchor” is using in Riksbank minutes in Figure 77. We see spikes when rates are cut by 50bps in July 2014 and when they go negative in February 2015.

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\(^{23}\) February 2013 Minutes p. 26
In fact, Governor Ingves said it himself in mid-2015: “The fact that we now have introduced a negative interest rate and begun purchasing government bonds in Sweden is basically because we want to safeguard the role of the inflation target as nominal anchor.”

It took some time, however. Even though the Riksbank started cutting in late 2011. It had various pauses underway. While the Riksbank held rates steady from February to October 2013, the swap rate increases again (see Figure 75). During this time, Deputy Governor Svensson – the most vocal dissenting voice during the hiking cycle – chose not to extend his position on the board for a second term (April 2013). In effect, he resigns and explains it by his not being able to gather support for the policy he deemed most appropriate.

A 2014 with inflation repeatedly undershooting Riksbank forecasts, inflation expectations dropping, and CPI hovering around zero (see Figure 78) in spite of persistent cuts convinced the Riksbank it had to take harsher measures. In October 2014 it cut to zero, in December 2014 it hinted unconventional measures at next meeting, in February is cut the target rate to -0.1% and started buying up SEK 10bn worth of securities each month.

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24 (Ingves, 2015)
We believe the worry about inflation to be the most important factor behind the Riksbank’s cut to NIRP. However, it is worth noticing that the Riksbank board members often refer to export numbers in the minutes. It was especially prevalent at the cut in December 2011 where exports had tumbled due to the euro zone trouble (see Figure 79). In general, the Riksbank “imports” a substantial amount of monetary policy from the ECB. Their exports run at around 40% of GDP and more than half of these have eurozone counterparties.
4.1.3 Monetary policy implementation strategy

In this section, we will describe how the Riksbank implements monetary policy and how it approached implementing negative rates. The Riksbank has several standing facilities which we describe. We also look at developments in the banking sector’s use of these before and after negative rates.

4.1.3.1 Payment system and basic implementation setup

The Swedish Riksbank implements monetary policy using an interest rate corridor setup. Their target rate is the O/N interest rate extended between participants in the Swedish wholesale payments system called the RIX.

The RIX system is a real-time gross settlement platform run by the Riksbank and it sits at the heart of Sweden’s various payment and settlement systems as all transactions in SEK eventually must go through the RIX. Settlement is done with crediting and debiting participating institutions’ accounts at the Riksbank. The RIX is mostly made up of banks but investment firms and clearing corporations also have access. Sweden does not have ‘reserve requirements’ for its banks, but because accounts with the Riksbank is the ultimate settlement instrument and because the Riksbank is the only entity that can increase the quantity of these liabilities, it controls the main interest rate for postponing any settlement in SEK. The Riksbank doesn’t use the term “reserves” for these accounts but going forward we shall call them “reserves” just because it is common parlance.
The Riksbank provides intraday credit to RIX participants at no interest but against collateral. If a RIX entity is in deficit at days-end it will borrow from the other RIX participants. The Riksbank has several standing facilities that serves to keep the O/N rate between RIX counterparties in check.25

Firstly, there is a one-week repo rate at which monetary counterparties can borrow reserves against eligible collateral to cover a deficit. Symmetrically, they can post reserves for one-week and get ‘Riksbank Certificates’. There is no bid-ask spread between rates on the repos (Riksbank lending out reserves) and certificates (Riksbank taking in reserves). The repo (and certificates) rate is the main signaling rate for the Riksbank and all other facilities are made with reference to this repo rate.

Secondly, there is a wide (+/- 75 bps) corridor around the repo rate where monetary counterparties can lend or deposit reserves O/N unsecured.26 This unsecured facility is hardly ever used because there is a narrower band (+/- 10 bps) around the repo rate where monetary counterparties can borrow and lend reserves. At this narrower band, counterparties have to post collateral if they borrow from the Riksbank. The narrow corridor is called the “fine-tuning” facility.27 By convention O/N credit between RIX counterparts is not negotiated “[i]nstead, the transaction is conducted using the repo rate or an interest rate very close to the repo rate. According to the banks themselves, the knowledge that the system will largely be in balance at the end of each day contributes to this pricing practice.”28

When the repo rate was cut to -0.1% on February 11th, 2015, nothing was changed in the Riksbank’s standing facilities. The deposit rate had been negative since June 9th, 2014. The fine-tuning deposit rate, however, only went negative when the repo rate went negative. During the three month where

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25 There is hierarchy within the RIX in that not all members of the RIX are monetary counterparties of the Riksbank and thus can’t use the monetary facilities provided by the Riksbank.
26 The Riksbank refer to these as the Lending Facility and the Deposit Facility.
27 … and was implemented in 1995 because the rates under the wider band didn’t average out to the repo-rate target. (Holmberg, 1996)
28 (Nessén et al., 2011)
the repo rate was at zero. The fine-tuning facilities were kept at zero instead of their usual +/- 10bps spread. In terms of the operational framework, the cut below zero was similar to any other cut. The same is true for 2009 and 2010 where the deposit facility was in negative territory for more than a year. See Figure 81.

Figure 81 Development of facility interest rates

Since the Riksbank have no reserve requirements, there is no tiering system where different rates apply to different reserves held at the Riksbank. The marginal rate is equal to the average rate for the various facilities and currently the repo rate is at -0.5%. Year to date, the distribution between Riksbank Certificates (at repo rate), Fine-Tuning Deposits (at repo -10bps) and Deposits (at repo - 75bps) is 69:31:0 so the average rate for liquidity held at the central bank is -0.53%.

4.1.3.1.1 Hierarchy of Riksbank counterparties and transmission of rates

The RIX has 29 participants including the Swedish National Debt Office and the publicly run Swedish Export Credit Corporation.29 The rest are Swedish banks, foreign bank branches and clearing corporations. Only 16 of these institutions, the monetary counterparties, are eligible to use the Riksbank standing facilities. See Figure 82.

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29 For more details see (Riksbanken, 2017)
These institutions disseminate the Riksbank’s monetary policy. The main players are Sweden’s “Big Four” banks: Nordea, Handelsbanken, SEB and Swedbank along with Danske Bank from Denmark. A couple of international bank branches also have access to the standing facilities. Between these institutions, the +/- 10 bps fine-tuning facility will be a binding corridor for O/N SEK rates since everyone has access to these facilities and since the access is not constrained at the individual level only for the system as a whole.

Beyond this group, there are non-monetary-counterparty-RIX-participants. These are smaller banks and securities clearing corporations. Technically, these players could have to accept higher borrowing rates and lower deposit rates. We don’t have the data for recent years, but a Riksbank study showed that during the crisis all RIX deposit trading happened within the fine-tuning corridor.\(^\text{30}\)

Beyond the RIX, players will have to get O/N SEK deposits from the monetary counterparties and might well have to pay a premium or take a discount above/below the fine-tuning rates. Premiums can relate credit risk and liquidity risk of borrowers and discounts below Riksbank deposit rates could relate to balance sheet restrictions of banks. In section 4.2.1.1, we look at a Bloomberg composite index for O/N deposit rates in SEK. It is an average of Bloomberg deposit quotes from 8 of the monetary counterparties and should thus apply to players beyond the RIX system.

That rounds off the conceptual walk-through of Swedish monetary policy implementation. We will now turn to recent developments in the actual implementation (4.1.3.2) and specific challenges for implementing NIRP (4.1.3.3).

4.1.3.2 Development in the uses of Riksbank monetary policy facilities
From 2001 to 2012, the Riksbank did not keep an inventory of SEK-denominated securities to conduct permanent open market operations. Monetary policy has been handled with the temporary OMO facilities described above.

\(^{30}\) (Sellin and Sommar, 2014)
Beyond their signaling function, the one week repo- and certificates-facilities handle the “structural reserve needs” of the banking system.\textsuperscript{31} The O/N corridors around the repo rate are meant handle interest rate management. Up until the 2008 crisis, the Swedish banking system had a structural reserve deficit and was thus borrowing at the one week repo facility. The amount was small at an average of four billion SEK outstanding. Fine-tuning lending averaged around 300 million SEK during this period.

After Lehman and up until December 2010, the Riksbank lent massively to the Swedish banks within extraordinary facilities of various maturities. This liquidity was largely posted at the Riksbank as a mix of one-week Certificates and O/N fine-tuning deposits. After the crisis lending was wound down, the Swedish banking sector emerged with a structural surplus of reserves that was parked at Riksbank as both one-week Certificates and O/N fine-tuning deposits. In the period between the end of crisis lending and before negative rates and QE (December 2010 – February 2015), the Swedish banking system parked approximately 10 billion steadily increasing to approximately 55 billion at the Riksbank on average. Figure 83 show all these developments.

\textit{Figure 83 Selected Riksbank balance sheet items}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure83.png}
\caption{Rikbank balance sheet values of instruments used for monetary policy}
\end{figure}

\textit{Source: The Rikbank}

\textbf{4.1.3.2.1 Excess liquidity after QE and NIRP}

In Figure 84, we focus on the banking sector’s claim on the Riksbank – the liquidity in the Swedish monetary system. Compared to Figure 83, we’ve flipped the claims around the horizontal axis. Importantly, we have added the Riksbank’s measure of the Swedish banking system’s structural liquidity position. This position is the net of all the Riksbank’s balance sheet items that are not related to monetary policy. For instance, the banking system’s liquidity surplus on March 7\textsuperscript{th}, 2017 was as follows:

\begin{table}[H]
\centering
\caption{Structural liquidity position calculation}
\begin{tabular}{|c|c|}
\hline
 & SEK Million \\
\hline
\end{tabular}
\end{table}

\textsuperscript{31} (Nessén et al., 2011)
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold and foreign currency reserve</td>
<td>531,611</td>
</tr>
<tr>
<td>Other assets</td>
<td>6,606</td>
</tr>
<tr>
<td>- Banknotes and coins in circulation</td>
<td>57,844</td>
</tr>
<tr>
<td>- Other liabilities</td>
<td>357,922</td>
</tr>
<tr>
<td>- Equity</td>
<td>51,351</td>
</tr>
<tr>
<td><strong>The banking system’s surplus</strong></td>
<td><strong>71,100</strong></td>
</tr>
</tbody>
</table>

This structural position increases and decreases independently of the main monetary policy. The main driver has been the Riksbank’s profit payments to the Treasury. Treasury posts these payments with commercial banks and these banks must place this liquidity somewhere. Beneath the chaos of the crisis, the banking moved from a structural deficit to a surplus.

The most interesting feature of the structural surplus is that any Riksbank monetary liabilities above this amount can be considered excess reserves or excess liquidity. Before the crises, we see that the banking sector’s deficit is filled out by Riksbank repo. During the crisis, the Riksbank expanded its balance sheet and the system became awash with liquidity. The last crisis loan matured October 2010 and after that the Riksbank toon in the surplus with (O/N) Fine-Tuning deposits. Fine-Tuning deposits track the structural position until December 2012 where the banks move into one-week Riksbank Certificates as vehicle for posting liquidity. They still need to hold O/N liquidity and they now post slightly more than the structural surplus would mandate. Supposedly, to have a buffer of O/N liquidity while utilizing the 10 basis point discount on the one-week certificates. In Table 3, we see that Riksbank certificates constitutes circa half of the banks’ liquidity after this date. In February 2015, when QE starts, excess liquidity takes off. We enter a new situation, where there is massive excess liquidity and banks/MFIs have to pay in order to park it at the Riksbank. More on this problem in section 4.2.1.1.

*Figure 84 Swedish banking system’s structural liquidity position*

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(Sellin and Sommar, 2014)
After rates go negative there is marked increase in the banking sector’s reserve holdings at the Riksbank. However, the accounts with the Riksbank are still less 10% of the Swedish MFIs’ holdings of transactional deposits and short-term debt (these are respectively the general categories that O/N fine-tuning deposits and (the one-week) Riksbank Certificates fall into). See circle on Figure 85.

**Table 3 Riksbank Certificates as % of bank liquidity (average weekly balance)**

<table>
<thead>
<tr>
<th>Period</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 2010 - December 2012</td>
<td>1.2%</td>
</tr>
<tr>
<td>December 2012 - February 2015</td>
<td>51.1%</td>
</tr>
<tr>
<td>February 2015 - March 2017</td>
<td>65.4%</td>
</tr>
</tbody>
</table>

Figure 85 Transactional deposits + short-term debt held by MFIs
4.1.3.3 Practical challenges to negative rates implementation

When rates go negative, banks, securities firms and the Riksbank itself might have to resolve issues with technical systems for booking and trading various interest rate product. In the publicly available information, there is no notice from the Riksbank to the banks saying that they should prepare systems for negative rates.

In the Riksbank’s October 2014 decision where the repo rate was cut to zero, there is little talk of monetary policy measures beyond that. In the minutes (published November 11th), Deputy Governor Martin Flodén’s section even reads: “As the scope for cutting the repo rate to negative levels is limited, or perhaps non-existent, he pointed out that the likelihood of the repo rate being lowered from its current level is small.” Deputy Governor Per Jansson’s section has this quote: “[M]onetary policy has no scope to help in this context, at least not by adjusting the repo rate.” If the Riksbank were planning to cut rates below zero, it was a very clandestine operation.

In the Riksbank’s December 2014 decision where the repo rate was kept to zero, the message was changed. In the official press release, it was announced that “The Riksbank is also preparing further measures that can be used to make monetary policy more expansionary. Such measures, were they necessary, could be presented at the next monetary policy meeting.” In the press conference, Ingves notes that they “could set a negative rate.” In the minutes of the December 2014 Rate Decision (published January 8th, 2015), Governor Ingves and Deputy Governor Jansson also calls for preparations for negative rates. I believe any market participant would have taken the message

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33 (Riksbanken, 2014a)
34 (Riksbanken, 2014b)
35 (Bränström, 2014)
from this three-pronged hint. But we do not know whether there was a practical implementation strategy playing out between the banks and the Riksbank behind the scenes.

In any event, the repo rate was cut on the February 12th, 2015 meeting and they were effective effective February 18th. That means the financial system had two months to make necessary preparations. The lag between the announcement and the effective day was not longer than for other cuts in negative territory.

4.2 Experience with negative rates

In this section, we look at how the cut below zero played out in selected credit markets. To the extent possible, we also look at whether various financial institutions changed portfolio compositions after rates went negative.

4.2.1 Price developments across markets

4.2.1.1 Money markets and interbank lending.

Short term money market rates follow the repo rate down below zero. Figure 86 shows the Swedish 3M xIBOR-fixing (Stibor) and SEK funding rates implied via €- and $-Libor swapped into SEK and FX-hedged. The spread from funding via $-Libor to Stibor and the Riksbank’s repo rate shouldn’t be attributed to negative rates (or Swedish QE). This breakdown of covered interest parity is a widely-observed phenomenon across dollar currency pairs.36 The main story is that the short-term rates relevant for funding in SEK track the repo rate down below zero is if it was a cut in positive territory.

Figure 86 Money market rates

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36 (Borio et al., 2016)
However, some dynamics of money markets have changed since rates went negative. In Figure 87, we zoom in 3m Stibor and the O/N interbank rate for Stockholm banks before and after the cut to negative rates and QE. The green band in the graph represents the Riksbank’s corridor for fine-tuning operations which was collapsed to zero when rates went to zero but is otherwise +/-10bps.

First, we see that the O/N interbank deposit rate becomes a lot more volatile post QE and negative rates. The O/N rate is Bloomberg’s composite aggregates bid-ask quotes from eight banks. It is listed as “interbank” but after correspondence with a researcher at the Riksbank we have concluded that these must be quotes applicable to customers outside the RIX bank payments system i.e. institutional clients that need to store liquidity.37

Nonetheless, the quotes faced by these agents becomes much more volatile after rates go negative and especially after the cut to -50bps in February 2016. Unfortunately, we have not been able to get turnover data for the O/N interbank lending, so we cannot conclude on the extent of the impact of this volatility. However, it does seem like a large amount of excess liquidity combined with costs for housing that liquidity at the Riksbank puts a lot of pressure on interbank/institutional client markets. In normal times, liquidity is scarce and costly to get, with QE and NIRP, it is abundant and costly to hold.

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37 We could conclude this because O/N rates within the RIX system never broke the fine-tuning corridor. We could not access the RIX data ourselves but were told so in an email April 10th, 2017.
Further, the O/N interbank rate breaks out of the Riksbank’s +/- 10bp corridor after NIRP/QE. That does not happen before. Banks can always post O/N liquidity at the Riksbank’s fine-tuning deposit rate. They could leave all the excess liquidity created by QE at the Riksbank O/N if they wanted. However, the deposit rate faced by the wider market can apparently dip lower.

There should be risk-free profit to be made by banks if they take in deposits at a rate lower than the fine-tuning facility rate and then depositing them at the Riksbank. The only credit risk faced by the bank is that of the Riksbank. The fine-tuning facility is only bounded on a banking system net position which increases in sync with QE, so that shouldn’t cap this trade.\(^\text{38}\) However, QE and NIRP still introduce some kind of distortion to this practice or at least to the price of O/N deposits. We are not sure of its precise nature.\(^\text{39}\)

\(^{38}\) “[T]he Riksbank receives funds, but not in an amount exceeding the banking system’s deposit requirement.” (Nessén et al., 2011) This is more intuitive in normal time where the Riksbank doesn’t lend funds beyond the banking system’s borrowing requirement. Before the Riksbank starts lending O/N, all banks with surplus liquidity must have lent to deficit banks. In a situation with a large liquidity surplus, the “banking system’s deposit requirement” is effectively unbounded because there is no upper limit to the amount of liquidity the banking system can hold. In “the normal situation”, there is definitely a lower limit – even without a reserve requirement: bank must have sufficient liquidity to make their payments on a given day.

\(^{39}\) It could be an interplay with Basel III regulation. However, the non-risk weighted leverage ratio (that would put a pressure on low-profit, high-volume trades like this deposit arbitrage) is not implemented in Sweden until 2018. Under the LCR, the deposit taken in by the bank might have a high outflow weighting but in this example the bank just post this deposit with the Riksbank. Central bank reserves have a 100% HQLA weighting. Lastly, central bank reserves have a zero percent risk weight under risk-weighted asset capital requirement, so that should bind the trade either.
Lastly, we wanted also to plot a Stibor spread. We find it interesting that the 3m interbank fixing essentially has a spread of zero to the Riksbank’s one-week facility (the target rate). Figure 88 plots moving averages of the spread between both 3m Stibor and O/N deposits. Stibor had an approximately 20bps spread to the repo rate before it went negative. It drops to an average of around zero after NIRP. The O/N Interbank deposit spread also drops.

4.2.1.2 Interest rate swaps
Going beyond three months, Figure 89 display various swap rates that reference the 3M Stibor. We saw earlier (Figure 75) that the five-month collapsed in early 2011 and spiked up during 2013 and then followed the repo rate down during 2014. The 10-year had the same dynamic. But both of them jump up after rates go negative. This picture is prevalent across various credit markets. This dynamic is seen across various credit markets for longer dated securities.

The 1-year swap tracks the repo down below zero at a lower and lower spread. This dynamic is also seen for shorter dated highly rated securities (government and covered bonds). We suspect that a lot of the excess liquidity provided by QE will be placed into these shorter dated securities and thus compress their yields.

We added vertical lines for when the repo rate when negative and for when futures on the repo rate went negative to see whether there are disjunctions around these dates. The jump in longer dated swaps occurs a couple of months after the rates go negative.
4.2.1.3 Government bonds
Government debt looks much like the interest rate swaps except, the yields are even lower due to lesser counterparty risk. Again, the shorter dated securities track the repo rate down below zero and again the longer dated 10-year government bond break off from its downward trend when rates go negative.

4.2.1.4 Mortgage bonds and cross cutting effects
We have looked at covered mortgage bonds issued by Skandinaviska Enskilda Bankens (SEB) to see how this market fairied under negative rates. The same picture arises: after rates go negative securities with longer maturities break their correlation to the repo rate. Banks need to fund the cost of negative rates somewhere as they can’t pass negative deposit rates on to their regular depositors.
One way to do this is to increase lending rates at longer maturities compared to a situation where the longer maturities would follow the repo rate downward. If a bank’s main deposit rate is floored at zero, its main lending rate must be floored somewhere as well to keep up an adequate net interest margin. In Figure 90, we present running indices of rates on SEB covered bonds at three different tenors. The 5- and 10-year covered bond rates seem to hit average floors of around 1.25% and 0.75% respectively on average.

Figure 90 Covered bond rates

![Covered Bonds (mortgages)](image)

When the longer-dated rates break with the repo path, it suggests that the credit-based monetary transmission mechanism changes when rates cross into negative territory.

To make this argument in a slightly more quantitative fashion, we calculated normalized correlations (Pearson’s r) between covered bond rates and the Riksbank’s repo rate for three time periods. The 1- and 2-year covered bond rates are highly correlated with the repo rate both before and after NIRP. The 5- and 10-year have high correlations to the repo rate before NIRP is introduced, but after NIRP these correlations fall meaningfully. As mentioned above, we believe this happens because banks are trying to conserve their net interest margins.

Table 4 Correlations between covered bonds rates and the Riksbank’s repo rate

<table>
<thead>
<tr>
<th></th>
<th>48-24 months before NIRP</th>
<th>24 months before NIRP</th>
<th>After NIRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1y Covered mortgage bond</td>
<td>0.88</td>
<td>0.97</td>
<td>0.91</td>
</tr>
<tr>
<td>2y Covered mortgage bond</td>
<td>0.78</td>
<td>0.97</td>
<td>0.83</td>
</tr>
</tbody>
</table>

40 In this calculation 1 means perfect correlation, 0 means no correlation and -1 means perfect negative correlation.
5y Covered mortgage bond  0.74  0.95  0.34  
10y Covered mortgage bond  0.67  0.94  0.07

4.2.1.5 Corporate bonds and corporate bank lending
In Figure 91 and Table 5 we repeat the analysis for non-financial corporates. We present bank lending rates at three different tenors and an index of investment grade corporate bond rates with and average duration of 2.5 years.

Figure 91 Borrowing cost for NFCs

![Graph showing Non-Financial Corporations Borrowing Rates](image)

Interestingly, corporate borrowing rates break off with the repo rate after NIRP for all tenors. In the rightmost column of Table 5 we see all correlations dropping from before to after NIRP. Again, the monetary transmission is changed by rates going negative.

<table>
<thead>
<tr>
<th></th>
<th>48-24 months before NIRP</th>
<th>24 months before NIRP</th>
<th>After NIRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corp. Borrowing Rate &lt;3M</td>
<td>0.88</td>
<td>0.96</td>
<td>0.63</td>
</tr>
<tr>
<td>Corp. Borrowing Rate 1-5y</td>
<td>0.81</td>
<td>0.93</td>
<td>0.37</td>
</tr>
<tr>
<td>Corp. Borrowing Rate &gt;5y</td>
<td>0.83</td>
<td>0.84</td>
<td>0.44</td>
</tr>
<tr>
<td>IG Corp. Bond Index</td>
<td>0.88</td>
<td>0.97</td>
<td>0.31</td>
</tr>
</tbody>
</table>

4.2.1.6 Equities
In Figure 92, we plot the main Stockholm Equity Index (OMX S30). Here we see a marked increase after the futures on the Riksbank repo went negative. We haven’t been able to isolate whether this
was due to other circumstances. It would make sense for equities to trade up on expectations where (at least short term) fixed income rates wait for the actual cut into negative territory.

Figure 9.2 Stock market index

4.2.2 Balance sheet and business developments across institutions

We now take a look at how portfolios of various financial institution groups reacted to NIRP. Unfortunately, we are hampered by a very low granularity of data. We have quarterly data for very aggregate balance sheet categories. The short story is that neither bank, insurers, pension funds or other investment funds changed their portfolio visibly after NIRP.
SIPA Capstone Project: Negative Interest Rates  
Spring 2017

Asset composition of Swedish banking sector

Investment Fund Asset Composition

Source: Sweden Statistics
We would expect portfolios to change when rates go negative but we haven’t been able to get our hands on the right kind of data so for now we can only conclude that nothing really happens at a macro level of asset categories.

4.2.3 Macroeconomic Impact and effectiveness

Has NIRP (and QE) been effective? We reprint the inflation expectations graph from above as it has the simple answer.
It is fairly clear that QE and NIRP changed the negative inflation expectations trend. It is important to notice that the Riksbank changed its message along with NIRP and QE. It emphasized that it was an inflation target and that the developments in housing markets and household debt were worrisome but not the Riksbank’s problem to handle. The total effect of this package seems to have worked and inflation expectations are almost back to the 2% anchor as of early 2017.

Actual inflation CPIF inflation is almost back to two percent but a lot of that is energy prices. In Figure 94, we see that CPIF excl. energy is trending downward since early 2016. The Riksbank attributes this to low inflationary pressures generally and in the eurozone particularly.
If we think of a 9-18 month lag in monetary policy, GDP growth does not seem to have responded well to NIRP. The counterfactual could be worse, but the Rikbank’s rather aggressive policies seemed to have had their strongest effect on inflation expectations – not real activity.

4.3 Concluding remarks on Sweden

The Rikbank was largely successful with NIRP and QE. Beyond weak realized inflation, their main problem was to re-convince markets that they were in fact an inflation targeting central bank. They were aggressive doing NIRP and QE at the same time. They cut several times within the first few months of going negative. Effective rates were pushed far below zero because the Rikbank did not employ a tiering system for negative rates implementation. All banks and a large section of
institutional investors were facing negative rates on their liquidity portfolios. Importantly, mortgage institutions and banks doing mortgage financing in Sweden could pass some of the negative rates on to markets because of the heavy use of covered bonds in mortgage financing. 1- and 2-year covered mortgage bonds yield negative rates in Sweden right now.

4.4 References for this section

5 Switzerland

5.1 Approach and Implementation

5.1.1 Swiss National Bank: Setup and Approach to Monetary Policy

What is the mandate of the Swiss National Bank? Since the financial crisis, global monetary policy has done a lot to stimulate the worldwide economy. Central banks around the world have been successful in driving down inflation with expansionary monetary policy. Nominal rates have fallen, but the real interest rate has also fallen. Inflation remains low in Switzerland and among its peers in the Eurozone, Japan, and in Sweden. The National Bank Act of Switzerland outlines the mandate of its independent central bank, the Swiss National Bank (SNB), “It shall ensure price stability. In so doing, it shall take due account of the development of the economy.”

In December 1999, the SNB abandoned monetary targets and adopted a new policy strategy consisting of the following three elements:

1) A definition of price stability
2) A conditional inflation forecast over the subsequent 12 quarters
3) A target range for the reference interest rate, namely, the three-month Swiss franc (CHF) Libor (London Interbank Offered Rate).

However, unlike other central bank of advanced economies, the SNB does not view this framework as inflation targeting. The SNB has refrained from indicating an explicit target horizon for inflation. Instead, the SNB defines price stability as a rise in the national consumer price index of less than 2% per year.\(^4\) According to this definition, deflation also breaches the objective of the central bank. After the financial crisis, core inflation in Switzerland, shown in red below, dropped from over 2% in September 2008 to about zero in September 2010 and fell to a low of -0.75%, a real deflation, in November 2011 before returning to about zero in December 2016.\(^5\)

The conditional inflation forecast is published by the SNB and shown in Figure 95 in purple. This broad-based inflation forecast spans 3 years and has been published quarterly since 2003. The forecast takes into account the most recent interest rate decision and therefore functions as the main indicator for its monetary policy decisions. The inflation forecast is based on the assumption that the reference interest rate of the SNB will remain unchanged over the time horizon. For Switzerland, as a small and open economy, global economic developments play an important role in shaping the forecast. By taking a forward-looking stance, the forecast plays a crucial role in communicating the probable future course of monetary policy to the public. For its monetary policy decisions, the SNB analyzes and assesses the economic and monetary situation in Switzerland by considering a large number of economic, monetary and financial stability indicators in addition to

\(^4\) (SNB, 2016)
\(^5\) SNB data
the inflation forecast. Global economic developments are given special attention, which have a major impact on a country like Switzerland with its strong international integration.

**Figure 95: Swiss Inflation**

![Swiss Inflation Graph](image)

**Source: Data portal of the Swiss National Bank**

The SNB implements its monetary policy by fixing a target range for the reference interest rate, the 3-month CHF Libor. The target range is the third element of the SNB's monetary policy strategy and is shown above in blue. This rate is typically steered by one-week repo transactions and indicates the SNB’s short-term intentions in the money market. The target range has a bandwidth of 100 basis points (1%) and as a rule the SNB holds Libor in the middle of the defined range. Given its unique definition of price stability, interest rates are not automatically adjusted if inflation forecasts deviate from the price stability range. In its monetary policy decisions, it also considers the general economic situation as well as possible risks that are not factored into the forecast models. As well, the SNB states that aiming to restore price stability too rapidly may harm the real economy. Instead, the SNB is obliged to maintain price stability in the medium-term. In 2008, the SNB slashed its target range from 2.25% - 3.25% down to 0% - 1% and then brought the range down further to 0% - 0.25% in August 2011. The CHF Libor rate effectively reached 0% by the end of 2014 ahead of the decision to enter negative interest rate territory in January of 2015, in the target range of -1.25% - -0.25% by the end of the month. The SNB has kept the target range unchanged since its initial decision up until this publication was written. The CHF Libor rate is currently -0.72%.
What makes the situation in Switzerland different from that of its peers?

Unlike its peers the European Central Bank (ECB) and the Bank of Japan (BOJ), the Swiss National Bank (SNB) is subject to the swift dynamics of Switzerland’s small and open economy. Switzerland's real GDP in 2016 was 661 Billion CHF. Switzerland’s real year-on-year GDP growth fell from over 2% through 2008 to -2% over the period of 2009. Growth rebounded to 3% in 2010 but has remained low since, and ended 2016 with just over 1% growth as shown in Figure 96.

As a small economy, Switzerland is particularly sensitive to global trends and foreign trade. Switzerland’s economy relies on trade. The value of total imports at the end of 2016 was 51% of Swiss GDP. Imports from the Eurozone accounted for 63% of total imports. Exports accounted for 66% of GDP in 2016 and 44% of Swiss exports went to the Eurozone. The consequences of such an open economy are much larger the smaller the country. As a result, the SNB is reactive to threatening economic activity, and especially from the Eurozone. Beginning in 2008, exports to the Eurozone began to fall from 55% down to 43% (of total) in 2016.43

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43 See Figure 97, Figure 98, Figure 99
In an open economy such as Switzerland's with its high level of imports, **exchange rate changes have an impact on import prices and therefore on the overall price level.** Given the high level of exports as a percent of GDP, exchange rate movements that affect the attractiveness of Swiss exports will have an impact on the Swiss economy. This applies particularly in the case of strong exchange rate movements.
Figure 99: Swiss Trade Balance

Source: Data portal of the SNB

Under normal market conditions the SNB uses market liquidity and the quantity allotted in daily repo auctions to steer the reference rate. Exchange rates enter into most of the SNB's analyses, as they can also have an impact on the monetary situation and influence economic developments. However, when the reference rate reached the zero lower bound in December 2008, the SNB adopted unconventional measures - including large foreign exchange purchases as an important instrument.

5.1.2 Macroeconomic Backdrop & Goals for Negative Rates

The global economic climate shifted in 2008 as interest rates worldwide began to fall. The Federal Reserve cut the effective federal funds rate from about 4% in January of 2008 to the zero lower bound by the end of the year. Coupled with a “flight to safety” effect, this put strong pressure on Switzerland. The Swiss franc is known to appreciate strongly during financial market turmoil, demonstrating its status as a typical safe haven currency. The SNB maintains price stability by ensuring appropriate monetary conditions by keeping interest rates, the exchange rate, and the supply of money and credit aligned to the prevailing economic situation. In practice, given the difficulty to decouple itself from the global macroeconomic environment, this becomes policy directed at external contributions to monetary conditions in Switzerland.
As a consequence of global conditions and the strong appreciation pressures on the Swiss franc, the SNB conducted heavy intervention in the foreign exchange market with a volume of CHF 200 billion from the end of 2008 to August 2011. The intervention by the SNB in the foreign exchange market is displayed as the blue line in Figure 100. This heavy intervention, directed primarily at the euro (Figure 100), did not appear to mitigate the fall of the euro against the Swiss franc; from the beginning of 2008 to August 2011 the exchange rate moved from CHF 1.6 for the Euro to 1.1. During this same period, the Swiss franc moved from CHF 1.1 for the US dollar to 0.8.

The SNB introduced a lower bound of CHF 1.20 against the euro in September 2011. As a rule, monetary policy decisions are taken with regard to interest rates. But, if necessary, the SNB can also take non-interest rate related decisions, such as the introduction of the minimum exchange rate, which applied from 6 September 2011, as a result of the considerable appreciation of the Swiss franc, and the SNB belief of its over-valuation. The introduction of the lower bound (shown as the “Currency Peg” in Figure 102) represented the conviction of the SNB to maintain the stability of the Swiss franc and thereby shape expectations. Even with the lower bound of CHF 1.20, it is possible an overvaluation remained. Over the years from 1996 to 2008 the average value of CHF was 1.56. Given this average, the implied revaluation of 39% down to CHF 1.12 stood to have extreme consequences for the Swiss real economy. With the introduction of the lower bound the SNB intended to shelter the Swiss real economy from a sizable recession and deflation. Even so, a weak deflation took place from the beginning of 2012 through May of 2013.
According to the SNB, from 6 September 2011 to 15 January 2015, the main focus of monetary policy implementation was on the minimum exchange rate. Since then, SNB monetary policy has been based on two key elements: the negative interest rate, and the willingness to intervene in the foreign exchange market.

**Why negative interest rates?** On December 18, 2014, the Swiss National Bank (SNB) announced negative interest rates on Swiss franc-denominated sight deposits above a pre-defined threshold set to take effect on January 22, 2015 at -0.25%. The goal of the negative interest rate policy (NIRP) was to discourage capital inflows and thereby counter the monetary tightening due to the Swiss franc's real effective appreciation as shown in Figure 103. Still, pressure on the currency persisted and the SNB continued to accumulate foreign exchange reserves. By the end of 2014, the market had begun to anticipate the Federal Reserve would start increasing its policy rates. The ECB also indicated that additional monetary stimulus would be required in the euro area. As a result, the euro weakened substantially against the US dollar. The EUR/CHF minimum exchange rate came under intense pressure, and by mid-January 2015, it had become clear that it was no longer sustainable.<sup>44</sup> On 15 January, with pressure on the Swiss franc unabated, the SNB discontinued its minimum exchange rate of CHF 1.20 to the euro, and announced a further cut in the interest rate on sight deposits to −0.75%.

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<sup>44</sup> (Maechler, 2015)
**Swiss Real Effective Exchange Rate**

Source: Bank for International Settlements (BIS)

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**Negative interest helps to maintain price stability and support economic activity in Switzerland.** For Switzerland, low global equilibrium interest rates and expansionary monetary policies made NIRP by the SNB necessary in order to fulfill its monetary policy mandate. It allows the SNB to counter the consequences of Swiss franc appreciation on economic development and inflation. Given low interest rates around the world and the difficult global economic situation, negative interest – coupled with the SNB’s willingness to intervene in the foreign exchange market – serves to ease upward pressure on the Swiss franc.

**Swiss franc appreciation calls for monetary policy easing** given the effect of the exchange rate on inflation and economic developments in Switzerland. After reaching the zero lower bound in December 2008, the SNB began to adopt unconventional measures. To this end, it first substantially expanded its balance sheet through foreign asset purchases, which is in essence a form of quantitative easing, QE. It also changed the composition of its assets to provide credit easing, CE. **Importantly, these purchases are not part of a large “QE” asset purchase program** – making the case of Switzerland different from that of its central bank peers. However, had the SNB not acted as it did in discontinuing the minimum exchange rate against the euro, it would have been forced to buy enormous amounts of foreign currency. The SNB’s balance sheet would have expanded rapidly, increasing the possibility of losses due to asset devaluations. Due to political pressure against the risks of a large balance sheet, the SNB had to abandon its currency peg and thereby allow the easing of its foreign exchange market interventions.
What is unique about Switzerland’s objective for NIRP? Unlike its peers, the decision to implement negative interest rate policy was primarily directed at the external contributions to monetary conditions in Switzerland. As such, the SNB saw this policy as a consequence of the fragile international environment and its exceptionally low interest rates. Unlike the Eurozone, Sweden, and Japan, there was no domestic crisis which created a need for “QE” in the form of asset purchase programs as was done in these regions. Low inflation, or deflation in the case of Japan, has been the driving cause of NIRP in all four regions. Similar to Sweden and Japan, Switzerland faces appreciation pressures on its currency. However, the SNB chooses to focus on the effect of NIRP on the exchange rate and through this channel have an effect on inflation, rather than attempting to have a direct, sudden impact on inflation.

5.1.3 Monetary Policy Implementation Strategy

The advance announcement allowed the market to prepare for the negative rate. On December 18, 2014, the Swiss National Bank (SNB) announced negative interest rates on Swiss franc-denominated sight deposits above a pre-defined threshold set to take effect on January 22, 2015 at -0.25%. The goal as stated by the SNB was to stem the inflow of funds by reducing the attractiveness of Swiss franc investments and therefore counter appreciation pressure to maintain the floor against the euro. Negative interest would help to maintain the interest rate differential between the Swiss franc and other currencies, and therefore make investments in Swiss francs less attractive, ease upward pressure on the Swiss franc, and as a result counter deflationary pressure on the Swiss economy. The advance announcement served to prepare the market for the implementation of negative interest rates. Although financial market participants were prepared for negative rates, the SNB surprised the market on January 15, 2015 when it suddenly announced the removal of the currency peg to the euro, accompanied by a drop in the interest rate to -0.75% on sight deposits held by banks and other financial market participants at the SNB.

The threshold for the negative interest rate on sight deposits limits the financial burden on banks. The negative interest rate applies to sight deposits above the threshold of 20 times the minimum reserve requirement. Sight deposits are used by banks for payment transactions, as a liquidity reserve, and to fulfill the minimum reserve requirement. The statutory minimum reserve requirement, as mandated in the National Bank Act, is currently 2.5% of short-term liabilities – the sum of short-term liabilities in Swiss francs up to 90 days and 20% of liabilities to customers. By setting the threshold in relation to the statutory requirement the SNB is able to set a well-defined measurement with existing, clear rules. For depositors not subject to minimum reserve requirements, a fixed exemption threshold of CHF 10 million was set.  

5.1.3.1 Basic Implementation Setup

How does the SNB influence money markets? The SNB implements its monetary policy by managing liquidity on the Swiss franc money market and thereby influencing the interest rate level. The SNB steers the 3-month Libor indirectly through liquidity-providing and liquidity-absorbing money market transactions, by means of the volume and conditions of these operations. The SNB distinguishes between open market operations and standing facilities. The SNB takes the initiative in the transaction in the case of open market operations. For the standing facilities, it specifies the

45 (SNB, The Swiss National Bank in Brief, 2016)
conditions at which counterparties can obtain liquidity but the initiative comes from the banks. Regular open market operations include repo transactions, the issuance of SNB Bills (SNB debt certificates), foreign exchange transactions, and foreign exchange swaps. The SNB carries out its open market operations in the form of auctions or bilateral transactions, and are mostly conducted via an electronic trading platform. The standing facilities of the SNB include the liquidity-shortage financing facility and the intraday facility. The liquidity-shortage financing facility provides needed liquidity in unexpected circumstances. This facility can be used until the next bank working day (overnight) through special-rate repo transactions. The special rate is based on the SARON (Swiss Average Rate Overnight) plus an interest premium and is announced daily through the electronic market information services. The intraday facility provides counterparties with interest-free liquidity during the day by means of repo transactions and facilitates the settlement of payment transactions via Swiss Interbank Clearing (SIC) and foreign exchange transactions.

**Who are the main counterparties to the SNB?** All banks domiciled in Switzerland and the Principality of Liechtenstein are admitted as SNB counterparties. Other domestic financial market participants, such as insurance companies and banks domiciled abroad, are admitted as counterparties if they influence the liquidity on the secured Swiss franc money market and there is a monetary policy interest in doing so. In 2015, around 150 domestic and foreign banks as well as 8 domestic insurance companies were accepted as SNB counterparties.

**Decreased importance of open market operations.** Although there exists excess liquidity in the market, the SNB is able to steer interest rates by means of open market operations such as the issuance of SNB Bills and repo transactions. However, due to the substantial increase in the liquidity in the banking system, as seen in the current high levels of sight deposits, there has been no need in recent years to conduct repo transactions within open market operations. From September 6, 2011 to January 15, 2015, the minimum exchange rate was the main focus of monetary policy implementation. Since the discontinuation of the minimum exchange rate, the SNB’s monetary policy has been based on two pillars: the negative interest rate on sight deposits at the SNB and the willingness to intervene on the foreign exchange market as required.

5.1.3.2 **Policy Target**

**The threshold structure allows the negative interest rate to affect different market participants differently.** Given the goal of the policy to reduce the relative attractiveness of Swiss franc investments, the policy is targeted at external contributions to monetary conditions in Switzerland. The threshold effectively creates three categories of market participants. First, there are the domestically Swiss banks, the regional, cantonal, and Raiffeisen banks. Their sight deposits mostly fall below or at the exemption threshold of 20 times the minimum reserve requirement. As such, in practice the SNB does not charge these banks interest on their sight deposits. Second, there are the Swiss banks that are not domestically focused, the larger banks. These banks hold more than the exempted threshold in sight deposits – though, not much more. Therefore these banks effectively pay an interest that is lower than the SNB target reference rate, effectively -0.23%. Third, there are depositors who are not subject to minimum reserve requirements whose fixed exemption threshold is only CHF 10 million. This group is effectively the target of the NIRP, most heavily subjected to the negative interest rate, and how the SNB targets capital flows into the Swiss franc by decreasing its attractiveness.
5.1.4 Challenges to Implementation

What makes negative interest rates different from low interest rates? The technical implementation of negative policy rates is different from that of normal or zero-lower bound policy rates. While much of the implementation was able to take place within the existing framework, the SNB changed their terms of business in order to implement the negative policy rates – importantly, they implemented a tiered remuneration schedule. In addition to the change in the contractual framework, an in-depth review of IT systems and accounting was completed. The SNB also carefully signaled the possibility of negative interest in advance in order to prepare financial institutions, which otherwise may not have been able to adapt to negative policy rates.\(^46\) In the case that terms of business or financial contracts did not allow for negative rates, these terms were rewritten to accommodate the new policy. Market infrastructures were adjusted to accommodate negative coupons in floating rate instruments as well as zero lower bound Libor-based mortgages. Instances of market operational issues have been limited.

Prior to the announcement of negative policy rates in December 2014, the SNB did not have a tiered remuneration schedule, unlike the ECB. Remuneration of reserves, both positive and negative, was not part of the contractual framework for sight deposit accounts. The SNB uses an exemption threshold to compute the negative remuneration. For banks that have to fulfill minimum reserve requirements, the exemption threshold is determined as 20 times the minimum reserve requirement prior to implementation plus or minus any change in the amount of cash held. For account holders at the SNB not subject to the minimum reserve requirement, an exemption threshold of CHF 10 million is set. Government sight deposits at the SNB are exempt. Banks that

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\(^46\) (Bech, Malkozov, 2016)
hold levels of reserves below their exemption threshold are willing to borrow reserves up to this threshold. Those with reserve levels above the threshold want to lend. Over time a redistribution of reserves has taken place to fully exploit the exemption thresholds.

**Are negative policy rates transmitted to money markets and the wider economy the way positive rates are?** The efficacy of NIRP as an unconventional monetary policy tool relies on its transmission to the wider economy. The experience so far suggests that the negative policy rate in Switzerland has been transmitted to money market rates in a similar way to positive rates. However, the pass-through to lending rates in the wider economy is less clear. Short-term money market rates have followed the policy rate into negative territory. The overnight repo rate and interbank rates have both tracked the reference CHF 3M Libor down. Trading volumes have risen as a result of the reshuffling of reserves amongst banks. Although negative rates have continued into money markets, institutional and contractual constraints may prevent the pass-through beyond them. In particular, there is a reluctance for banks to pass through negative rates to depositors should it lead to substantial withdrawals. In order to protect net-interest-margins (NIMs), **banks have responded by increasing some lending rates** such as mortgages. Government and corporate bond yields have tracked the reference rate down.

**Beholden to Global Conditions: “At the end of the dog’s tail”** An important challenge to note, perhaps the most important for Switzerland, is that it is a small and open economy as compared to the Eurozone or Japan. As a result, the SNB’s policy is reactive to global economic events. Switzerland is at the end of the dog’s tail, so to speak. When global conditions swing into slow growth and low interest rates, Switzerland feels the effects stronger than a comparatively larger or closed country. Although domestic economic conditions were relatively stable post-crisis, with rising inflation expectations and strong GDP growth returning, the persistent global low interest rates and loose monetary policies of the Eurozone put strong pressure on Switzerland. The announcement of QE by the ECB in the beginning of 2011 immediately put appreciation pressure on the Swiss franc, and subsequently, Switzerland experienced lower GDP growth and falling core inflation and inflation expectations.

### 5.2 Experience with Negative Rates

#### 5.2.1 Price Developments Across Markets

**Swiss interest rates, by and large, have tracked the policy rate down after the implementation of NIRP.** However, it appears the correlation between the policy rate and market wide rates is lower when cutting into negative territory than when lowering the policy rate in positive interest rate territory. In addition, the uptick in government and corporate bond rates in 2017 implies that NIRP may lose its effectiveness over time. There has been no pass-through of NIRP to mortgage or corporate lending rates.
5.2.1.1 Money Markets and Interbank Lending

The introduction of NIRP does not appear to have had a marked effect on money markets. The pass-through to short-term money market rates has persisted as overnight repo and overnight interbank rates have followed the reference CHF 3M Libor below zero. The Swiss Average Rate Overnight (SARON) is an ongoing, volume-weighted reading based on CHF repo transactions concluded. The CHF overnight deposit rate is the annualized rate of interest that a bank will charge for lending or pay for borrowing a currency for a specific tenor. After the crisis, the spread between the CHF 3M Libor and overnight rates began to narrow. For the duration of the currency peg, the spreads between CHF 3M Libor and overnight rates collapsed. After the peg was abandoned,
interbank overnight rates were volatile for a period in the beginning of 2015 but has since remained stable. Money market rates continue to track the reference rate around -0.75%.

**Figure 107: Money Markets**

![Swiss Money Markets](image)

Source: Bloomberg

After the crisis in 2008, the SNB started to provide large amounts of liquidity\(^{47}\) to decrease liquidity risk and resulted in decreased turnover rates.\(^{48}\) As a consequence, there was an overall decline in money market activities from the satisfaction in liquidity and resulting low interest rates. The large-scale purchases of foreign currency by the SNB in 2009 and 2010 led to a substantial liquidity surplus in the banking system, which contributes to the compression of overnight and CHF 3M Libor spreads. Liquidity management was based on the absorption of excess liquidity using repo transactions and the issuance of SNB Bills. The appreciation pressure on the Swiss franc in mid-2011 led the SNB to use repo transactions to achieve a massive increase in liquidity, in line with its monetary policy, and to maintain liquidity at an extraordinarily high level afterwards. The foreign currency purchases to enforce the minimum exchange of CHF 1.20 per euro resulted in a further expansion of liquidity on the Swiss franc money market. The SNB stopped renewing the last outstanding repo transactions in June 2012.

\(^{47}\) Figure 100

\(^{48}\) Figure 108
Following the massive expansion of liquidity, call money turnover in the secured and unsecured Swiss franc money market fell sharply (Figure 108). Trading activity on the repo market remained minimal, due to low money market rates and high levels of Swiss franc liquidity. The introduction of negative interest by the SNB did lead to a moderate increase in turnover. Institutions whose sight deposits at the SNB were above their exemption thresholds reduced their account balances using repo trades, while other institutions who had not yet reached their thresholds increased their balances.

![Swiss Interbank Clearing Turnover](image)

Source: Data portal of the SNB

### 5.2.1.2 Government Debt

Swiss government bonds of all durations initially continued to track the policy rate down after the implementation of NIRP. Yields for 20-year bonds reached negative territory towards the end of 2016. Over time, however, yields for durations over 5 years broke the correlation to the policy rate and began to rise, beginning in 2017. Currently 20-year yields are positive yielding and 10-year government bonds yield 0%. A regression of the 10-year government bond against the policy rate shows a decreased correlation with the policy rate after the crisis and close to zero correlation for the entire period after the implementation of NIRP. (Error! Reference source not found.)
5.2.1.3 Mortgage Lending Rates

Swiss variable and fixed mortgage lending rates are unaffected by NIRP. While fixed-rate 5 and 10 year lending rates tracked market-wide yields downward after 2008, this trend markedly discontinues after the implementation of negative rates. Most notably with an increase in 10-year lending rates after NIRP. Variable lending rates fell sharply in 2009 but have since remained flat and remain above 2.5%. Both 5-year fixed lending and variable lending remained flat after the implementation of NIRP. (Figure 110)

NIRP has not passed through to mortgage lending rates in Switzerland. The transmission of monetary policy has not occurred through this channel. As a result, the property market in Switzerland has become a source for yield in an otherwise low-yield environment.
Outstanding mortgages are at a high level to GDP and are growing faster to businesses than to households. Low interest rates have fueled growth in the housing market. (Figure 111)
Mortgages are not of very long maturity although maturities are increasing. The typical mortgage is for 2-10 years with a loan-to-value ratio of 80 percent, and longer maturities are becoming increasingly popular. However, shorter term fixed-rate lending is most common, and implies that loans are rolled over when they mature. Fixed lending is more desirable to borrowers due to the low interest rates but banks are reluctant to lend for long periods at low rates favoring the shorter-term lending. Another important feature of the Swiss mortgage market is that pension fund assets can be used as down payment to finance real estate.\textsuperscript{49}

5.2.1.4 Equity Markets

**Swiss equity markets have improved since the crisis but have remained relatively even since the implementation of NIRP.** (Figure 112) Compared to global equity markets in 2016, the Swiss market index (SMI) has performed comparably to the European market, although not as strongly as the S&P 500. (Figure 113)

\textsf{Figure 112: Swiss Equity Markets}

\begin{center}
\includegraphics[width=\textwidth]{Swiss_Equity_Markets.png}
\end{center}

\textit{Source: Bloomberg}

\textsuperscript{49} (IMF, Technical Note, 2014)
5.2.2 Developments Across Institutions

Bank health remains stable currently while net interest margins show no marked changes since an adjustment in 2009. (Figure 114) Non-performing loans have also remained stable.

Source: SNB
Although Switzerland’s banks are heavily deposit funded which could squeeze interest margins, these regional banks mostly fall under the threshold of 20x reserve requirements and therefore do not pay negative rates on their reserves – preventing them from feeling as much pressure on NIMs. There is no data currently available to conclusively assess impacts after NIRP.

As a result of low interest rates, banks have made some changes to their balance sheets. Domestically focused banks reacted to the pressure on the interest rate margin by increasing their asset margins on newly extended mortgages.\(^{50}\) Mortgage bond net borrowing has steadily increased since 2007, reaching a peak after NIRP in 2016 before returning to its high pre-NIRP.

\(^{50}\) (SNB, Financial Stability Report, 2016)
Figure 116: Mortgage Bond Borrowing

Source: SNB

5.2.3 Macroeconomic Impact and Effectiveness

5.2.3.1 Inflation

Since the implementation of NIRP, core inflation remains low and inflation expectations have returned to previous levels. Although the SNB is not an “inflation targeter” such as its peers, inflation is still the most important outcome of NIRP. After core inflation (shown as the red line in the chart below) peaked at 2% at the beginning of 2009, Switzerland has struggled with falling inflation. Even with the reference rate at the zero lower bound (shown in blue) by the beginning of 2009, core inflation steadily fell until the middle of 2010. However, by the third quarter of 2010, GDP had reached the same level as before the crisis and core inflation began to pick up until the beginning of 2011. After the ECB announced its first round of QE and the SNB responded to the pressure with the currency peg in September 2011 (shown as the green line), core inflation fell and Switzerland experienced a brief deflation. Directly following the implementation of NIRP, core inflation fell to a low of -0.75% at the beginning of 2016 before returning to near zero levels at present.

It is not conclusive that NIRP has had the desired effect on raising inflation or inflation expectations. The 3-year conditional inflation forecast (shown above in purple) fell to a low of 0.25% after the crisis but rose sharply when conditions improved in 2010. The forecast fell again after the currency peg and has remained between 0.7% and 1.4% since. The announcement of NIRP appears to have brought down expectations until the beginning of 2015, after which expectations gradually returned to 1.4%.
5.2.3.2 Foreign Exchange Market

Over the year of 2016, the Swiss franc has moved within a narrow range, appreciating only slightly against the EUR since the beginning of the year. The SNB suggests this is likely due in part to their monetary policy – that is, to the negative interest rate and their willingness to take an active role in the foreign exchange market, as necessary. At the beginning of 2008 the Swiss franc started a steady, constant appreciation against the EUR until the currency peg was implemented in 2011, despite large-scale foreign exchange market intervention. The SNB maintained the fixed exchange of CHF 1.20 per EUR until January 2015. The abandoning of the peg was followed by a sharp appreciation to 1.03 before returning to 1.1. The Swiss franc was more volatile against the USD until it started a steady appreciation against it beginning in mid-2010, continuing until the currency peg against the EUR, after which it remained around 0.9-0.95. Despite abandoning the currency peg against the EUR, the value against the USD remained stable over 2015-2016 around 1.0. The difference in reaction to the USD versus the EUR after abandoning the currency peg is likely due to the dollar’s appreciation and not to the SNB’s NIRP in 2015 and 2016.

The real effective exchange rate has remained stable over 2016. Beginning in mid-2010 the real effective exchange rate experienced a rapid, steady appreciation of 25% before the currency peg was implemented in September 2011. The real effective exchange rate then returned to the level it reached in the beginning of 2011, before the ECB announcement of QE and its sharp appreciation, for the duration of the currency peg. When the peg was abandoned the real rate experienced a sharp appreciation of almost 10%. It fell shortly after, although it remained at an appreciated value as compared to the peg for the duration of 2016.
Source: Data portal of the SNB, Bloomberg

Source: Bank for International Settlements (BIS)
The large-scale purchases of foreign currency that have been needed to counter the upward pressure on the Swiss franc since 2009 have led to a sharp rise in foreign currency investments. The currency reserves are made up primarily of bonds and equities, which are mainly denominated in euros and US dollars. Foreign exchange market volumes grew from CHF 50 billion at the beginning of 2008 to CHF 282 billion by September 2011 when the currency peg was implemented. Although volumes dropped for a period they continued to rise to defend the peg over 2012 to CHF 420 billion in August of 2012. Volumes then hovered around this level until the beginning of 2014 when intervention in the foreign exchange market was necessary again. Although the peg was abandoned, the SNB continues to intervene in the foreign exchange market and volumes have steadily increased reaching CHF 645 billion at the end of 2016.

Figure 120: Foreign Currency Investments

The exchange rate is crucial to the Swiss economy due to its impact on Swiss exports, which amounted to 66% of GDP in 2016. Of these exports, 44% when to the Eurozone, making it their largest trading partner by a large margin. If the Swiss franc is overvalued against the euro, this will have a negative impact on exports to the euro area. As a result of the Swiss franc appreciation in combination with the economic situation in the Eurozone, exports to the area have fallen since
2008. If this trend continues, it stands to have serious implications for the Swiss economy, which relies on trade to the euro area.

*Figure 121: Exports to the Euro Area and by Region*

An analysis of capital flows shows that the inflow of capital is not necessarily linked to pressure on the exchange rate. Even so, it appears that a sharp inflow over 2014 put pressure on the Swiss franc and the balance sheet of the SNB. Subsequent to NIRP, capital flows abated for the year of 2015.

*Figure 122: Swiss Capital Flows*

Source: Data portal of the SNB

Source: IMF and own calculations
5.3 Conclusion: Perceived Effectiveness

Since January 2015, SNB monetary policy has been based on two key elements: the negative interest rate, and the willingness to intervene in the foreign exchange market. The goal of the negative interest rate policy (NIRP) was to discourage capital inflows and thereby counter the monetary tightening due to the Swiss franc's real effective appreciation. Unlike its peers, the decision to implement negative interest rate policy was primarily directed at the external contributions to monetary conditions in Switzerland. As such, the SNB saw this policy as a consequence of the fragile international environment and its exceptionally low interest rates.

**Negative interest aimed to maintain price stability and support economic activity in Switzerland.** For Switzerland, low global equilibrium interest rates and expansionary monetary policies made NIRP by the SNB necessary in order to fulfill its monetary policy mandate. It allows the SNB to counter the consequences of Swiss franc appreciation on economic development and inflation. It is not possible to know the counterfactual, but although NIRP has not so far helped to raise inflation, there has been no deflationary pressure after NIRP. Through price stability, and abated capital flows – post-NIRP there has been a modest relief of pressure on the currency. Growth has rebounded to modest levels after NIRP. Although one possible effect has been a growth in the housing market, bank health has remained stable. Thus far there seem to be no large consequences to financial stability.
5.4 References for this section


6 Comparative observations

In this section, we will highlight some of the cross-cutting themes we saw in the impacts of negative interest rates. We will look at money markets, asset markets, bank health and macroeconomic impacts across jurisdictions. The conclusions will not be new compared to the country-specific chapters. We are just gathering them here for reference.

6.1 Money markets

The main conclusion for effects on money markets is that the Zero Lower Bound does not exist. In Figure 123 we have adjusted the dates of O/N money market rates data around the day the respective central banks went to NIRP. The all go below zero.

6.1.1 Money market rates: levels and volatility

![Figure 123 Levels in O/N money markets](image)

Different central banks had different cutting cycles. The Riksbank and the SNB were more aggressive and went deeper into negative territory faster. However, all the O/N rates across jurisdictions go negative when the policy rate goes negative. As we will see below turnover in the Japanese O/N uncollateralized call market suffered a drop after NIRP but in terms prices all the relevant O/N money markets followed policy rates down below zero as if it was a regular cut.

Sweden and Switzerland saw changes to volatility of overnight rates. In Switzerland*, volatility increased but declined as the initial shock of EURCHF-peg waned. In Sweden, volatility picked up as Sweden's QE program (that was launched in concert with NIRP) increased. Both Euroland and
Japan had no currency policies or QE policies that coincided with NIRP. Japan had QE in place when it went negative and the ECB only started QE nine months after NIRP.

If we only looked at the Swedish and Swiss experiences, it would be tempting to conclude that NIRP increases volatility in short term markets, but the ECB and BoJ experiences refute this. The currency shock in Switzerland and excess reserves in all four jurisdictions definitely contribute to money market price volatility. Further we cannot conclude that the introduction of QE and corresponding excess reserves increases volatility. That would imply a volatility spike for the euro rates (grey line) around 230 days after NIRP (June 2014) when then ECB introduced QE (January 2015). It picks up slightly but nothing like the Swedish and Swiss experiences. However, there might be a data problem. The Bloomberg composite of O/N deposit rates comprises only quotes from 8 banks in Swedish Krona and 10 banks in Swiss Francs.\footnote{For Sweden, we know (from email conversations with the Riksbank) that the \textit{interbank} O/N market (traded on the Riksbank’s RIX platform for monetary counterparties) is less volatile than the Bloomberg composite series of O/N-deposit rates would suggest. The data is unfortunately not publicly available.}

6.1.2 Turnover in O/N money markets

In the Eurozone, we have data for interbank deposit turnover in the EONIA series. NIRP (June 2014) does not change these flows markedly. However, QE (or APP as it’s called by the ECB) seems to have quite a significant effect. We see that as the EONIA trading volume (blue shaded area) trends downward after QE starts (blue vertical dots).
Again, when then depo rate drops below zero, there is no marked change in EONIA turnover.

In Switzerland, we saw an uptick in interbank deposits trading as Swiss banks reshuffled their deposit holdings between each other to get below the tiering boundaries for negative rates.

We don’t have turnover data for Japan, but we can see a shift outstanding amounts after NIRP. In the uncollateralized call market, outstanding amounts drop because Japanese banks and trading companies were not ready to handle negative rates from a technical perspective. The three other
central banks all prepared markets that negative rates might be happening, but the BoJ surprised market players and trading basically suspended for a month while technical system were upgraded. Collateralized call markets (essentially an interbank repo market) saw a persistent drop in outstanding amounts after negative rates were introduced.

For Sweden, we have anecdotal evidence (an email from a Riksbank researcher) that O/N money market turnover has dropped very low because all banks essentially have more liquidity than they need.

6.1.3 A new money markets situation (but due to QE)

Across jurisdictions we are in a new situation where it is hard to find cash investment options. QE and NIRP moved us from a world where liquidity is scarce and costly to get into a world where liquidity is abundant and costly to hold. We tend to think QE or Excess reserves is more important than NIRP in this regard. The next four graphs show that when excess reserves pick up in a system, the relevant 2-year bond rate goes below the relevant central bank policy rate (the spread becomes negative). Short-dated government bonds is a cash-like investment that every investor has access to. Central bank deposits are only available to banks, so instruments with wider access get bid down below central bank deposit rates.
As QQE picks up in Japan around April 2013, the two-year JGB goes below the BoJ’s policy rate.

Swiss reserves increase as the SNB starts to intervene in currency markets and we see the same dynamic where the policy rate becomes a (soft) roof over the two-year Swiss government bond (in the graph the spread is mostly below zero after banks’ sight deposits pick up in August 2011.)
In Sweden, the spread is more volatile in the period before QE. This can be explained by the volatility of market expectations on the Riksbank’s policy rate. The forward path of the policy rate swung up and down as markets figured out what the Riksbank was going to do. After QE/NIRP in January 2015 that uncertainty reduced and the spread went negative like in the other cases.

In Euroland Excess reserves picked up already in 2012 with the ECB’s LTROs. However, not before the outright QE program in early 2015 did two-year bunds go consistently below

### 6.2 Asset markets

The commentary below endeavours to catalogue the market impacts of NIRP in the four jurisdictions, across a handful of the most important asset classes. It should be borne in mind, of course, that a variety of other policy treatments were at play in addition to negative rates during this time, as well as global drivers that may have moved all markets for reasons unassociated with monetary policy. However, the following observations can still be useful in framing the broad
evolution of markets during the NIRP era, and thus shed some light on the degree of transmission to governments, firms and households that this unconventional tool achieved.

6.2.1 Sovereign Debt Markets

“Running out of steam” as NIRP takes hold

Sovereign debt markets saw a broad compression across all of the jurisdictions under investigation in the 2013-2015 period. By way of differentiating dynamics, Germany and Sweden 10yr yields have largely stabilized since then, but Switzerland and Japan continued downward into mildly negative territory in 2015.

NIRP is correlated with an improvement of...

1. 150bps for Germany
2. 50bps for Sweden and Switzerland
3. 25bps for Japan

Figure 129 Cross-Country Impact & Effectiveness Comparison: Sovereign Debt Markets (10yr Yields)

Sources: CEIC, Bloomberg and national authorities

6.2.2 Corporate Bond Markets

“Weakening momentum” in the post-NIRP period

Investment grade corporate bonds in the four jurisdictions saw near-universal compression in risk premia in 2011-2014. This tightening action can be seen to largely slow in 2015 as NIRP comes
online, but Switzerland is the one exception to this rule. Yields continued downward as negative rates were introduced, and were hovering around 0% as of early 2017.

NIRP is correlated with an improvement of…

1. 75bps for Switzerland
2. 50bps for the Euro Area
3. 25bps for Sweden
4. Flat for Japan

Figure 130 Cross-Country Impact & Effectiveness Comparison: Corporate Bond Markets (IG Index Yields)

6.2.3 Equity Markets

Two-tiered rallies in stock markets alongside NIRP
The story of equity markets in the context of this analysis is one of significant appreciation over the 2010-2017 timeframe, but in two distinct tranches. The Euro Area and Switzerland have both improved roughly 40% since 2010, while Sweden and Japan have done nearly twice as well in the same period (approximately 80-100% up). All jurisdictions saw some kind of modest correction or retracement of these gains in 2015-2016. As for developments that separate the markets during this time, the onset of NIRP appears correlated with an immediate rally in Japan, while the feed-through is somewhat more delayed for the others.

Figure 131 Cross-Country Impact & Effectiveness Comparison: Equity Market Indices
6.2.4 Mortgage Markets

Most jurisdictions tighten, but Swiss unaffected

Mortgage financing costs, measured by either covered bond yields or bank lending rates, have tightened significantly across countries since 2012, with the exception of Switzerland (which has stayed remarkably flat throughout). Compression action in the Euro Area and Sweden has asymptotically decelerated following the onset of NIRP, while Japan adjusted precipitously because of the Bank of Japan’s unexpected policy announcements in connection with going negative.

NIRP is correlated with an improvement of…

1. 100bps for the Euro Area
2. 75bps for Japan
3. 50bps for Sweden
4. 5bps for Switzerland

*Figure 132 Cross-Country Impact & Effectiveness Comparison: Mortgage Market Yields / Rates*
6.2.5 Property Markets

**Euro Area alone in consistent acceleration post-NIRP**

Whereas the foregoing market analysis has generally lent itself to the drawing out of broad themes that touch most or all of the jurisdictions under examination, the stories in property markets are somewhat more bespoke. Japan’s property prices have whipsawed from expansion to contraction and back again several times over the 2010-2017 window. Sweden’s NIRP period saw a significant (albeit delayed) deceleration in the 2012-2015 housing rally. Switzerland’s market was briefly reinvigorated after rates went negative, but deceleration quickly took hold again from early 2016. The Euro Area has been alone in enjoying a consistent, upward climb since depths of crisis in 2012.

*Figure 133 Cross-Country Impact & Effectiveness Comparison: YoY Growth in Residential Property Price Indices*
6.3 Banking Health

One of the more interesting and oft-cited implications of low and negative interest rates has been their potential impact on the health and profitability of the banking sector. In looking at banking health, we examined two outcomes: net interest margins (as a proxy for profitability), and portfolio rebalancing.

It should be noted that we started out with certain theoretical assumptions of what we expected the data to look like after the implementation of NIRP. However, we were disadvantaged by a low granularity of available data, and therefore cannot state conclusively any overt NIRP impact (vs. that of the long-term low interest rate environment that has been plaguing the four regions).

6.3.1 Pressure on Net Interest Margins

For the purposes of our analysis, we have used the interest margins as a proxy for discussing bank profitability. The difference between a bank’s lending rate and the rate at which they fund their lending is known as the interest margin.52 In general, these rates usually follow the central bank’s policy rate. However, as we have discussed in previous sections, banks have yet to pass on the negative rates to their customers (especially retail depositors). As such, when the rates go negative, the rates on deposits do not fall as much as rates on other bank lending. This downside rigidity should imply an erosion of the net interest margins of banks across the four regions.

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52 Riksbank, 2016
In examining the data, both the Euro Area and Japan have seen a steady decline in their interest margins since NIRP (as an example, see Figure 134 for the evolution of Euro Area banks’ interest margin). In Switzerland and Sweden, there have been no marked changes in the interest margins post-NIRP.

![Figure 134 Net Interest Margin of Euro Area Banks](image)

**Figure 134 Net Interest Margin of Euro Area Banks**

06/14: ECB cut to negative rates

To explain this disparity, we looked at the balance sheets of banks in the four regions we are studying (since the degree to which interest margins will affect bank profitability depends on how heavily the bank relies on deposit funding). As seen in Figure 135, in Sweden, banks largely obtain financing through non-deposit funding. Conversely, in Japan, the Euro Area, and Switzerland, banks are highly dependent on deposits for their funding. This would explain the declining interest margins in the Euro Area and Japan and the minimal impact in Sweden, but would not account for why margins in Switzerland haven’t been affected much.

![Figure 135 Deposit Funding for Banking Sector](image)

**Figure 135 Deposit Funding for Banking Sector**

Source: ECB, Riksbank, BoJ, SNB
When analyzing the post-NIRP environment in Switzerland, our research has shown that banks have increased their rates on longer-maturity lending like mortgages; thus banks are able to “protect” their margins to an extent. Furthermore, it is the regional banks in Switzerland that are more heavily dependent on deposit funding. As mentioned in Section 5, due to the implementation strategy for NIRP, the regional banks in Switzerland have been unaffected by negative rates. The combination of these factors can explain why banks in Switzerland have not seen an erosion of their interest margins.

6.3.2 Portfolio Rebalancing

Faced with the negative interest rate, banks are expected to change their portfolio. However, there seems to be no discernable pattern across the banks’ portfolio rebalancing behavior after NIRP was introduced.

In Japan, there seems to be some evidence of rebalancing from JGB’s to risky assets. As shown in the chart below, on the banks’ asset side, cash and deposits witnessed the most significant rise. In terms of the other asset classes, loans and bills, securities investment excluding JGBs increased, while JGB holdings decreased. The data suggest that portfolio rebalancing from JGBs to other risky assets has continued to take place. However, NIRP appears to have no separate “treatment effect” on the composition of Japanese bank balance sheets as those trends started before the implementation of NIRP.

Figure 136: Assets of Domestically Licensed Banks

Source: BOJ
In the rest three areas, changes in portfolio rebalancing caused by NIRP are more ambiguous. In Euro area, there seems to be an increase in the share of fee-based income in the income composition of bank balance sheet. In Switzerland, the average leverage ratio grows slightly. While in Sweden, banks did not change their portfolio visibly after NIRP.

### 6.3.1 Impact on Institutional Investors

NIRP also seems to have an ambiguous impact on institutional investors. Institutional investors in Japan have an increased propensity to accumulate foreign bonds and other risky assets in investment portfolio. For instance, as described in the previous chapters, as domestic interest rates have declined further, life insurance companies in Japan have focused on securing investment income by, for instance, accumulating overseas assets such as currency-hedged foreign bonds, and investing in areas in which relatively higher growth is expected. There are some similar patterns for Pension Funds, Depository Institutions, Money Management Funds (MMFs), Money Reserve Funds (MRFs) in Japan. In the euro zone, Institutional investors have been stepping up exposure to NFC’s and non-EA bond markets and have shifted their asset allocation from higher to lower-rated debt securities and increased the duration of their portfolios. In Sweden, according to some reports, currently there is little evidence of a rush to buy property but some pension funds are selling Swiss government bonds. 53

### 6.4 Macroeconomic Outcomes

By adopting NIRP, the central banks expected the macroeconomic outcomes to be improved. Official statements from these four central banks clearly express the main motivations of the use of NIRP: to provide further accommodation in order to support growth and stabilize inflation in line with their main policy objectives. In an environment of low inflation and a declining equilibrium real rate of interest, negative rates restore the signaling capacity of the central bank by effectively removing the zero lower bound. A decline in the nominal rate is supposed to lower its real rate component, allowing inflation expectations to rise and boosting aggregate demand.

In light of the above expected movements in key domestic variables, this section explores the evolution of inflation, inflation expectation, exchange rate, real GDP growth, output gap, and credit creation before and after the introduction of NIRP. Comparative observations on macroeconomic impacts suggest that there are similarities and differences across the four jurisdictions.

#### 6.4.1 Inflation

All of the four regions have inflation problems before NIRP. The core inflation in Euro area and Sweden has been flat and persistently below target. As for Switzerland and Japan there was deflation. Especially, Japan has been fighting against deflation for decades. The jump in Japanese headline inflation in 2014 is caused by a consumption tax hike, core inflation (excluding tax) turned positive mainly because of yen depreciation and QQE.

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53 Marriage 2015
After NIRP, none of these regions have seen core inflation hitting their targets yet. Core remained flat for euro area, thus NIRP has not helped much in pushing up prices there. In Sweden, core inflation rose in 2015 but fell again since 2016. In Switzerland, core inflation fell in 2015 because of currency appreciation and trended up since 2016, we see no sign of a deflationary spiral at this stage. In Japan, it is too early to assess the impact of NIRP on inflation, because it generally takes 9-18 months for monetary policy to take effect on the real economy. So far, the downward trend of core suggests BOJ has not been successful in lifting inflation.

6.4.2 Inflation Expectation

Since the introduction of NIRP, neither inflation projections and expectations has picked up significantly. In Euro area, the 5-year/5-year inflation rate swap suggests that market-based inflation expectation has been on a downward trend and below 2% for euro area, it started to pick up since late 2016, investors boosted their outlook for inflation largely because of energy price rally. In Sweden, the 5-year inflation expectation based on a survey of money market players is a modest upward trend and approaching 2%. In Switzerland, the 3-year conditional inflation forecast by Swiss bank is picking up since 2015, but stuck around 1.5 percent. In Japan, the 10-year break-even inflation says inflation expectation has remained low, but the sample period is too short yet.

It seems NIRP has not had the desired effect on raising inflation expectation greatly. But we need to note that NIRP was implemented when the central banks were pushing against the tide, the precondition itself makes it harder for inflation expectation to rise.
6.4.3 Exchange Rate

In Euro area and Sweden, the currencies depreciated as the central banks expected. Negative rates cause exchange rates to depreciate by providing incentives for moving capital to higher-yield jurisdictions. But for Switzerland and Japan, currency appreciated because they are viewed as safe havens among global risk-off environment.

Assessing the effect of NIRP on exchange rates is difficult since many other factors influence external demand.

6.4.4 Real GDP Growth

Sweden economy has been relatively strong, while euro area is on a slow recovery. The real GDP growth rates in Switzerland and Japan are relatively slow. Switzerland growth was dented in 2015 by the abrupt strengthening of the franc; Japan's economy has been turning toward a moderate expansion since 2016, on the back of highly accommodative financial conditions and fiscal spending through the government's large-scale stimulus measures.

There is no sign that this move towards negative rates has done much to stimulate the domestic economies yet.

6.4.5 Output Gap

The output gaps, measured by the percentage of actual GDP to potential GDP, are narrowing in the four regions. Sweden even has a positive output gap, indicating the economy is above the long-term trend. In Japan, the output gap is shrinking not only because the actual GDP grows faster, but also potential growth rate is on a downward trend.
6.4.6 Credit Creation

The patterns of year on year change of the quarterly credit flow are similar across the jurisdictions, they went from credit contraction to credit expansion around one year after implementing NIRP. But for Japan, the sample period is too short.

The observation is consistent with the conclusion of IMF working paper (Jobst and Lin, 2016) that Negative interest rates have so far supported easier financial conditions and contributed to a modest expansion in credit.

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54 Andreas (Andy) Jobst and Huidan Lin, Aug 2016
Negative Interest Rate Policy (NIRP): Implications for Monetary Transmission and Bank Profitability in the Euro Area
6.5 References for the comparative section


7 Conclusions

In 2012, the traditional monetary policy mechanism entered uncharted territory when Denmark’s central bank decided to cross the assumed “Zero Lower Bound” and charge a negative deposit rate. Since then, central banks in the Euro Area, Japan, Switzerland, and Sweden have also embarked on this unprecedented experiment with negative interest rates.

In our report, we analyzed how each of the four central banks (the ECB, BoJ, Riksbank, and SNB) approached the heretofore unique policy tool of NIRP. We looked at how central banks implemented negative rates, and we evaluated how markets in the respective jurisdictions reacted to these policies. Throughout our analyses, we worked with the central question of whether cutting rates below zero yields the same impact as cutting them in positive territory. In this context, we have seen five major themes evolve:

Implementation frameworks were largely the same as for interest rates in positive territory. The ECB applied the rate to reserves about the reserve requirement. The BoJ and the SNB used a tiered system beyond the required/excess reserves, the Riksbank applied negative rates to all reserves. The reason for tiering was to move marginal rates negative but alleviate pressures on banking systems.

While the implementation of negative rates across the central bank jurisdictions we studied took place (for the most part) within prevailing operational frameworks, the signaling strategies of each central bank prior to NIRP can provide insight into their respective experiences. For example, the ECB telegraphed its intention to go negative to its counterparties almost a year in advance of the official announcement, giving them plenty of time to get their IT and documentation systems prepared for rates below zero. Conversely, the BoJ’s choice to surprise the markets with its negative rate policy resulted in a shutdown of trading activity for many weeks as market players strained to update and amend their IT systems. As such, the importance of forward guidance seems especially important for unfamiliar policy moves like NIRP.

At the short end of the yield curve, markets largely responded as if NIRP was a regular interest rate cut. Up to two years in tenor, most investment grade securities in all jurisdictions go negative. However, for long-dated securities the effect is different from a regular interest cut, as the correlation between them and the central bank policy rate weakens after the policy rate crosses into negative territory. In other words, monetary policy transmission through credit prices is hampered once rates cross into negative territory.

As mentioned in Section 6.4, there seems to be a delayed feed-through from NIRP to macro outcomes across the four jurisdictions we studied. While Sweden seems to be the so-called “success story” of a NIRP tool, there has been a neutral-to-modest pickup in the macroeconomic outcomes of the jurisdictions we have analyzed.

It is important to point out that in most of the jurisdictions we analyzed, NIRP was implemented alongside several other monetary policy tools (such as asset purchase programs). Therefore, the empirical data reflects the effects of a combination of policy actions, and it is very difficult to disentangle the causal effect of NIRP from these other policies.
While our analysis suggests that negative rates behave similarly to positive rates close to zero, it is important to consider the context within which each central bank initiated NIRP. The macroeconomic environment in each jurisdiction was extremely challenging prior to NIRP, and the long-term low interest rate environment wasn’t having the intended effect. In order to jump-start their respective economies, the central banks needed to take aggressive and unprecedented action. Based on this, even a very modest impact could be framed as having prevented severe distress. However, as mentioned previously, it still might be too soon to judge the success or failure of this unprecedented policy tool.